

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION**

Washington, D.C. 20549

FORM 10-K

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2021

OR

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from _____ to _____

Commission file number: 001-36481

ASPEN AEROGELS, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction of
incorporation or organization)
30 Forbes Road, Building B
Northborough, Massachusetts
(Address of principal executive offices)

04-3559972
(I.R.S. Employer
Identification No.)

01532
(Zip Code)

Registrant's telephone number, including area code (508) 691-1111
Securities registered pursuant to Section 12(b) of the Exchange Act:

Title of each class	Trading Symbol	Name of exchange on which registered
Common Stock, par value \$0.00001 per share	ASPN	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Exchange Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Exchange Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer", "accelerated filer", "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	<input checked="" type="checkbox"/>	Accelerated filer	<input type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>	Smaller reporting company	<input type="checkbox"/>
		Emerging growth company	<input type="checkbox"/>

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

The aggregate market value of the registrant's common stock held by non-affiliates of the registrant (without admitting that any person whose shares are not included in such calculation is an affiliate) computed by reference to the price at which the common stock was last sold as of the last business day of the registrant's most recently completed second fiscal quarter was approximately \$936.7 million. As of February 25, 2022, the registrant had 33,234,316 shares of common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive Proxy Statement for its Annual Meeting of Stockholders to be held on June 2, 2022 are incorporated by reference into Part III of this Annual Report on Form 10-K to the extent stated herein.

Auditor Firm Id:	185	Auditor Name:	KPMG LLP	Auditor Location:	Hartford, CT, United States of America
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PART I

Item 1. BUSINESS

Aspen Aerogels, Inc. is an aerogel technology company that designs, develops and manufactures innovative, high-performance aerogel materials used primarily in the energy infrastructure, building materials and electric vehicle markets. We have provided high-performance aerogel insulation to the energy infrastructure and sustainable building materials markets for more than a decade. We have also recently introduced a line of high-potential aerogel thermal barriers for use in battery packs in the electric vehicle market and other energy storage systems. In addition, we are developing applications for our aerogel technology in the battery materials and a number of other high-potential markets.

We have historically conducted research related to aerogel technology supported by funding from several agencies of the U.S. government and other institutions in the form of research contracts. We have decided to cease efforts to secure additional funded research contracts and to wind down existing contract research activities.

When used in this report, the terms “we,” “us,” “our” and “the Company” refer to Aspen Aerogels, Inc. and its subsidiaries.

We design, develop and manufacture innovative, high-performance aerogel insulation used primarily in the energy infrastructure and sustainable building materials markets. We believe our aerogel blankets deliver the best thermal performance of any widely used insulation product available on the market today and provide a combination of performance attributes unmatched by traditional insulation materials. Our end-user customers select our products where thermal performance is critical and to save money, improve resource efficiency, enhance sustainability, preserve operating assets, and protect workers.

Our technologically advanced insulation products are principally targeted at the estimated \$3.9 billion annual global market for energy infrastructure insulation materials. Our aerogel insulation has undergone rigorous technical validation and is used by many of the world’s largest oil producers and the owners and operators of refineries, petrochemical plants, liquefied natural gas facilities and power generating and distribution assets, such as ExxonMobil, Reliance Industries, PTT LNG, and Royal Dutch Shell. Our products replace traditional insulation in existing facilities during regular maintenance, upgrades and capacity expansions. In addition, our aerogel products are increasingly being specified for use in new-build energy infrastructure facilities.

We introduced our two key aerogel insulation product lines for the energy infrastructure market, Pyrogel® and Cryogel®, in 2008. Pyrogel and Cryogel have undergone rigorous technical validation by industry-leading end-users and achieved significant market adoption. We introduced our aerogel insulation product for the building materials market, Spaceloft®, in 2006. Our insulation product revenue has grown from \$17.2 million in 2008 to \$114.4 million in 2021, representing a compound annual growth rate of 17%. During this period, we have sold nearly \$1.2 billion of our insulation products globally, representing an installed base of more than 400 million square feet of insulation. We believe that our long-term record of success positions us for future growth and continued gain in market share in the energy infrastructure and building materials markets.

We have grown our business by forming technical and commercial relationships with industry leaders, which has allowed us to optimize our products to meet the particular demands of targeted market sectors. We have benefited from our technical and commercial relationships with ExxonMobil in the oil refinery and petrochemical sector, with TechnipFMC in the offshore oil sector, and with BASF in the sustainable building materials market. We will continue our strategy of working with innovative companies to target and penetrate additional opportunities in the energy infrastructure and sustainable building materials markets.

We are also actively developing a number of promising aerogel products and technologies for the electric vehicle market. We have developed and are commercializing our proprietary line of PyroThin® thermal barriers for use in battery packs of electric vehicles. Our PyroThin product is an ultra-thin, lightweight and flexible thermal barrier designed with other functional layers to impede the propagation of thermal runaway across multiple lithium-ion battery system architectures. Our thermal barrier technology is designed to offer a unique combination of thermal management, mechanical performance and fire protection properties. These properties enable electric vehicle manufacturers to achieve critical battery performance and safety goals.

In addition, we are seeking to leverage our patented carbon aerogel technology to develop industry-leading battery materials for use in lithium-ion battery cells. These battery materials have the potential to increase the energy density of the battery cells, thus enabling an increase in the driving range of electric vehicles.

During 2020 and 2021, we entered into multi-year production contracts with a major U.S. automotive manufacturer to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. We are currently supplying thermal barrier production parts to both this major U.S. manufacturer and a major Asian automotive manufacturer. We are also supplying thermal barrier prototype parts to a number of other U.S., European and Asian manufacturers of electric vehicles, grid

storage and home battery systems. During 2021, our first full year of serving the electric vehicle and energy storage market, we sold \$6.7 million of our PyroThin thermal barriers to ten customers.

The commercial potential for our PyroThin thermal barriers and our carbon aerogel battery materials in the electric vehicle market is significant. Accordingly, we are hiring additional personnel, incurring additional operating expenses, incurring significant capital expenditures to expand our aerogel manufacturing capacity, establishing an automated thermal barrier fabrication operation, enhancing research and development resources, and expanding our battery materials research facilities, among other items.

In addition, our Spaceloft building materials products are increasingly used by building owners to improve energy efficiency and to enhance fire protection in buildings ranging from historic brownstones to modern high rises. We also derive product revenue from a number of other end markets. Customers in these markets use our products for applications as diverse as military and commercial aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. As we continue to enhance our Aerogel Technology Platform™, we believe we will have additional opportunities to address high-value applications in the global insulation market, the electric vehicle market and in a number of new, high-value markets, including hydrogen energy, filtration, water purification, and gas sorption.

Our patented aerogel products and manufacturing technologies are significant assets. Silica aerogels are complex structures in which 97% of the volume consists of air trapped between intertwined clusters of amorphous silica solids. These extremely low-density solids provide superior thermal and acoustic insulating properties. Although silica aerogels are usually fragile materials, we have developed innovative and proprietary manufacturing processes that enable us to produce industrially robust aerogel insulation cost-effectively and at commercial scale. We believe that our electrically conductive carbon aerogel materials are reaching development maturity and expanding our market opportunities in energy storage. These patented carbon aerogels are uniquely strong, providing the physical strength, charge and ion conductivity, and porosity required to host high concentrations of silicon in lithium-ion battery anodes. These silicon carbon aerogels have the potential to lower the costs and increase the energy density of electric vehicle battery systems.

Our insulation products help end-users to improve resource efficiency, reduce energy consumption, and reduce the carbon footprint of their operations. These products enable compact system design, reduce installation time and costs, promote freight and logistics cost savings, reduce system weight, minimize required storage space and enhance job site safety. Our insulation products reduce the incidence of corrosion under insulation, which is a significant maintenance cost and safety issue in energy infrastructure facilities. Many of our insulation products also offer strong fire protection, which is a critical performance requirement in our markets. We believe our array of product attributes provides strong competitive advantages over traditional insulation. Although competing insulation materials may have one or more comparable attributes, we believe that no single insulation material currently available offers all of the properties of our aerogel insulation products.

Our aerogel thermal barrier products are designed to enable our customers to enhance the safety and performance of their lithium-ion battery systems. These barriers are designed to impede the propagation of thermal runaway in lithium-ion battery systems at the battery cell, module and pack levels across multiple lithium-ion battery system architectures. Our ultra-thin, lightweight and flexible thermal barriers are designed to allow battery manufacturers to achieve critical safety goals without sacrificing energy density. We believe we offer the best technology available for the management of thermal runaway in the electric vehicle market.

Total revenue for the years ended December 31, 2021, 2020 and 2019 was \$121.6 million, \$100.3 million, and \$139.4 million, respectively. For the years ended December 31, 2021, 2020 and 2019, based on shipment destination or research services location, our U.S. revenue was \$66.8 million, \$44.8 million, and \$58.3 million, respectively, and our international revenue was \$54.8 million, \$55.5 million, and \$81.0 million, respectively.

We manufacture our products using our proprietary technology at our facility in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have increased our estimated annual revenue capacity in phases to approximately \$250.0 million. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in Bulloch County, Georgia. We expect to build the second plant in two phases at an estimated cost of approximately \$575.0 million for the first phase and approximately \$125.0 million for the second phase. We currently expect that the first phase of the plant will increase our annual revenue capacity by approximately \$650.0 million and the second phase by approximately \$700.0 million. We expect to have the first phase of the second plant operational late in the second half of 2023. In addition, we are planning to construct and commence operation of a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico, during 2022, in order to keep pace with the significant potential demand for our PyroThin thermal barriers.

In order to manage the effects of the COVID-19 pandemic on our business, we continue to follow safe practices recommended by public health authorities and other government entities. We will continue to focus on the safety and health of our employees, customers and vendors. We have implemented various precautionary measures, including remote work arrangements, restricted

business travel and procedures for social distancing, face coverings, safe hygiene, and vaccination requirements for all employees. We continue to monitor public health guidance as it evolves and plan to adapt our practices as appropriate. Refer to the section below entitled “Item 1A. Risk Factors” for more information concerning risks to our business associated with COVID-19.

Financial information about our product and research services revenues, net loss per share and our total assets are provided in our consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

Our Markets and Competition

Our principal market is the energy infrastructure insulation market. This market is global, well-established and includes large and well-capitalized end-users. This market includes companies operating refinery, petrochemical, oil production, and LNG production and storage facilities. The market also includes firms operating gas, coal, nuclear, hydro and solar thermal power generating plants and district energy systems. Insulation systems in the energy infrastructure market are designed to maintain hot and cold process equipment, piping and storage tanks at optimal temperatures, to protect plant and equipment from the elements and from the risk of fire, and to protect workers. The market is served by a well-organized, well-established worldwide network of distributors, contractors, and engineers.

Demand for insulation in the energy infrastructure market is composed of demand associated with new-build construction of facilities, capital expansions and related capital projects, as well as with routine, non-discretionary maintenance programs within existing facilities. Capital expansions and related capital projects in the energy infrastructure market are driven primarily by overall economic growth and projected growth in energy demand. Maintenance programs are essential to optimal operation of process equipment, to protect workers and to minimize the risk of a catastrophic loss. Accordingly, we believe that demand for insulation for maintenance purposes in comparison to capital projects is less affected by volatility associated with economic cycles, energy prices and other macroeconomic factors.

The major end-user markets that drive demand for our products include oil refining, petrochemical, natural gas and LNG production and storage, onshore oil production, offshore oil production and power generation. Global energy demand is expected to increase in the long-term and, in order to serve this growing demand, we believe our end-user customers will continue to invest in major energy infrastructure projects.

We have also developed and commercialized a proprietary line of aerogel-based thermal barriers for use in battery packs of electric vehicles and energy storage systems. The market for our thermal barrier products encompasses batteries used in mobile platforms, including automobiles, trucks, buses and light aircraft, and fixed platforms, including home storage, grid storage and other commercial applications. The global lithium-ion battery market was estimated to be more than \$40.0 billion in 2021 and continues to grow and evolve rapidly. Our thermal barrier technology offers a unique combination of thermal management, mechanical performance, and fire protection properties that enables electric vehicle manufacturers to achieve critical battery performance and safety goals. We believe that as the e-mobility and energy storage markets require increasingly powerful lithium-ion battery systems, the demand for our aerogel thermal barriers will grow rapidly as the market players seek to reduce the associated risk of thermal runaway.

We have entered into contracts with a major U.S. automotive original equipment manufacturer (OEM) to supply fabricated, multi-part thermal barriers for use in the production of the battery system of its next-generation electric vehicles. Pursuant to the contracts, we are obligated to supply the barriers at fixed annual prices and at volumes to be specified by the customer up to a daily maximum quantity through the term of the agreements, which expire at various times from 2026 through 2034. While the customer has agreed to purchase its requirement for the barriers from us at locations to be designated from time to time, it has no obligation to purchase any minimum quantity of barriers under the contracts. In addition, the customer may terminate the contracts any time and for any or no reason. All other terms of the contracts are generally consistent with the customer’s standard purchase terms, including quality and warranty provisions customary in the automotive industry.

We also sell our products for use in the sustainable building materials and other end markets, including for the fabrication of insulation parts by original equipment manufacturers, or OEMs. These OEMs develop products incorporating our aerogel blankets for applications in a diverse set of markets including military aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. While these are not presently our core markets, we anticipate that we will allocate a growing portion of our manufacturing capacity to serve these markets in the long term. We believe the key performance criteria for insulation in these markets and applications include thermal performance, compact design, durability and fire resistance.

We operate in a highly competitive environment. In the energy infrastructure and sustainable building materials markets, we compete with traditional insulation materials based on product performance, price, availability and proximity to the customer. Customers may choose among a variety of insulation materials that offer a range of characteristics including thermal performance,

durability, vapor permeability, moisture resistance, ease of installation and upfront and lifecycle costs. Within each type of insulation material, there is also competition between the manufacturers of that material. Most types of traditional insulation materials are produced by a number of different manufacturers and once customers have chosen the type of insulation material that they intend to use, they will choose a manufacturer of that material based primarily on each manufacturer's price and delivery schedule. Insulation manufacturers include a range of large, high-volume, multinational manufacturers offering branded products and strong technical support services to small, low-volume, local manufacturers offering low prices and limited customer support.

We believe the primary competitive factors in these markets are:

- product performance (along multiple criteria), quality and fitness for purpose;
- product price, installed cost and lifecycle cost;
- product availability; and
- proximity to customer and logistics.

Our products are priced at a premium to traditional insulation materials. While our competitors offer many traditional insulation products that are priced below our products on a per-unit basis, we believe our products have superior performance attributes and may have the lowest cost on a fully-installed basis or offer significant life-cycle cost savings.

Competition in the thermal barrier market is evolving. We believe our patented aerogel thermal barrier technology offers a unique combination of attributes to mitigate thermal runaway in lithium-ion battery systems. These attributes include industry-leading thermal performance, limited combustibility, tunable compressibility and scalable density. We expect to face increasing competition within the thermal barrier market over the next several years as new entrants seek to develop and market their own technologies and solutions.

We compete in the aerogel materials market with Cabot Corporation, Armacell International S.A., Guangdong Alison Hi-Tech Co., Ltd. and Nano Tech Co., Ltd. and a growing number of other competitors that manufacture, sell or resell aerogel-based insulation products. We expect to face increasing competition in the aerogel insulation market over the next several years as existing competitors and new entrants seek to develop and market their own aerogel products. In addition to other aerogel insulation products, we also encounter competition from innovatively packaged traditional insulation materials that compete with our products based on one or more performance factors.

Within each of our target markets, we encounter one or more of these organizations or their resellers and a significant number of other aggressive national, regional and local suppliers of traditional insulation products. Our competitors are seeking to enhance traditional insulation materials and to develop and introduce new and emerging insulation technologies. Competing technologies that outperform our insulation products in one or more performance attributes could be developed and successfully introduced. See "Risk Factors —The insulation markets we serve are highly competitive. If we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues."

Our market share in 2021 was approximately 3% of the estimated \$3.9 billion annual global market for energy infrastructure insulation materials. Our market share in 2021 in the sustainable building materials, thermal barrier, and other markets was either not significant or not measurable. Many of our competitors have greater market presence, larger market share, longer operating histories, stronger name recognition, larger customer bases and significantly greater financial, technical, sales and marketing, manufacturing and other resources than we have and may be better able to withstand volatility within the industry and throughout the economy as a whole, while retaining greater operating and financial flexibility. If our competitors lower their prices, or develop new products with better performance, or if we are unable to compete effectively, our growth opportunities, share of the market, margins and profitability may decline.

Our Competitive Strengths

Because insulation is used in a wide variety of demanding applications, insulation materials must satisfy a wide range of performance criteria on a cost-effective basis. We believe that our aerogel technology has allowed us to create superior insulation products and will allow us to continue to grow our share of the energy infrastructure, sustainable building materials and thermal barrier markets. We believe that the potential for significant technological innovation in traditional materials is limited and that new high-performance materials will be required to meet evolving market requirements for energy efficient insulation and thermal barrier systems. Our line of high-performance aerogel products is positioned to meet these requirements. Our solutions are driven by our innovative and proprietary technology that produces aerogels in a flexible and industrially robust blanket form. Our solutions also benefit from over 20 years of research and development dedicated to new aerogel compositions, form factors and manufacturing technologies. We believe our aerogel blankets deliver a superior combination of performance attributes that enable energy

infrastructure and sustainable building materials end-users to save money, improve resource efficiency, preserve operating assets and protect workers across a wide range of applications in our target markets. We believe our patented aerogel thermal barriers offer an industry-leading combination of attributes to mitigate thermal runaway in lithium-ion battery systems.

We believe the following combination of capabilities distinguishes us from our competitors and positions us to continue to gain market share in the energy infrastructure, sustainable building materials, and electric vehicle markets:

- **Disruptive Products with a Compelling Value Proposition.** Our aerogel insulation provides two to five times the thermal performance of widely used traditional insulation in a thin, easy-to-use and durable blanket form. We believe our array of product attributes provides strong competitive advantages over traditional insulation and will enable us to gain a larger share of the energy infrastructure insulation market. In addition, our aerogel thermal barriers offer a combination of attributes that provide industry-leading protection against thermal runaway in lithium-ion batteries. We believe our thermal barriers provide the market-leading technological solution to combat thermal runaway and will help us gain share within the market for lithium-ion batteries used in the e-mobility and grid storage markets. Although competing materials may have one or more comparable attributes, we believe that no single insulation or thermal barrier material currently available offers all of the properties of our aerogel products.
- **Important End Markets.** Our aerogel insulation products are primarily used in large-scale energy infrastructure facilities. Our aerogel thermal barrier products are gaining share in the rapidly growing, high value electric vehicle market. Given the projected high growth in the e-mobility markets and continued growth in global energy consumption in the long-term, and the construction of new facilities to satisfy this demand, we believe that we serve well-capitalized and rapidly growing global end markets. In order to capture the opportunities in our end markets, we have a network of sales professionals and qualified distributors in more than 50 countries around the world.
- **Strong Installed Base with Industry-leading Energy Customers.** We have an installed base of more than 400 million square feet of insulation, representing nearly \$1.2 billion in cumulative product sales since 2008. Through our relationships with industry-leading energy infrastructure customers, our products have undergone rigorous testing and technical validation and are now in use at most of the world's largest oil producers, refiners and petrochemical companies. These relationships have shortened the sales cycle with other customers and have helped to facilitate our market penetration. We also have strong relationships with a global network of energy-focused distributors, contractors and engineering firms that understand the significant advantages our products provide to end-users.
- **Thermal Barrier Adoption by Leading Electric Vehicle Customers.** In 2020 and 2021, we entered into contracts with a major U.S. automotive OEM to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. This relationship has helped to validate our thermal barrier technology with other companies providing products and solutions to the electric vehicle, lithium-ion battery and grid storage markets. We are currently supplying thermal barrier production parts to both the major U.S. and a major Asian automotive manufacturer. We are also supplying thermal barrier prototype parts to a number of other U.S., European and Asian manufacturers of electric vehicles, grid storage and home battery systems. During 2021, our first full year of serving the electric vehicle and energy storage market, we sold \$6.7 million of our PyroThin thermal barriers to ten customers. We are engaged in system development and quoting activities with a wide range of additional prospective customers in the broader e-mobility and energy storage markets.
- **Proven, Scalable Business Model.** Our proprietary manufacturing technology is proven and has been successfully scaled to meet increasing demand. We have operated the East Providence facility since 2008 and have increased our annual revenue capacity in phases to approximately \$250.0 million. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in two phases in Bulloch County, Georgia. We expect to have the first phase of the second aerogel plant operational late in the second-half of 2023. In addition, we are planning to construct a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico in order to keep pace with the significant potential demand for our PyroThin thermal barriers.
- **Protected Technology Platform and Proprietary Manufacturing Capability.** Our aerogel technology platform is the result of extensive research and development dedicated to new aerogel compositions, form factors and manufacturing technologies. Our intellectual property portfolio is supported by 166 issued patents, with an additional 191 pending and one allowed, in U.S. and foreign jurisdictions in areas related to product design, chemistry, process technology and market applications. In addition, we have significant knowledge and trade secrets related to product formulations and manufacturing techniques. We believe our portfolio of patents, trade secrets, and knowledge present a barrier to potential new entrants in the commercialization of aerogel products.
- **Experienced Management Team with a Demonstrated Track Record.** Our executive officers have an average of more than 20 years of experience in global industrial companies, specialty chemical companies, automotive, or related material science research. This management team is responsible for the continued development of our aerogel technology platform, the commercial acceptance of our products, and the creation of a global distribution and marketing platform. As of

December 31, 2021, we employed 418 people including material scientists, engineers, manufacturing line operators, sales personnel, administrative staff, and management. We believe our dedicated and experienced team is an important competitive asset.

Our Growth Strategy

Our strategy is to create economic value by leveraging our technological and market leadership in aerogels to be the premier provider of high-performance aerogel products serving the global electric vehicle and energy infrastructure markets. We also will pursue high-value opportunities for our aerogel insulation products within the sustainable building materials market and a diverse set of new markets. In addition, we will leverage our aerogel technology platform to develop innovative, aerogel-enhanced products for applications outside of the global insulation market.

Key elements of our strategy include:

- **Leverage Aerogel Technology Platform in the Electric Vehicle Market.** We plan to build upon the initial commercial success of our industry-leading PyroThin thermal barriers within the battery systems of electric vehicles. We will continue to hire experienced automotive business development personnel, construct a state-of-the-art thermal barrier fabrication operation, hire dedicated thermal barrier fabrication employees, and increase our aerogel blanket manufacturing capacity to keep pace with the significant potential demand for our PyroThin thermal barriers. In addition, we will seek to leverage the unique properties of our proprietary and patented carbon aerogels to improve the performance and cost of lithium-ion batteries. We will continue our efforts with our partners to explore the potential use of Aspen's silicon-rich carbon aerogel materials in the anode and cathode of lithium-ion batteries and in solid-state batteries. We will continue to seek to engage with additional leading battery material and electric vehicle manufacturers to realize the full potential of our silica aerogels, our carbon aerogels and our broader aerogel technology platform within the electric vehicle market.
- **Strategically Increase Capacity to Meet Demand.** Demand for our aerogel products has grown significantly since our inception. From 2008 through 2021, our product revenue has grown at a compound annual growth rate of 17% to \$114.4 million. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in Bulloch County, Georgia. We expect to build the plant in two phases at an estimated cost of \$575.0 million for the first phase and \$125.0 million for the second phase. We currently expect the first phase of the plant will increase our annual revenue capacity by approximately \$650.0 million and the second phase by approximately \$700.0 million. In addition, we are planning to establish a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico, in order to keep pace with the significant potential demand for our PyroThin thermal barriers.
- **Capitalize on Innovation to Develop New Markets.** Our team of materials scientists and engineers focus on advancing our aerogel technology platform and developing next generation aerogel compositions, form factors and manufacturing processes. We believe that we are well-positioned to leverage over 20 years of research and development to develop and commercialize disruptive aerogel products for a wide array of new markets beyond the energy infrastructure, sustainable building materials, and electric vehicle markets. We will seek to exploit the unique characteristics of aerogels, including low thermal conductivity, high surface area, high electrical conductivity, and tunable porosity, to develop aerogel-enhanced products and next generation technology addressing complex and unmet market needs. We will continue to seek potential partnerships with industry leaders that include a mix of commercial, technical and financial elements to realize the full potential offered by our proprietary aerogel technology platform in targeted markets.
- **Broaden Energy Market Diversity and Grow Market Share.** We plan to add resources to continue to grow our share of the energy infrastructure insulation market, both through increased sales to our existing customers and through sales to new customers. We plan to continue to expand and enhance our global sales and distribution network and seek to promote greater enterprise-wide adoption of our products by existing end-user customers. To date, the majority of our revenue has been generated from applications in refineries and petrochemical facilities. We will continue to pursue and expect greater adoption of our products for applications in the LNG and power markets. In addition, our product revenue will continue to be generated, in large part, by demand for insulation associated with scheduled plant shutdowns, or turnarounds, and other maintenance-related projects. With broad adoption of our products and our growing installed base, we expect that our products will be specified at increasing rates during the design phase in a growing number of new-build and capital expansion projects. We also expect that growth in global energy demand over time will result in increased new-build and large capacity expansion projects, thereby driving additional demand for our aerogel products.
- **Enhance Our Profit Margins, Operational Cash Flow and Return on Invested Capital.** We will seek to improve the efficiency of our manufacturing process, to optimize the formulation of our products and to manage our supply chain to reduce costs. We believe additional opportunities to realize production efficiencies and to reduce per unit overhead costs

will arise with growth in the scale of our manufacturing operations. We believe our current expansion plans and available manufacturing technology advancements will enhance profit potential, increase operating cash flow capability, and offer attractive returns on incremental invested capital. In addition, we will focus our development efforts on new products and next generation technology with application in new, high value market segments.

Our Aerogel Products

Silica aerogels are highly porous structures in which 97% of the volume consists of air trapped between intertwined clusters of amorphous silica solids. Silica aerogels are a very low-density solids and are extremely fragile materials. However, our proprietary manufacturing process produces silica aerogels in a flexible, resilient, durable and easy-to-use blanket form.

The core raw material in the production of our aerogel insulation products is silica precursors. Our manufacturing process initially creates a semi-solid alcogel in which the silica structure is filled with ethanol. We produce aerogel by means of a supercritical extraction process that removes ethanol from the gel and replaces it with air. Our process allows the ethanol to be extracted without causing the solid matrix in the gel to collapse from capillary forces.

Our material costs were 48%, 44%, and 48% of product revenue for the years ended December 31, 2021, 2020 and 2019, respectively. We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs, by enhancing manufacturing process controls to improve yields, by realizing price reductions from existing vendors, by qualifying new vendors and by reducing shipping costs. Our objective is both to reduce costs to enhance our competitive position and to ensure we deliver high quality products to our customers.

The materials used in the production of our silica aerogel products consist primarily of several silica precursors, fiber batting, and other additives. The markets for these materials are generally competitive and multiple sources of supply exist for all of our raw materials. However, from time-to-time, we have experienced a significant increase in the price of certain silica precursors due to supply imbalances in the silanes market. We are actively working to reformulate our products to reduce our reliance on the materials that are susceptible to significant price fluctuations. We are also working to expand the geographic diversity of our supply base to reduce the risk of demand and supply imbalances in any one country or region.

We purchase silica precursors from several suppliers in the United States, Europe and Asia, including China. Based on the current level of demand for our products, we believe that an adequate long-term supply of silica precursors is available. However, if demand for our products increases rapidly, we will need to work with suppliers to ensure that an adequate long-term supply of silica precursors will be available at competitive prices. Suppliers of silica precursors include industrial companies that produce the materials directly or that produce them as a byproduct of other industrial processes. We are working with a number of these suppliers to plan for our potential future needs and to develop our processes to reduce the long-term cost impact of these materials. We are also considering investing in the technology and the capital assets required to produce certain critical silica precursors in our planned aerogel manufacturing facility in Bulloch County, Georgia. See “Risk Factors — Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could adversely impact our financial condition and results of operations.”

Our aerogel blankets are reinforced with fiber batting. We manufacture and sell our blankets in 60-inch-wide, three-foot diameter rolls with a standard range of thickness of two millimeters to ten millimeters. Our base products are all flexible, hydrophobic, vapor permeable, compression resistant and able to be cut and fabricated using conventional tools. We have specifically developed our line of aerogel blankets to meet the requirements of a broad set of applications within our target markets. The composition and attributes of our standard aerogel blankets are described below:

Electric Vehicle & Energy Storage Market

- ***PyroThin.*** PyroThin thermal barriers are our new generation of ultra-thin flexible aerogel products engineered to satisfy the needs of the electric vehicle and energy storage industries to address thermal runaway issues in lithium-ion batteries. PyroThin thermal barriers can be used to provide passive fire protection at the cell, module or pack level within multiple lithium-ion battery system architectures. PyroThin thermal barriers can also be customized to offer a unique combination of thermal management, mechanical performance and fire protection properties that enable an electric vehicle manufacturer to achieve targeted battery performance and safety goals.

Energy Infrastructure Markets

- ***PyroGel XTE.*** PyroGel XTE, our best-selling product, is reinforced with a glass-fiber batting and has an upper use temperature of 650° C. PyroGel XTE was initially designed for use in refineries and petrochemical facilities, but has

proven to have wide applicability throughout the energy infrastructure market. Pyrogel XTE is optimized for high temperature applications between 100° C and 400° C. Pyrogel XTE's hydrophobicity and vapor permeability reduce the risk of corrosion under insulation in energy infrastructure operating systems when compared to traditional insulation.

- **Pyrogel HPS.** Pyrogel HPS is optimized for applications within the power generation market with operating temperatures greater than 400° C. With an upper use temperature of 650° C, high durability and extremely low thermal conductivity, Pyrogel HPS is ideal for installation in high performance turbine systems and in demanding thermal environments in power plants and systems. Pyrogel HPS also provides strong value at high temperatures and in demanding thermal applications in refining and chemical processing systems.
- **Pyrogel XTF.** Pyrogel XTF provides thermal performance similar to Pyrogel XTE, but is reinforced with a glass- and silica-fiber batting. Pyrogel XTF is specially formulated to provide strong protection against fire.
- **Cryogel Z.** Cryogel Z is designed for sub-ambient and cryogenic applications in the energy infrastructure market. Cryogel Z is reinforced with a glass- and polyester-fiber batting and is produced with an integral vapor barrier. Cryogel Z is also specially formulated to minimize the incidence of stress corrosion cracking in stainless steel systems. Cryogel Z's combination of properties allows for simplified system designs and reduced installation costs in cold applications throughout the energy infrastructure market when compared to traditional insulation.
- **Spaceloft Subsea.** Spaceloft Subsea is reinforced with glass- and polyester-fiber batting and is designed for use in pipe-in-pipe applications in offshore oil production. Spaceloft Subsea is typically fabricated and pre-packaged to permit faster installation. Spaceloft Subsea allows for small profile carrier pipelines and associated reductions in capital costs.

Other Markets

- **Spaceloft Grey.** Spaceloft Grey is reinforced with a glass- and polyester-fiber batting and is designed for use in the sustainable building materials market. Spaceloft Grey is either utilized in roll form by contractors in the field or fabricated by OEMs into strips, panels and systems that meet industry standards. Spaceloft Grey is designed for use in solid wall buildings and where space is at a premium.
- **Spaceloft A2.** Spaceloft A2 is reinforced with a glass-fiber batting and specifically designed to meet Euroclass A2 fire standards in the sustainable building materials market. Spaceloft A2 is designed to provide industry-leading thermal performance in applications where building regulations require the use of non-combustible products.
- **Cryogel X201.** Cryogel X201 is similar in composition to Cryogel Z, but is produced without the integral vapor barrier. Cryogel X201 is designed for use in cold system designs where space is at a premium. Cryogel X201 is targeted to OEMs that design, produce and sell refrigerated appliances, cold storage equipment and aerospace systems.

R-Values by Material

Insulation is a material or combination of materials that slows the transfer of heat from one side of the material to the other. The composition of our aerogel products minimizes the three mechanisms of thermal transport:

- **Conduction.** Heat conduction through a material is correlated to the material's density. Aerogels are very low-density solids. As a result, thermal conductivity through the aerogel material itself is extremely low.
- **Convection.** Heat convection in gases is through movement of gas molecules. Due to the restricted movement of gases in the nanoporous aerogel structure, thermal convection is eliminated inside the aerogels.
- **Radiation.** Radiation requires no medium to transfer the heat. Thermal radiation is partially absorbed by aerogels. Our aerogel products also contain infrared absorbing additives to reduce radiant heat transfer significantly.

We believe our aerogel products offer the lowest levels of thermal conductivity, or best insulating performance, of any widely used insulation or thermal barrier available on the market today.

The lower a material's thermal conductivity, the more slowly heat is transferred through the material. R-values are a commonly used measure of an insulating material's resistance to heat transfer. R-value is calculated as the thickness of an insulation material divided by the thermal conductivity of the insulation material. Materials with higher R-values have lower thermal conductivity and are better insulators. Traditional and specialty insulation materials provide a range of R-values. Aerogels have the highest R-value per unit of thickness in comparison to traditional insulation materials.

Qualification for Use

Our products have undergone rigorous testing and are now qualified for global usage in both routine maintenance and in capital projects at many of the world's largest oil producers, refiners, and petrochemical companies, and within the next-generation lithium-ion battery systems of two of the largest global automotive manufacturers. These end-users of our products have well-defined practices, codes, specifications and standards for materials and systems installed in their vehicles or used in their facilities. These specifications include system design standards, material qualification and selection processes, insulation application practices, and quality control requirements. As part of the material qualification process established by these companies, a new insulation or thermal barrier product must meet general industry standards, such as consensus standards developed by ASTM International, and, in many cases, company-specific internal standards to be considered and approved for use or designed into vehicle platforms. In addition, most of these companies require one or more field trials of tests to evaluate fitness for use in specific applications. These companies either run these qualification processes and field trials internally or through third parties engaged by them, and they generally do not publicly disclose the results of their testing. While the specific processes and timelines vary from company to company, in general, upon successful completion of the qualification process for an insulation or thermal barrier product, an end-user will typically deem the product to be qualified for use in its facilities on a local, regional or global basis for one or more applications or vehicles. Because our end-user customers are typically businesses with very large operations in multiple sites, our insulation or thermal barrier sales likely represent only a small portion of the total product used by any one of these companies. Accordingly, once our products are qualified or designed into a platform at a specified company, we continue to seek to expand the use of our products by the end-use customer in additional applications, platforms, locations or vehicles.

Our Sales Channel

We market and sell our products primarily through our global sales force. Our sales personnel are based in North America, Europe and Asia and travel extensively to market and sell our products to new and existing customers. The efforts of our sales force are supported by a small number of sales consultants with extensive knowledge of a particular market or region. Our sales force establishes and maintains customer and partner relationships, delivers highly technical information and provides first-class customer service. We plan to expand our sales force and business development resources globally to support anticipated growth in customers and demand for our products.

Our sales force calls on and maintains relationships with participants at all levels of the energy infrastructure supply chain. We have established a network of insulation distributors to ensure rapid delivery of our products in critical regions. Our sales personnel work to educate insulation contractors about the technical and operating cost advantages of aerogel blankets. Our sales force also works directly with end-users and engineering firms to promote qualification, specification and wider acceptance of our products in existing and new applications. In the energy infrastructure market, we rely heavily on the existing and well-established channel of distributors and contractors to deliver products to our customers. In addition, our sales and business development personnel work directly with OEMs and strategic partners, including within the electric vehicle industry, to create new product designs and solutions to expand our market reach.

The sales cycle for a new insulation material or thermal barrier is typically lengthy. Our sales cycle from initial customer contact to widespread use can take from one to three years, although we typically realize increasing revenue at each stage in the cycle. We believe our relationships with technically sophisticated customers and strategic partners serve to validate our technology, products and value proposition within a target market. These relationships have proven to accelerate the sales cycle with other customers within specific markets and to facilitate growth in market share. We have focused our marketing efforts on developing technical support materials, installation guides, case studies and general awareness of the superior performance of our aerogel blankets and thermal barriers. We rely principally on our website, social media, printed technical materials, participation in industry conferences and tradeshow and presentation of technical papers to communicate our message to existing and potential customers. We also receive strong word-of-mouth support from the growing network of distributors, installation contractors, OEMs, strategic partners and end-users that understand the benefits of our products.

As of December 31, 2021, we had 63 sales and marketing professionals worldwide. Their efforts were supported by a team of ten sales consultants.

Our Customers and End-Users

Customers

Energy Infrastructure

Our primary customers in the energy infrastructure market are distributors, installation contractors and fabricators that stock, install and customize insulation products, components and systems for technically sophisticated end-users that require high-performance insulation.

- **Distributors:** We currently operate through a global network of 68 insulation distributors. In general, insulation distributors stock, sell and distribute aerogel materials to insulation contractors and end-users. The distribution of our product outside of the United States is at times conducted under agreements that provide for exclusivity by geography linked to annual purchase volume minimums. These insulation distributors typically market, promote and advertise our aerogel materials across their market.
- **Contractors:** We currently sell directly to a number of insulation contractors under project specific contracts or general purchase orders. Insulation contractors generally perform insulation installation, inspection, maintenance and project management for end-users. In addition, some insulation contractors provide end-users with project engineering and design services.
- **Fabricators:** We currently sell directly to a small network of fabricators that design, customize and manufacture insulation components and systems for use in the energy infrastructure, industrial, building materials, transportation, appliance and apparel markets.
- **Direct Sales to End-Users:** In certain instances, we sell directly to end-users in the energy infrastructure insulation market. In these instances, our end-users directly manage and control specification, logistic, installation, inspection, maintenance and fabrication activities of our aerogel products.

Electric Vehicle and Energy Storage

Our customers in the evolving electric vehicle and energy storage markets include electric vehicle manufacturers, Tier 1 automotive suppliers, lithium-ion battery manufacturers, and e-mobility and energy storage companies. Our existing and prospective customers range from start-ups to the largest automotive manufacturers in the world.

We typically supply thermal barrier products to our automotive OEM customers through purchase orders, which are generally governed by general terms and conditions established by the OEM. The terms and conditions typically contemplate a relationship under which our customers place orders for their requirements of specific components supplied for particular vehicles but are not required to purchase any minimum quantity of products from us. We expect that these relationships will typically extend over the life of the related vehicle. Prices are negotiated with respect to each business award, which may be subject to adjustments under certain circumstances, such as commodity or foreign exchange escalation/de-escalation clauses or for cost reductions achieved by us. The terms and conditions typically provide that we are subject to a warranty on the products supplied; in most cases, the duration of such warranty is coterminous with the warranty offered by the OEM to the end-user of the vehicle. We may also be obligated to share in all or a part of recall costs if the OEM recalls its vehicles for defects attributable to our products.

Individual purchase orders from our automotive OEM customers are terminable for cause or non-performance and, in most cases, upon our insolvency and certain change of control events. In addition, our automotive OEM customers often have the option to terminate for convenience on certain programs, which permits our customers to impose pressure on pricing during the life of the vehicle program, and issue purchase contracts for less than the duration of the vehicle program, which potentially reduces our profit margins and increases the risk of our losing future sales under those purchase contracts.

Although customer programs typically extend to future periods, and although there is an expectation that we will supply certain levels of automotive OEM production during such future periods, customer agreements including applicable terms and conditions do not constitute firm orders. Firm orders are generally limited to specific and authorized customer purchase order releases. Firm orders are typically fulfilled as promptly as possible from the conversion of available raw materials, sub-components and work-in-process inventory for OEM orders. The dollar amount of such purchase order releases on hand and not processed at any point in time is not believed to be significant based upon the time frame involved.

Additional Customer Information

Distribution International, Inc. represented 28% of our total revenue in 2021 and was our only customer representing 10% or more of our revenue for that period.

Our product revenue is generated by sales to customers around the world. In 2021, 55% of our product revenue was generated in the United States, 23% in Europe, 16% in Asia, 4% in Latin America, and 2% in Canada based on shipment destination.

A substantial portion of our sales are to shipment destinations located outside of the United States, including France, Norway, Thailand, Russia, Canada, Germany, Taiwan, Great Britain, Columbia, and South Korea. Total revenue generated from outside of the United States amounted to \$54.8 million or 45% of total revenue, \$55.5 million or 55% of total revenue and \$81.0 million or 58% of total revenue, in the years ended December 31, 2021, 2020 and 2019, respectively. In addition, we may continue to expand our operations outside of the United States. As a result, we are subject to a number of risks. See “Risk Factors — A substantial portion of our revenue comes from sales in foreign countries and we may expand our operations outside of the United States, which subjects us to increased economic, foreign exchange, operational and political risks that could increase our costs and make it difficult for us to operate profitably.”

End-Users

The end-users of our aerogel blankets and thermal barriers include some of the largest and most well-capitalized companies in the world. Our products are installed in more than 50 countries worldwide.

Energy Infrastructure

- ***Oil Refining:*** We believe our products have been installed in more than 30% of the world’s 640 refineries. In addition, we believe our aerogel blankets are used by 24 of the world’s 25 largest refining companies including ExxonMobil, Shell and Chevron, among others. Over time, these companies have used our products in an increasing range of applications and throughout an increasing number of their facilities.
- ***Petrochemical:*** We believe our aerogel blankets are used by all of the world’s 20 largest petrochemical companies including Reliance Industries, Formosa Petrochemical, and LyondellBasell Industries, among others.
- ***Natural Gas and LNG:*** Our products are in use at facilities operated by PTT LNG, ExxonMobil, and Dominion Energy, among others.
- ***Onshore:*** Our aerogel blankets are in use in several Canadian oil sands facilities owned and operated by Suncor Energy, ConocoPhillips and Husky Energy, among others.
- ***Offshore:*** Our products are currently used in subsea projects off the coast of Brazil, in the Gulf of Mexico, in the North Sea, off the coast of Malaysia and off the west coast of Africa. Our products are installed in offshore projects owned by Total, Marathon Oil, ConocoPhillips, and Shell, among others.
- ***Power Generation:*** We are targeting operators of gas, coal, nuclear, hydro and solar power generating facilities. Our products are currently used at facilities owned and operated by NextEra Energy Resources, Southern Company, and Duke Energy, among others.
- ***District Energy:*** Our products are used in medium- to high-temperature steam distribution networks in universities and municipalities within the United States and Asia.

Electric Vehicle Market

Our thermal barrier products are in use today in electric vehicle battery systems of a major U.S. automotive manufacturer and a major Asia-based automotive OEM with a leading global platform. We believe our customer base will expand in the near term to include additional electric vehicle manufacturers, Tier 1 automotive suppliers, lithium-ion battery manufacturers, and e-mobility and energy storage companies.

Our carbon aerogel program seeks to increase the performance of lithium-ion battery cells to enable electric vehicle manufacturers to extend the driving range and reduce the cost of electric vehicles, among other uses. We are targeting the manufacturers of battery components, batteries, grid battery systems, and electric vehicles as potential customers for our carbon aerogel materials.

Sustainable Building Materials and Other Markets

Traditionally, we have relied on the efforts of a small network of partners, OEMs and fabrication houses to serve the sustainable building materials, transportation, apparel and appliance markets. These partners, OEMs and fabricators are manufacturers of components and systems for buildings, refrigerated and hot appliances, cold storage equipment, automobiles, aircraft, trains,

electronics, and outdoor gear and apparel. The end-users of our products in these markets include a wide range of institutions, businesses, individuals, municipalities and government agencies.

Manufacturing

We manufacture our products using our proprietary technology at our facility located in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have significantly increased manufacturing capacity and productivity during the period. Our manufacturing process is proven and has been scaled to meet increasing demand.

Our manufacturing group is led by a seasoned team with management experience at global industrial and specialty chemical companies. Our manufacturing workforce is skilled and we have experienced employee turnover consistent with our industry. We have well-defined operating processes and maintenance, environmental, health and safety programs to support our operations. We employ statistical processes and quality controls in our manufacturing systems. We routinely measure and monitor thermal conductivity, hydrophobicity and other key properties of the aerogel blankets produced in our manufacturing operations. We are ISO 9001:2015 certified.

We have operated the East Providence facility since 2008 and have increased our capacity in phases since that time. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in Bulloch County, Georgia. We expect to build the plant in two phases with the first phase operational late in the second -half of 2023. In addition, we are planning to construct a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico in order to keep pace with the significant potential demand for our PyroThin thermal barriers.

We directly control all stages in the manufacture of our aerogel blankets. Our direct ownership of manufacturing operations allows us to maintain control of proprietary process technologies and to control product quality. Our production of aerogel blankets utilizes a continuous process and consists of the following key steps:

- **Sol Preparation.** Mixing of silica precursors in ethanol, a catalyst and additives in set formulas to deliver the target properties of the resultant aerogel.
- **Casting.** Combination of the sol and fiber batting and initial formation of the gel structure.
- **Aging.** Bathing of the gel blankets in fluids to impart desired physical and thermal properties.
- **Extraction.** Supercritical extraction of the ethanol liquid from the gel blanket to produce a dried aerogel blanket.
- **Heat Treatment.** Drying to remove trace ethanol, salts and water from the aerogel blankets.
- **Finishing.** Coating to enhance quality and product handling.
- **Fabrication.** Cutting, lamination, and production of components and multi-layer systems for custom applications in the electric vehicle and subsea markets.
- **Quality Control.** Utilizing statistical process and quality controls to measure thermal conductivity, hydrophobicity and other key properties of our aerogel products.

Our material costs were 48%, 44%, and 48% of product revenue for the years ended December 31, 2021, 2020 and 2019, respectively.

The materials used in the production of our products consist primarily of several silica precursors, fiber batting, and other additives. The markets for these materials are generally competitive and multiple sources of supply exist for all of our raw materials. However, from time-to-time, we have experienced a significant increase in the price of certain silica precursors due to a supply imbalance in the silanes market. We are actively working to reformulate our products to reduce our reliance on materials that are susceptible to significant price fluctuations. We are also working to expand the geographic diversity of our supply base to reduce the risk of demand and supply imbalances in any one country or region.

We purchase silica precursors from several suppliers in the United States, Europe and Asia, including China. Based on the current level of demand for our products, we believe that an adequate long-term supply of silica precursors is available. However, if demand for our products increases rapidly, we will need to work with suppliers to ensure that the long-term supply of silica precursors will be available at competitive prices. Suppliers of silica precursors include industrial companies that produce the materials directly or that produce them as a byproduct of other industrial processes. We are working with a number of suppliers to plan for our potential future needs and to develop our processes to reduce the long-term cost impact of these materials. We are also considering investing in the technology and the capital assets required to produce certain critical silica precursors in our planned aerogel manufacturing facility

in Bulloch County, Georgia. See “Risk Factors — Risks Related to Our Business and Strategy — Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could adversely impact our financial condition and results of operations.”

We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our aerogel blankets by optimizing our formulations to reduce material costs, by enhancing manufacturing process controls to improve yields, by realizing price reductions from existing vendors, by qualifying new vendors and by reducing shipping costs. In addition, we believe additional opportunities to realize production efficiencies and to reduce per unit overhead costs will arise with growth in the scale of our manufacturing operations. Our objective is both to reduce costs to enhance our competitive advantage and to ensure we deliver high quality finished products to our customers.

Research and Development

The mission of our research and development team is to leverage our aerogel technology platform in support of our commercial objectives. In our existing markets, research and development personnel design new and improved insulation and thermal barrier products to enhance our value to customers and to expand our revenue potential. Our materials scientists and engineers also seek to develop enhanced chemical and process technologies to improve yields, lower manufacturing costs and improve product performance. In new markets, research and development personnel seek to exploit the unique characteristics of aerogels, including low thermal conductivity, high surface area, high electrical conductivity, and tunable porosity, to develop aerogel-enhanced products and next generation technology addressing complex and unmet market needs.

Our research and development expenditures were \$11.4 million, \$8.7 million, and \$8.4 million for the years ended December 31, 2021, 2020 and 2019, respectively. In addition, we spent \$0.1 million, \$0.1 million and \$1.3 million for the years ended December 31, 2021, 2020 and 2019, respectively, on research and development activities sponsored by federal and other government agencies.

Contract Research and Government Support

We have received funding from a number of government agencies, including the Department of Defense, the Department of Energy and other institutions, in support of our research and development and manufacturing activities. We have also worked closely with customers in government and industry to develop potential aerogel solutions that leveraged not only the thermal insulation performance but other benefits of aerogels as well.

In late 2019, we decided to wind down our existing contract research activities. This decision reflected our desire to focus our research and development resources on initiatives to improve the profitability of our existing business and on efforts to develop new products and next generation technology with application in new, high value market segments.

We have received \$59.2 million in funding under government contracts from our inception through December 31, 2021. Our contract research revenue was \$0.5 million, \$0.4 million and \$2.4 million for the fiscal years ended December 31, 2021, 2020 and 2019, respectively.

Intellectual Property

Our success depends in part upon our ability to obtain, maintain and enforce intellectual property rights that cover our aerogel technology platform, including, product forms, applications and/or manufacturing technologies and the technology or know-how that enables these product forms, applications, technologies and specifications, to avoid and defend against claims that we infringe the intellectual property rights of others, and to prevent the unauthorized use of our intellectual property. Since aerogels were developed more than 80 years ago, there has been a wide range of research, development and publications on aerogels and related technologies, which make it difficult to establish intellectual property rights to many key elements of aerogel technology and to obtain meaningful patent protection. Where appropriate, we seek to protect our rights by filing patent applications in the U.S. and other key foreign jurisdictions related to products, processes, technology and improvements that we consider patentable and important to our business and, in particular, our aerogel technology, product forms and their applications in promising markets and our manufacturing technologies. We also rely on trade secrets, trademarks, licensing agreements, confidentiality and nondisclosure agreements and continuing technological innovation to safeguard our intellectual property rights and develop and maintain our competitive edge.

As of December 31, 2021, we owned 63 issued U.S. patents, 45 pending U.S. patent applications (including eight issued U.S. patents and one pending U.S. patent application that we co-own with third parties), 130 issued foreign patents, 136 pending foreign patent applications (including 28 issued foreign patents and five pending foreign patent applications that we co-own with third parties), and one allowed foreign patent. The patents that we own are generally effective for 20 years from the filing date of the

earliest application to which each U.S. patent claims priority. The scope of each of our foreign patents varies in accordance with local law. Our early product patent family covering a fiber-reinforced aerogel composition expired in December 2021.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case.

- In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active.
- On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.
- The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding.
- The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.
- Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it. Upon our appeal of the opposition division's decision and after conducting an oral hearing on January 21, 2021, the Board of Appeals of EPO set aside the opposition division's December 2018 decision based on amended set of claims and remitted the case back to the opposition division for further prosecution.

- On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent which action Nano subsequently failed to pursue.
- On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled “Continuous Sheet of Gel Materials and Continuous sheet of Aerogel”. (983 Patent). On December 22, 2021, based on the oral hearing conducted on November 12, 2021, opposition division of EPO found the amended claims of 983 Patent to be valid. This decision is further subject to an appeal to the Board of Appeals within two months of the notification of the opposition division’s decision.
- On January 28, 2021, a search order was executed and relevant evidence secured at the principal places of business of AMA S.p.A. and AMA Composites S.r.l. (collectively, AMA) in San Martino in Rio and Campogalliano, respectively, based on an ex-parte search order issued by the Court of Genoa, Italy at our request in connection with alleged infringement of the Italian part of our patents previously asserted successfully against Nano and Alison in Germany. The Court of Genoa subsequently held a hearing and confirmed the validity of the search order and its execution. While the search proceedings do not take a position on the infringement issues, we may use any evidence collected during the search proceedings to prove infringement. As a result, on May 3, 2021, we filed an infringement complaint, a writ of summons, as known in Italy, at the Court of Genoa alleging that AMA has infringed the Italian part of three European patents (same patents asserted in the German litigation) and a patent on composition of aerogel-based composites in connection with AMA’s resale of aerogel products supplied by Chinese companies and sale of any products derived therefrom. We are seeking monetary damages and preliminary injunction of AMA’s alleged infringing activities. We expect the Court of Genoa to assess our claims and AMA’s defense through appointment of an expert after the submission of relevant writs and evidence. We issued a press release on May 6, 2021 describing the patent enforcement action of May 3, 2021 (Press Release). On June 7, 2021, AMA served us a copy of a request it previously filed with the Court of Genoa seeking an ex-parte preliminary injunction (PI) against us alleging the Press Release constituted anti-competitive conduct and that it infringed AMA’s trademark rights. The service of the request followed the court’s prior denial of the ex-parte order and an order requiring AMA to serve the request on us. The court subsequently conducted an oral hearing on June 15, 2021. On June 24, 2021, the court denied AMA’s request for a PI, reasoning that our Press Release was factually accurate, was not misleading, distinguished facts from opinions and that it was neither anti-competitive nor did it infringe trademark rights of AMA. The Court also ordered AMA to pay certain of our legal fees. On July 5, 2021, AMA informed us that it has decided not to appeal the denial of June 24, 2021. We subsequently learned that AMA had also made a criminal complaint against our chief executive officer for defamation in connection with the Press Release. On December 31, 2021, the local prosecutor, after reviewing the underlying facts, rejected AMA’s arguments and requested the judge overseeing the matter to dismiss the complaint against our chief executive officer. In response to our infringement complaint, AMA has also added as a counter-claim in connection with its claims regarding the Press Release, those same claims that it previously sought a preliminary injunction that was denied by the court. The patent infringement proceedings are ongoing.

Additionally, a reseller of Nano’s products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021, the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation. Furthermore, our adversaries may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. We have incurred approximately \$9.7 million of expenses related to this litigation since 2015 through December 31, 2021. In addition to the foregoing, we have been and may be from time-to-time party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

We believe that having distinctive names is an important factor in marketing our products, and therefore we use trademarks to brand some of our products, including Pyrogel, PyroThin, Cryogel and Spaceloft. As of December 31, 2021, we had seven trademark registrations in the United States, two trademark registrations with the World Intellectual Property Organization, and 71 trademark registrations in foreign jurisdictions, including the European Union, Japan, China, Canada, South Korea and Brazil. Additionally, we had three pending US trademark applications and eleven pending foreign trademark applications. Although we have a foreign trademark registration program for selected marks, our approach may not be comprehensive and we may not be able to register or use such marks in each foreign country in which we seek registration.

Cross License Agreement with Cabot Corporation

In April 2006, we entered into a cross license agreement with Cabot Corporation, as amended in September 2007, in which each party granted certain intellectual property rights to the other party. The cross license agreement remains in effect until the expiration of the last to expire of the issued patents or patent applications and acquired patents licensed thereunder. We hold a non-exclusive, worldwide license to those patents and patent applications owned or licensed by Cabot that are necessary for us to (i) practice our manufacturing technology within a field of use, which is defined in accordance with the specific chemistry of our aerogel products and the supercritical fluid technology that we use in our manufacturing technology and (ii) use and sell the resulting aerogel blanket and derivative products. We paid Cabot \$38 million over a period of approximately seven years, with the last payment made in March 2013, in connection with this license agreement. We have granted to Cabot a reciprocal, non-exclusive, worldwide license to certain patents and patent applications that we own that are necessary for Cabot to practice its processes within a field of use defined in accordance with the specific chemistry in its aerogel products and the drying technology that it uses to manufacture its products. The grant of license to each party covers issued patents, patent applications and patents issued from such counterpart applications, as well as patents licensed or acquired during a specified period, in each case that claim aerogels, or methods, materials of manufacture, or uses of aerogels.

Our Company

We are a corporation organized under the laws of Delaware. We own three wholly owned subsidiaries: Aspen Aerogels Rhode Island, LLC, Aspen Aerogels Germany, GmbH and Aspen Aerogels Georgia, LLC. We maintain our corporate offices in Northborough, Massachusetts.

On June 18, 2014, we completed our initial public offering, or IPO, of 7,500,000 shares of our common stock at a public offering price of \$11.00 per share. On February 18, 2020, we completed an underwritten public offering of 1,955,000 shares of our common stock at a public offering price of \$8.25 per share. We received net proceeds of \$14.8 million after deducting underwriting discounts and commissions of \$1.1 million and offering expenses of approximately \$0.3 million. On November 5, 2020, we entered into a sales agreement for an at-the-market (ATM) offering program under which we could sell up to \$33,871,250 of our common stock through B. Riley Securities as our sales agent. We were not obligated to sell any stock under the sales agreement. We agreed to pay B. Riley Securities a commission of 3.0% of the gross sales proceeds of shares sold under the agreement. During 2020, we sold 714,357 shares of our common stock through the ATM offering program and received net proceeds of \$9.5 million. During the year ended December 31, 2021, we sold an additional 929,981 shares of our common stock through the ATM offering program and received net proceeds of \$19.4 million. On June 29, 2021, we sold 3,462,124 shares to an affiliate of Koch Strategic Platforms, LLC, or Koch, in a private placement of our common stock and received net proceeds of \$73.5 million after deducting fees and offering expenses of \$1.5 million. On February 18, 2022, we sold and issued a convertible note to an affiliate of Koch of \$100.0 million in aggregate principal amount. Additionally, on February 15, 2022, we entered into a securities purchase agreement with an affiliate of Koch to sell 1,791,986 shares of our common stock for aggregate gross proceeds of \$50.0 million, or the 2022 Offering. The closing of the 2022 Offering is subject to customary closing conditions, including the expiration or termination of the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976.

As of February 25, 2022, we had 33,234,316 shares of our common stock outstanding.

We are required to file annual, quarterly and current reports, proxy statements and other information required by the Securities Exchange Act of 1934, as amended, or the Exchange Act, with the Securities and Exchange Commission, or the SEC. SEC filings are available at the SEC's website at <https://www.sec.gov>.

We maintain a public website at <https://www.aerogel.com> and use our website as a means of disclosing material non-public information and for complying with our disclosure obligations under Regulation FD. Our website includes an Investors section through which we make available, free of charge, our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, Proxy Statements and Forms 3, 4 and 5 filed on behalf of directors and executive officers, as well as any amendments to those reports filed or furnished pursuant to the Exchange Act as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. The members of our Board of Directors and the designated chairs of the committees of the Board of Directors are reflected on the signature page of this annual report on Form 10-K. We also make available on our website the charters for our Board of Directors' Audit Committee, Compensation and Leadership Development Committee and Nominating and Corporate Governance Committee, as well as our Code of Business Conduct and Ethics, our Corporate Governance Guidelines and other related materials. The information on our website is not part of this annual report.

Our Investor Relations Department can be contacted at Aspen Aerogels, Inc., 26 Forest Street, Suite 200, Marlborough, MA 01752, Attention: Investor Relations; telephone: 508-691-1111; e-mail: ir@aerogel.com.

Human Capital Resources

As of December 31, 2021, we had 418 full-time employees with 57 in research and development, 257 in manufacturing operations and supply chain, 63 in sales and marketing and 41 in general and administrative functions. Of our employees, 397 are located in the United States and 21 are located abroad. We consider our current relationship with our employees to be of good standing. None of our employees are represented by labor unions or have collective bargaining agreements.

Compensation and Benefits

We believe that our future success largely depends upon our continued ability to attract and retain highly skilled employees. Technology companies both large and small compete for a limited number of qualified applicants to fill specialized positions. To attract qualified applicants, we offer a total rewards package consisting of base salary and target bonus, a comprehensive benefit package and equity compensation for every employee. Bonus opportunity and equity compensation increase as a percentage of total compensation based on level of responsibility. Actual bonus payout is based on performance.

Diversity and Inclusion

Much of our success is rooted in the diversity of our teams and our commitment to inclusion. We value diversity at all levels. We believe that our business benefits from the different perspectives a diverse workforce brings, and we pride ourselves on having a strong, inclusive and positive culture based on our shared mission and values.

Protection and Support of Our Employees during the COVID-19 Pandemic

In response to the COVID-19 pandemic, we have implemented and are following safe practices recommended by public health authorities and other government entities. We continue to focus on the safety and health of our employees. In addition, we have implemented various precautionary measures, including remote work arrangements, restricted business travel and procedures for social distancing, face coverings and safe hygiene. We continue to monitor public health guidance as it evolves and plan to adapt our practices as appropriate. Refer to the section below entitled “Item 1A. Risk Factors” for more information concerning risks to our business associated with COVID-19.

Seasonality

Our energy infrastructure product offerings make us less susceptible to seasonal patterns as our operating results are generated in part by demand for insulation associated with new-build construction of facilities, capital expansions and related capital projects, and larger maintenance-related projects in the energy infrastructure market. Historically, our third and fourth quarter results have shown increased levels of revenue, which we believe is associated with our end-user customers’ maintenance schedules and timing of capital projects. As we pursue and grow revenue opportunities in the electric vehicle market, we expect that a portion of our revenues may be subject to seasonal patterns typical of automotive suppliers.

Environmental Matters

We are subject to federal, state, local and foreign laws and regulations designed to protect the environment and to regulate the discharge of materials into the environment. We believe that our policies, practices, and procedures are properly designed to prevent unreasonable risk of environmental damage and associated financial liability. To date, environmental control regulations have not had a significant adverse effect on our overall operations. See “Risk Factors — We may incur significant costs complying with environmental, health and safety laws and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could adversely affect our results of operations.”

Item 1A. RISK FACTORS

Summary of Risk Factors

Our business is subject to numerous risks and uncertainties, including those highlighted in this section below, that represent challenges that we face in connection with the successful implementation of our strategy. The occurrence of one or more of the events or circumstances described in more detail in the risk factors below, alone or in combination with other events or circumstances, may have an adverse effect on our business, cash flows, financial condition and results of operations. Such risks include, but are not limited to:

- We have incurred annual net losses since our inception, and we may continue to incur net losses in the future and may never reach profitability.

- Our efforts in developing, selling, and supplying products in electric vehicle market may subject us to increased financial, operational, and legal risks that could materially adversely impact our business, financial conditions, and results of operations and may also increase our costs and make it difficult for us to operate profitably.
- We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all.
- Our estimates regarding market opportunity for our products in the electric vehicle market and the assumptions on which our financial targets and our planned production capacity increases are based may prove to be inaccurate, which may cause our actual results to materially differ from such targets, which may adversely affect our future profitability, cash flows, and stock price.
- Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could have a material adverse impact on our financial condition and results of operations.
- Our working capital requirements involve estimates based on demand and production expectations and may decrease or increase beyond those currently anticipated, which could materially harm our results of operations and financial condition.
- Our business, results of operations and financial condition could be materially adversely affected by the effects of widespread public health epidemics, including coronavirus and the resulting COVID-19 pandemic, that are beyond our control.
- The cyclical nature of automotive sales and production can adversely affect our business. Furthermore, disruptions in the components that our customers in the EV market, including our automotive OEM customers, use in their products may adversely affect our business operations and projected revenue.
- Trends in the selection of cell chemistries, battery pack system architectures, and the adoption of active cooling methods may reduce thermal complexities to render the demand for our thermal barrier products less obvious.
- We are currently dependent on a single manufacturing facility. Any significant disruption to this facility or the failure of any one of our three production lines in this facility to operate according to our expectation could have a material adverse effect on our business and results of operations.
- If we fail to successfully construct and operate our planned second manufacturing facility in Bulloch County, Georgia and increase our production capacity that our continued and anticipated growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.
- We may not realize sales represented by awarded business. Continued pricing pressures, automotive OEM cost reduction initiatives and the ability of automotive OEMs to re-source or cancel vehicle programs may result in lower than anticipated margins, or losses, which may have a significant negative impact on our business.
- Our supply agreements with our automotive OEM customers are generally requirements contracts, and a decline in the production requirements of any of our customers, could adversely impact our revenues and profitability.
- If we do not respond appropriately, the evolution of the automotive industry towards mobility on demand services could adversely affect our business.
- A sustained downturn in the energy industry, due to lower oil and gas prices or reduced energy demand, could decrease demand for some or all of our products and services, which could have a material adverse effect on our business, financial condition and results of operations.
- The markets we serve are subject to general economic conditions and cyclical demand, which could harm our business and lead to significant shifts in our results of operations from quarter to quarter that make it difficult to project long-term performance.
- The insulation markets we serve are highly competitive. If we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues.
- The qualification process for our products can be lengthy and unpredictable, potentially delaying adoption of our products and causing us to incur significant expense, potentially without recovery.
- Employee strikes and labor-related disruptions involving us or one or more of our automotive OEM customers or suppliers may adversely affect our operations.
- Our revenue may fluctuate, which may result in a high degree of variability in our results of operations and make it difficult for us to plan based on our future outlook and to forecast our future performance.

- The results of our operations could be materially adversely affected if our operating expenses incurred do not correspond with the timing of our revenues.
- If we fail to achieve the increase in production capacity that our long-term growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.
- If the expected growth in the demand for our products does not follow each of our planned capacity expansions, then our business and results of operations will be materially adversely affected.
- A substantial portion of our revenue comes from sales in foreign countries and we are planning to expand our operations outside of the United States, which subjects us to increased economic, trade, foreign exchange, operational and political risks that could materially adversely impact our business, financial conditions and results of operations and also increase our costs and make it difficult for us to operate profitably.
- If we lose key personnel upon whom we are dependent, or if we are unable to successfully recruit and retain skilled employees, we may not be able to manage our operations and meet our strategic objectives.
- We may face certain product liability or warranty claims on our products, including from improper installation of our products by third parties. Consequently, we could lose existing and future business and our ability to develop, market and sell our insulation could be harmed.
- We may incur significant costs complying with environmental, health and safety laws and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could materially adversely affect our results of operations.
- Breakdowns, security breaches, loss of data, and other disruptions of our information technology systems could compromise sensitive information related to our business, prevent us from accessing critical information, and expose us to liability, which would cause our business and reputation to suffer.
- Our ability to use our net operating loss carryforwards may be subject to limitation, which could result in a higher effective tax rate and adversely affect our financial condition and results of operations.
- Our inability to protect our intellectual property rights could negatively affect our business and results of operations.
- We have initiated intellectual property litigation that is and will continue to be costly, and could limit or invalidate our intellectual property rights, divert time and efforts away from business operations, require us to pay damages and/or costs and expenses and/or otherwise have a material adverse impact on our business, and we could become subject to additional such intellectual property litigation in the future.
- Our contracts with the U.S. government and other third parties could negatively affect our intellectual property rights.
- We rely on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could materially adversely affect our competitive business position.
- We have incurred and will continue to incur increased costs and demands upon management as a result of complying with the laws and regulations affecting public companies in the United States, which may adversely affect our results of operations.
- Because we are a public company, we are obligated to develop and maintain proper and effective internal control over financial reporting. If our internal controls over financial reporting are determined to be ineffective, or if our auditors are otherwise unable to attest to their effectiveness, investor confidence in our company, and our common stock price, may be adversely affected.
- Our shareholders may experience future dilution as a result of future equity offerings.

Risks Related to Our Business and Strategy

We have incurred annual net losses since our inception, and we may continue to incur net losses in the future and may never reach profitability.

We have a history of losses, and we may not ever achieve full year profitability. We experienced net losses of \$37.1 million, \$21.8 million and \$14.6 million for the years ended December 31, 2021, 2020 and 2019, respectively. As of December 31, 2021, our accumulated deficit was \$545.1 million. We expect to continue to incur operating losses as a result of expenses associated with the continued development and expansion of our business. Our expenses include research and development, sales and marketing, and general and administrative costs. Furthermore, these expenses are not the only factors that may contribute to our net losses. For example, interest expense that we incur on any future financing arrangements could contribute to our net losses. Any failure to increase revenue or manage our cost structure as we implement initiatives to grow our business could prevent us from achieving profitability, or sustaining profitability if we do achieve it. In addition, our ability to achieve profitability is subject to a number of

risks and uncertainties discussed below, many of which are beyond our control. Failure to become and remain profitable may adversely affect the market price of our common stock and our ability to raise capital and continue operations.

We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all.

The growth of our business will depend on substantial amounts of additional capital for expansion of existing production lines or construction of new production lines or facilities, for ongoing operating expenses, for continued development of our aerogel technology platform, or for introduction of new product lines. Our capital requirements will depend on many factors, including the rate of our revenue growth, our introduction of new products and technologies, our enhancements to existing products and technologies, and our expansion of sales and marketing and product development activities. In addition, we anticipate significant cash outlays during 2022 and 2023 related to maintaining our aerogel manufacturing operations in our East Providence, Rhode Island facility, the planned construction of our second aerogel plant in Bulloch County, Georgia and the construction of an automated fabrication operation in Mexico, among other items. We are planning to raise capital through debt financings, equity financings, partner financings, or technology licensing agreements to fund these operating and capital expenditure requirements in 2022, 2023 and beyond. Any such future significant expansion of our aerogel capacity, fabrication capacity or similar investment will require us to raise substantial amounts of additional capital. There is no assurance that we will be able obtain any such type of financing on terms acceptable to us or at all and in a timely manner.

In addition, we may consider strategic acquisitions of complementary businesses or technologies to grow our business, which would require significant capital and could increase our capital requirements related to future operation of the acquired business or technology.

We may not be able to obtain loans or raise additional capital on acceptable terms or at all. Our revolving credit facility with Silicon Valley Bank, or SVB, and the convertible note issued to an affiliate of Koch, which together with Koch, we refer to as KSP, contain restrictions on our ability to incur additional indebtedness, which, if not waived, could prevent us from obtaining needed capital. Our revolving credit facility with SVB is scheduled to mature on April 28, 2022, and our convertible note issued to KSP is scheduled to mature on February 18, 2027, unless earlier converted or redeemed. Any future credit facilities or debt instruments would likely contain similar or additional restrictions, requirements or conditions. We may not be able to obtain bank credit arrangements or effect an equity or debt financing on terms acceptable to us or at all in order to fund our future capacity expansion plans. Any failure to obtain additional financing when needed could adversely affect our ability to maintain and grow our business.

Our efforts in developing, selling, and supplying products in the electric vehicle market may subject us to increased financial, operational, and legal risks that could materially adversely impact our business, financial conditions, and results of operations and may also increase our costs and make it difficult for us to operate profitably.

We have a focus on developing and selling products in the automotive industry, specifically for electric vehicle applications. In 2020 and 2021, we entered into contracts with a U.S. automotive OEM to supply our thermal barrier products for use in the battery system of its electric vehicles. We are currently selling thermal barrier production parts to the U.S. automotive OEM, an Asian automotive OEM, and prototype thermal barrier parts to a number of other companies. We are also continuing our efforts to develop additional thermal barrier products for sale to others in the electric vehicle market. As a result of our existing contract with the U.S. automotive OEM, current sales to others in the electric vehicle market and any future supply of our products to the automotive industry, including through specific contracts, we are subject to a number of risks, including, but not limited to:

- Under our contracts with the U.S. automotive OEM, the U.S. automotive OEM is not obligated to make any purchases from us and may terminate the contract at any time. There can be no assurance that significant revenue, or any revenue at all, will result from the contract.
- In order to support the projections and estimates of our product demand that our potential automotive customers present to us, we may need to make substantial capital and other investments without any assurance that such potential demand will materialize. For example, under the contract with the U.S. automotive OEM, we are obligated to supply products up to a daily maximum quantity even without a specific purchase commitment. This requires us to invest in capacity, infrastructure and personnel. These investments could result in substantial capital expenditures without any commensurate increase in revenue, or any increase at all. Even if significant sales of our products to automotive OEMs materialize, the need to make these significant capital investments, as well as the costs related to developing these products and related process and manufacturing developments, and the costs of meeting the stringent requirements of the automotive industry, could result in sales to the automotive industry being significantly less profitable than we expect, or potentially unprofitable.

- Automotive OEMs require that we timely meet stringent requirements with respect to capital investment and quality standards in connection with our efforts to develop, sell and support products for use in the electric vehicle market. We may not be able to meet these requirements on a timely basis or at all.
- Automotive OEMs require suppliers of various tiers to assume liability for ordinary warranty expenses and product liability issues that are not necessarily commensurate with the roles the supplier played in the development of the final product sold to the consumer. This could expose us to significantly greater risk of liability for warranty expenses and/or for defects, failures or accidents involving the final products sold to the consumer.
- Automotive OEMs purchasing from us may have certain rights to intellectual property developed by us in connection with our work for that OEM. These rights could permit the OEM to purchase products similar to ours from other third party suppliers or to develop internally products that could replace our products in their manufacturing process.
- We face significant competition in selling our products to the automotive industry and anticipate that competition increasing over time, both from products similar to ours and from other technologies that may address in a superior fashion the technical issues currently addressed by our products. In particular, we face significant competition from Chinese firms, many of whom have longstanding experience in supplying electric vehicle OEMs and are part of a Chinese electric vehicle industry that we believe is in many ways more mature than the electric vehicle industry in the United States and other markets. In order to compete with such firms and sustainably participate in the automotive market, we will have to overcome the advantages possessed by those Chinese firms.
- Electric vehicles and battery technologies are evolving at a rapid pace. They may evolve in such a way as to render our products obsolete. While we are investing considerable capital and other resources based on what we believe to be the currently identified needs of the industry, our belief as to the current needs of the industry may be incorrect or our technology, products or other resources may not be applicable to the future needs of the industry.

Our ability to successfully sell our products to the automotive industry will depend in large part on our ability to manage these and other risks.

Our estimates regarding market opportunity for our products in the electric vehicle market and the assumptions on which our financial targets and our planned production capacity increases are based may prove to be inaccurate, which may cause our actual results to materially differ from such targets, which may adversely affect our future profitability, cash flows, and stock price.

Our estimates regarding market opportunity for our products in the electric vehicle market, the assumptions underlying our estimates regarding market opportunity and our financial targets, including any revenue targets we may provide from time to time, are dependent on certain estimates and assumptions related to, among other things, category growth, development and launch of innovative new products, market share projections, product pricing and sale, volume and product mix, volatility, material prices, distribution, cost savings, and our ability to generate sufficient cash flow to reinvest in our existing business. The estimates and financial targets and our planned production capacity increases are based on estimates that our management believes are reasonable with respect to our future results of operations, based on present circumstances, and have not been reviewed by our independent accountants. Some assumptions upon which the estimates and financial targets are based, however, invariably will not materialize due to the inevitable occurrence of unanticipated events and circumstances beyond our management's control or the occurrence of events that were believed to be less likely to occur. Our estimates regarding market opportunity and our financial targets are based on historical experience and on various other estimates and assumptions that we believe to be reasonable under the circumstances and at the time they are made, and our actual results may differ materially from our expectations. Any material variation between our estimates and financial targets and our actual results may adversely affect our future profitability, cash flows and stock price.

We have yet to achieve positive total cash flow, and our ability to generate positive cash flow is uncertain.

To develop and expand our business, we have made, and will need to continue to make, significant up-front investments in our manufacturing capacity and have incurred research and development, sales and marketing and general and administrative expenses. In addition, our growth has required a significant investment in working capital. We experienced negative cash flows from operating activities of \$18.6 million, \$9.9 million and \$1.1 million for the years ended December 31, 2021, 2020 and 2019, respectively. The negative cumulative cash flows from operating activities during the three-year period were exacerbated by cash flows used in investing activities to maintain, enhance and expand our manufacturing operations during the same time period. As a result, we experienced negative total cash flows during the three-year period.

We expect our operating cash flow will be negative on an annual basis during 2022. In addition, we anticipate that we will incur significant cash outlays related to maintaining our aerogel manufacturing operations in our East Providence, Rhode Island facility, the planned construction of our new plant in Bulloch County, Georgia, and the planned construction of an automated fabrication operation

in Mexico. We are planning to raise capital through debt financings, equity financings, partner financings, or technology licensing agreements to fund these operating and capital expenditure requirements in 2022, 2023, and beyond. However, we expect that our existing cash balance or cash balance after any such financing, alone, may periodically be insufficient to fund these operating, capital expenditure or working capital requirements. During such periods, we may be dependent on our line of credit with SVB, under which we have the ability to borrow up to \$20.0 million, to fund the balance of the required investment in working capital. The credit agreement requires us to comply with both non-financial and financial covenants, which have included minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined in the credit agreement. In December 2020, we obtained a waiver from SVB related to our potential non-compliance with these financial covenants. This waiver was subject to certain conditions, and there can be no assurance that in the future SVB will waive such potential or actual covenant non-compliances, if requested, or waive them with reasonable and achievable conditions, or that we will comply with any such covenants, waivers or conditions. As a result, we could end up in default under the agreement or otherwise be unable to continue to borrow under our line of credit, subject to acceleration of the payment of any balance and further subject to the remedies typically available to a lender. See *“Our revolving credit facility contains financial and operating restrictions that may limit our access to credit. In addition, our revolving credit facility expires on April 28, 2022 and we may not be able to renew, extend or replace the expiring facility. If we fail to comply with covenants in our revolving credit facility or if such facility is terminated, we may be required to repay our indebtedness thereunder, which may have an adverse effect on our liquidity.”*

In addition, we may not achieve sufficient revenue growth to generate positive cash flow in 2023 or any future year. As a result, we may need to raise additional capital from investors to achieve our expected growth or to fund the working capital investment necessary to maintain operations. Any inability to generate positive future cash flow, to borrow funds or to raise additional capital on reasonable terms, if at all, may harm our short-term financial condition or threaten our long-term viability.

Our working capital requirements involve estimates based on demand and production expectations and may decrease or increase beyond those currently anticipated, which could materially harm our results of operations and financial condition.

In order to fulfill the product delivery requirements of our direct and end-user customers, we plan for working capital needs in advance of customer orders. In particular, our OEM customers estimate and place their orders significantly in advance of the time they are needed, requiring us to plan our working capital needs well in advance of delivering their orders. As a result, we base our funding and inventory decisions on estimates of future demand. If demand for our products does not increase as quickly as we have estimated or drops off sharply, our inventory and expenses could rise, and our business and results of operations could suffer. Alternatively, if we experience sales in excess of our estimates, which has occurred in previous reporting periods, our working capital needs may be higher than currently anticipated. Additionally, in the early years of electric vehicle adoption, our electric vehicle customers’ forecasts may be prone to multiple and frequent revisions resulting in changing demand levels. Our ability to meet this excess or changing customer demand depends on our ability to arrange for additional financing for any ongoing working capital shortages, since it is likely that cash flow from sales will lag behind these investment requirements. In the past, we have principally relied on our line of credit with SVB to supplement these financing needs. The revolving credit agreement requires us to comply with both non-financial and financial covenants. In the future, there can be no assurance that we will continue to comply with such covenants and that SVB will waive any non-compliance, if requested. As a result, we could end up in default under the agreement or otherwise be unable to continue to borrow under our line of credit. Any failure to borrow under our line of credit or inadequate access to working capital when needed could adversely affect our ability to invest in the working capital required to maintain and grow our business.

Our revolving credit facility with SVB and our convertible note arrangement with KSP contain financial and/or operating restrictions that may limit our access to credit. In addition, our revolving credit facility with SVB expires on April 28, 2022 and we may not be able to renew, extend or replace the expiring facility. If we fail to comply with covenants in our revolving credit facility or if facility is terminated, we may be required to repay our indebtedness thereunder, which may have an adverse effect on our liquidity.

Provisions governing our revolving credit facility with SVB impose restrictions on our ability to operate, including, for some of the agreements and instruments, but not for others, our ability to:

- incur capital expenditures;
- incur additional debt;
- pay dividends and make distributions;
- redeem or repurchase capital stock;
- create liens;

- enter into transactions with affiliates; and
- merge or consolidate with or into other entities.

Furthermore, our convertible note arrangement with KSP contains certain restrictions on our ability to operate, including our ability to incur indebtedness. Our revolving credit facility also contains other financial and non-financial covenants. Historically, when we were not in a position to meet the financial covenants, SVB has agreed to modify or otherwise waive the requirements. We may not be able to comply with these covenants in the future and SVB may not accommodate modifications or waivers. Our failure to comply with these covenants may result in the declaration of an event of default and could cause us to be unable to borrow funds under our revolving credit facility. In addition to preventing additional borrowings under our revolving credit facility with SVB or convertible note arrangement with KSP, an event of default, if not cured or waived, may result in the acceleration of the maturity of indebtedness outstanding under the revolving credit facility and the convertible note arrangement with KSP, which would require us to pay all amounts outstanding. Such an event may also lead our secured lender to exercise its security interest in our assets, including all of our real property and equipment at our East Providence facility. If an event of default occurs, we may not be able to cure it within any applicable cure period, if at all. If the maturity of our indebtedness is accelerated, we may not have sufficient funds available for repayment or we may not have the ability to borrow or obtain sufficient funds to replace the accelerated indebtedness on terms acceptable to us, or at all.

Shortages of the raw materials used in the production of our products, increases in the cost of such materials or disruptions in our supply chain could have a material adverse impact on our financial condition and results of operations.

The raw materials used in the production of our products consist primarily of fiber battings, silica precursors and other additives. In addition, the production process requires the use of process gases and other materials typical to the chemical processing industry, as well as access to electricity, natural gas, water, and other basic utilities. Although we are not dependent on a single supplier, we are dependent on the ability of our third-party suppliers to supply such materials on a timely and consistent basis. While these materials and utilities are available from numerous sources, they may be, and have been in the past, subject to fluctuations in availability and price. For example, during the year ended December 31, 2018 and again during the year ended December 31, 2021, we experienced significant increases in the costs of certain silica precursor materials, which constituted over 50% of our raw material costs.

In addition, our third-party suppliers may not dedicate sufficient resources to meet our scheduled delivery requirements or our suppliers may not have sufficient resources to satisfy our requirements during any period of sustained or growing demand. Failure of suppliers to supply, delays in supplying or disruptions in the supply chain for our raw materials, or adverse allocations in the supply of certain high demand raw materials could materially adversely affect the results of our operations. Supply disruptions may affect our ability to meet contractual commitments or delivery schedules on a timely basis and could materially negatively impact our results of operations. For example, during 2015 and again during 2021, pursuant to force majeure notifications, our primary carbon dioxide gas suppliers temporarily curtailed supply of carbon dioxide to us due to a feedstock issue impacting the northeastern United States. During this period, the supply disruption required that (i) we make special arrangements to procure carbon dioxide from alternative suppliers outside the region often at higher costs and incur additional transportation expenses, and (ii) we intermittently idle a portion of our manufacturing equipment thereby reducing our production volume and adversely impacting our results of operation.

While we have recently entered into a three-year contract to secure exclusive supply of certain silanes from Silbond Corporation, most of our raw materials are procured through individual purchase orders or short-term contracts and not through long-term contracts that ensure a fixed price or guaranteed supply for an extended period. This procurement strategy may not support sustained long-term supply chain stability. Fluctuations in the prices of these raw materials could have a material adverse effect on our results of operations. Our suppliers also seek alternative uses for our raw materials at higher price points. Such competitive uses for our raw materials create material price and availability risks to our business. In addition, our ability to pass increases in raw material prices on to our customers is limited due to competitive pricing pressure and the time lag between the increase in costs and the implementation of related price increases.

In particular, we purchase a variety of silica precursors from several suppliers, mostly pursuant to individual purchase orders or short-term contracts and not pursuant to long-term contracts. We do not have a secure, long-term supply of all of our silica precursors. We may not be able to establish arrangements for secure, long-term silica precursor supplies at prices consistent with our current costs or may incur a delay in supply while we seek alternative sources. From time-to-time, we experienced a significant increase in the price of certain silica precursors due to a supply imbalance or other factors in the silanes market. While we seek to reformulate our products to reduce our reliance on materials that are susceptible to significant price fluctuations, while maintaining appropriate performance characteristics, our efforts may not be successful. Any inability to continue to purchase silica precursors without long-term agreements in place, or to establish a long-term supply of silica precursors at prices consistent with our current cost estimates, would have a material adverse effect on our ability to increase our sales and achieve profitability.

We are also projecting significant revenue growth associated with an anticipated demand for PyroThin thermal barriers in the electric vehicle market. To keep pace with this anticipated growth, we are planning to expand our manufacturing capacity by constructing a second aerogel plant in Bulloch County, Georgia and an automated fabrication operation in Mexico. We are also planning to expand the supply of raw materials available to us by securing commitments to expand supply from existing raw material suppliers, by identifying and qualifying additional suppliers of critical raw materials, and by potentially investing in the assets and hiring the personnel required to produce certain critical raw materials directly in our second aerogel plant. However, our efforts to expand the supply of raw materials may not be successful or could lead to significant increase in our raw material costs. Any such failure or increase in raw material costs would have a material adverse effect on our ability to increase our sales or to achieve profitability.

In light of the increased demand for many of our raw materials, we have recently expanded our supplier base beyond North America, to Europe and Asia, and specifically to China. We do not have considerable experience managing issues arising out of this globalized supply chain and these risks are significantly magnified during current global supply chain disturbances. If such disturbances persist and manifest in different forms, they present additional substantial operational difficulties that would have a material adverse effect on our ability to meet our customer demands or fulfil our contractual obligations to our customers.

Additionally, our suppliers may prioritize their resources for any long-term commitments to third parties and to our detriment. We may not be in a position to find alternate suppliers in a timely manner to continue to operate consistent with our obligations to or expectations of our customers. The supply chain for our materials has been increasingly global in nature. Global events such as trade wars between nations, armed conflicts, or the coronavirus outbreak could have both short-term and long-term effects on our supply chain.

The cyclical nature of automotive sales and production can adversely affect our business. Furthermore, disruptions in the components that our customers in the EV market, including our automotive OEM customers, use in their products may adversely affect our business operations and projected revenue.

Our thermal barrier business, which is projected to grow significantly in the coming years, is directly related to sales and vehicle production by our automotive OEMs. A reduction in automotive sales and production could cause our automotive OEM customers to reduce their orders of our products. Automotive sales and production are highly cyclical and are dependent on general economic conditions, customer confidence, and consumer preferences. Lower global automotive sales would be expected to result in our automotive OEM customers having reduced vehicle production schedules, which has a direct impact on our revenues generated from this portion of our business. Automotive sales and production can also be affected by labor relation issues, regulatory requirements, trade agreements, the availability of consumer financing and supply chain disruptions. Our customers in the EV market, particularly our automotive OEM customers, use a broad range of materials and supplies and are reliant on a global supply chain. A significant disruption in the global supply chain may cause them to halt or delay production, which in turn would reduce their requirements of our aerogel thermal barrier or delay their orders. We have no control over these disruptions in supply chain and the resulting delay or reduction in our customers' orders. Any such delay or reduction would adversely impact our targets of awarded business for our thermal barriers and other products. Our sales are also affected by inventory levels and OEMs' production levels. We cannot predict when OEMs will decide to increase or decrease inventory levels or whether new inventory levels will approximate historical inventory levels. Uncertainty and other unexpected fluctuations could have a material adverse effect on our business and financial condition.

Trends in the selection of cell chemistries, battery pack system architectures, and the adoption of active cooling methods may reduce thermal complexities to render the demand for our thermal barrier products less obvious.

Energy density requirements for electric vehicle batteries have been consistently increasing, the resulting choice of cell chemistries and pack architectures have typically presented more demanding thermal problems that our thermal barrier products are designed to address. However, due to the safety issues, we believe that some vehicle manufacturers tend to select less thermally demanding and inherently safer cell chemistries and design choices at the expense of lower energy densities and lower driving range. Such systems may not present a demanding thermal problem requiring solutions like our thermal barrier products. If the electric vehicle landscape evolves in such direction, the demand for our products will not materialize or not meet our current forecasts, plans and expectations, which will have a material adverse effect on our business and operations.

Our business, results of operations and financial condition could be materially adversely affected by the effects of widespread public health epidemics, including coronavirus and the resulting COVID-19 pandemic, that are beyond our control.

Any outbreaks of contagious diseases, public health epidemics, and other adverse public health developments in countries where we, our customers, and suppliers operate could have a material and adverse effect on our business, results of operations, and financial condition. The novel strain of the coronavirus affecting the global community, including the United States, is expected to continue to impact our operations, and the nature and extent of the impact may be highly uncertain and beyond our control. In particular, our sales

globally, including to customers in the energy infrastructure and sustainable building materials markets that are impacted by the COVID-19 pandemic, are being negatively impacted as a result of disruption in demand, which could have a material adverse effect on our business, results of operations and financial condition. The COVID-19 pandemic has resulted in significant volatility in the price of oil and has reduced the demand for our products used in energy infrastructure facilities. We have also faced market-based challenges in the hiring and retention of non-exempt labor in our East Providence, Rhode Island manufacturing facility during 2021 that has limited our manufacturing output and has delayed the fulfillment of customer orders. In addition, suppliers of our raw materials have intermittently been unable to supply the materials that we require to manufacture our products according to our schedules. This COVID-19 related revenue shortfall and the employee and raw material shortages constrained manufacturing output, reduced our ability to fulfill orders, reduced our revenue and contributed to an increase in our net loss in 2021. We estimate that our production output was depressed by between \$6.0 to \$8.0 million during the fourth quarter of 2021 due to COVID-related staffing issues and raw material shortages. The future impact of similar COVID-19 related disruptions to our business cannot be accurately estimated at this time. The COVID-19 pandemic may also impact automotive sales and production by our automotive OEM customers, which in turn affects our ability to realize the awarded business and our business operations.

Uncertain factors relating to the COVID-19 pandemic include the duration of the outbreak, the severity of the disease, the effect of various mutated variants of the virus in circulation, the availability of vaccines, the rate of vaccination in the various geographies, and the actions, or perception of actions that may be taken, to contain or treat its impact, including declarations of states of emergency, business closures, manufacturing restrictions and a prolonged period of travel, commercial and/or other similar restrictions and limitations. While the potential economic impact of the coronavirus outbreak may be difficult to assess or predict, a widespread pandemic could result in significant or sustained disruption of global financial markets, reducing our ability to access capital, which could in the future negatively affect our liquidity. In addition, while we believe we have taken appropriate steps to maintain a safe workplace to protect our employees from contracting and spreading the coronavirus, including following the guidance set out from both the Occupational Safety and Health Administration and Centers for Disease Control and Prevention, we may not be able to prevent the spread of the virus among our employees, face litigation or other proceedings making claims related to unsafe working conditions, inadequate protection of our employees or other claims. Any of these claims, even if without merit, could result in costly litigation or divert management's attention and resources. Furthermore, we may face a sustained disruption to our operations due to one or more of the factors described above.

We may not realize sales represented by awarded business.

We estimate awarded business for our thermal barrier business using certain assumptions, including projected future sales volumes. Our customers in the EV market generally do not guarantee volumes. In addition, awarded business typically includes business under arrangements that our customers in the EV market have the right to terminate without penalty. Therefore, our actual sales volumes, and thus the ultimate amount of revenue that we derive from such sales, are not committed. If actual production orders from our EV market customers are not consistent with the projections we use in calculating the amount of our awarded business, we could realize substantially less revenue over the life of these projects than the currently projected estimate estimates and our financial targets developed based on such estimates.

Continued pricing pressures, automotive OEM cost reduction initiatives and the ability of automotive OEMs to re-source or cancel vehicle programs may result in lower than anticipated margins, or losses, which may have a significant negative impact on our business.

Cost-cutting initiatives adopted by our customers in the EV market or our automotive OEM customers result in increased downward pressure on pricing. In addition, our customers in the EV market often reserve the right to terminate their supply contracts for convenience, which enhances their ability to obtain price reductions. Automotive OEMs also possess significant leverage over their suppliers, including us, because the automotive technology and component supply industry is highly competitive, serves a limited number of customers, has a high fixed cost base and historically has had excess capacity. Based on these factors, and the fact that our automotive OEM customers' product programs are anticipated to encompass large volumes, our customers are able to negotiate favorable pricing. Accordingly, we are subject to substantial continuing pressure from automotive OEMs to reduce the price of our products. It is possible that pricing pressures beyond our expectations could intensify as automotive OEMs pursue restructuring and cost-cutting initiatives. If we are unable to generate sufficient production cost savings in the future to offset price reductions, our gross margin and profitability would be adversely affected.

Our supply agreements with our automotive OEM customers are generally requirements contracts, and a decline in the production requirements of any of our customers, could adversely impact our revenues and profitability.

We receive automotive OEM purchase orders for specific components supplied for particular vehicles. Typically, our automotive OEM customers agree to purchase their requirements for specific products but are not required to purchase any minimum

quantity of products from us. Therefore, a significant decrease in demand for certain key models or group of related models sold by any of our automotive OEM customers or the ability of a manufacturer to re-source and discontinue purchasing from us, for a particular model or group of models, could have a material adverse effect on us and reduce the value of the awarded business. To the extent that we do not maintain our existing business with our automotive OEM customers because of a decline in their production requirements or because the contracts expire or are terminated for convenience, we will need to attract new customers or win new business with existing customers, or our results of operations and financial condition as well as the value of the awarded business will be adversely affected.

We are currently dependent on a single manufacturing facility. Any significant disruption to this facility or the failure of any one of our three production lines in this facility to operate according to our expectation could have a material adverse effect on our business and results of operations.

While we are planning to build a second manufacturing facility in Bulloch County, Georgia, we currently have only three production lines in a single manufacturing facility located in East Providence, Rhode Island. Our ability to meet the demands of our customers depends on efficient, proper and uninterrupted operations at this manufacturing facility. In the event of a significant disruption to our sole manufacturing facility or breakdown of any of the production lines, we currently do not expect that we would have sufficient inventory in stock to meet demand until the production lines return to operation.

Power failures or disruptions, the breakdown, failure, or substandard performance of equipment, or the damage or destruction of buildings and other facilities due to fire or natural disasters could severely affect our ability to continue our operations. In the event of such disruptions, we are unlikely to find suitable alternatives or may not be able to make needed repairs on a timely basis and at reasonable cost, which could have a material adverse effect on our business and results of operations. In particular, our manufacturing processes include the use of high pressures, high temperatures, and flammable chemicals, which subject us to a significant risk of loss resulting from fire, spill, or related event. We had occasional incidences of fires at our initial facility in Northborough, Massachusetts that preceded our current manufacturing facility in East Providence, Rhode Island.

If our manufacturing facility or any equipment therein were to be damaged or cease operations, it may reduce revenue, cause us to lose customers, and otherwise adversely affect our business. The insurance policies we maintain to cover losses caused by fire or natural disaster, including business interruption insurance, may not adequately compensate us for any such losses and will not address a loss of customers that we expect would result or may have large deductibles insufficient to support our continuing operations. If our existing manufacturing facility was damaged or destroyed, we would be unable to operate our business for an extended period of time and our business and results of operations may be materially adversely affected, potentially even threatening our viability.

If we fail to successfully construct and operate our planned second manufacturing facility in Bulloch County, Georgia and increase our production capacity that our continued and anticipated growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.

We have projected significant increase in the demand for our aerogel products, driven by our expected growth in the EV market and sales to our automotive OEM customers. Our continued growth requires that we increase our production capacity. Consequently, we are planning to construct a second manufacturing plant in Bulloch County, Georgia. We are planning to invest nearly \$700.0 million in two phases in the construction of the second facility and we expect to have the first phase of the second plant operational during the second -half of 2023. If, for any reason, including our inability to obtain financing, the second manufacturing plant should fail to be completed in a timely manner, or at all, or any of the production lines in the second manufacturing plant do not operate according to our expectations, sales may be impeded, our growth may be hindered and our business or results of operations may be materially adversely affected.

Many factors could delay or prevent the construction of a second manufacturing facility or cause us to reduce the scale or scope of the new facilities, including:

- our inability to obtain financing on favorable terms, or at all;
- design, engineering and construction difficulties or delays;
- our failure or delay in obtaining necessary legal, regulatory, and other approvals;
- interruptions in the supply of the necessary equipment, or construction materials or labor or an increase in their price;
- opposition of local interests; and
- natural disasters, accidents, political unrest, or unforeseen events.

Many factors could prevent the second manufacturing facility from producing at their expected effective or nameplate capacity or could cause us to reduce the scale or scope of the new facilities, including:

- design and engineering failures;
- inability to retain and train a skilled workforce;
- the challenges of operating significantly higher volume equipment at the planned second facility than currently employed at our existing facility in East Providence;
- improper operation of the manufacturing equipment;
- decreases in our manufacturing yields due to the inefficient use of the materials needed to make our products in our manufacturing process;
- the availability of raw materials to support the levels of production that we anticipate at these facilities;
- strikes or labor disputes; and
- damage to the manufacturing equipment due to design and engineering flaws, construction difficulties or operator error.

Any such expansion will place a significant strain on our senior management team and our financial and other resources. The costs associated with and the resources necessary for our expansion could exceed our expectations and result in a materially adverse impact on our business, results of operations, financial condition and cash flows. If we are unable to complete the project contemplated, the costs incurred in connection with such projects may not be recoverable.

We may encounter manufacturing challenges in the EV market.

The volume and timing of sales to our customers in the EV market may vary due to a wide range of factors, including but not limited to, variation in demand for our customers' products; our customers' attempts to manage their inventory; design changes; changes in our customers' manufacturing strategy; our customers' production schedules; acquisitions of or consolidations among customers; and disruptions in the supply of raw materials or other supplies used in our customers' products. Due in part to these factors, we believe that many of our automotive OEM customers and customers in the EV market do not commit to long-term production schedules. Our inability to forecast the level of customer orders with certainty makes it difficult to schedule production and maximize utilization of manufacturing capacity.

In order to meet the anticipated demand in the EV market, we are planning to construct a second manufacturing plant in Bulloch County, Georgia, to expand our aerogel capacity. Any delays or disruptions in constructing the second manufacturing plant would directly impact our ability to meet such customer demand and adversely impact our business operations and the value of the awarded business.

From time to time, we have underutilized our manufacturing lines. This excess capacity means we incur increased fixed costs in our products relative to the net revenue we generate, which could have an adverse effect on our results of operations, particularly during economic downturns. If we are unable to improve utilization levels for these manufacturing lines and correctly manage capacity, the increased expense levels will have an adverse effect on our business, financial condition and results of operations. In addition, we are planning to construct a fabrication facility in Mexico. Facilities located in Mexico or other countries are subject to a number of additional risks and uncertainties, including increasing labor costs, which may result from market demand or other factors, political, social and economic instability, difficulty in enforcing agreements, or unexpected changes in laws, regulations or policy. Additionally, our manufacturing activities in Mexico may also be adversely affected by political events, terrorist events and hostilities, complications due to natural, nuclear or other disasters or the spread of an infectious disease, virus or other widespread illness. For instance, the global spread of COVID-19, which originated in late 2019 and was later declared a pandemic by the World Health Organization in March 2020, caused certain governmental authorities worldwide to initiate "lock-down" orders for all non-essential activities, which at times, included extended shutdowns of businesses in the impacted regions. This or any further political or governmental developments or health concerns in Mexico could result in social, economic and labor instability. These uncertainties could have a material adverse effect on the continuity of our business and our results of operations and financial condition.

Existing free trade laws and regulations, such as the United States-Mexico-Canada Agreement, provide certain beneficial duties and tariffs for qualifying imports and exports, subject to compliance with the applicable classification and other requirements. Changes in laws or policies governing the terms of trade, and in particular increased trade restrictions, tariffs or taxes on imports from and exports to Mexico, where we intend to fabricate automotive parts from PyroThin products manufactured in the U.S., could have a material adverse effect on our business and financial results.

From time to time we have had difficulty in consistently producing products that meet applicable product specifications and technical and delivery requirements, and such difficulties could expose us to financial, contractual, or other liabilities.

Our insulation products are technologically advanced and require a precise and complex manufacturing process. Because of the precision and complexity of this manufacturing process and the high-performance characteristics of our products, from time to time we have had difficulty in consistently producing products that meet applicable specifications and technical and delivery requirements, including, our customer and end-user specifications and requirements. At certain times in the past, the growth in demand for our products has contributed to this difficulty by putting significant pressure on our management, our personnel and our production facilities. See “*Risk Factors — Growth has placed significant demands on our management systems and our infrastructure. If we fail to manage our long-term growth effectively, we may be unable to execute our business plan, address competitive challenges and meet applicable product specifications and technical and delivery requirements.*”

Furthermore, we seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs. Any failure to meet the specifications for our products as a result of our attempts to optimize our formulations, or otherwise, or technical and delivery requirements could result in the termination of existing customer contracts or purchase orders, the elimination or reduction of future purchase orders, the impairment of customer relationships, and the incurrence of financial, contractual or other liabilities. Products that do not meet these specifications or requirements may also expose us to warranty and product liability claims and associated adverse publicity. Any such termination, reduction, impairment, liability or publicity could result in a broader loss of existing customers and revenues and delay the execution of our business plans, disrupt our operations and could have a material adverse effect on our results of operations and financial condition.

A sustained downturn in the energy industry, due to lower oil and gas prices or reduced energy demand, could decrease demand for some or all of our products and services, which could have a material adverse effect on our business, financial condition and results of operations.

Demand for a significant portion of our products and services depends on the level of capital expenditure by companies in the energy industry, which depends, in part, on current and expected energy prices. Prices of oil and gas have been highly volatile in the past several years with oil prices reaching a high above \$100 per barrel in mid-2014 to a low below \$12 per barrel in early 2020, and recently climbing to over \$90 per barrel. The volatility in oil prices and declines in oil prices, which are often associated with unrelated world events, such as the recent tensions between Russia and Ukraine and political instability in Ukraine and other areas in the world, have resulted, from time to time, in a reduction in capital expenditures by many companies in the energy industry, and in particular by end-users of our products involved in the construction and expansion of offshore and onshore oil and gas production facilities. Sustained lower energy prices may also reduce our energy infrastructure and building materials end-users’ need to improve energy savings by using premium-priced insulation products like ours, thus reducing demand for our products and causing downward pressure on the pricing of our products. A sustained downturn in the capital expenditures of our energy infrastructure and building materials customers, whether due to periods of lower energy prices or a further decrease in the market price of oil and gas or otherwise, and including the perception that such a downturn might occur or continue, may delay capital projects, decrease demand for our products and cause downward pressure on the prices we charge for our products, which, in turn, could have a material adverse effect on our business, financial condition and results of operations. Such downturns, including the perception that they might occur or continue, could have a significant negative impact on the market price of our common stock.

Regulation of greenhouse gas emissions could reduce demand for hydrocarbon products and lead to a sustained downturn in the energy industry, which could decrease demand for our products and have a material adverse effect on our business, financial condition and results of operation.

Due to growing concerns about the risks of climate change, a number of countries are adopting or considering adopting regulations to reduce greenhouse gas emissions. The current U.S. administration has announced a renewed focus on potential legislation and regulations to combat climate change. Any potential greenhouse gas regulations, while potentially helpful in the adoption of electric vehicles, could have the impact of increasing energy costs, reducing the demand for hydrocarbons, decreasing profitability and return on investment in the energy industry, and leading to a sustained downturn in the energy industry. Demand for a significant portion of our products depends on the aggregate level of capital expenditure in the energy industry, which depends, in part, on the expected return on such investments. A sustained period of diminished returns or expected returns on capital deployed in the energy industry as a result of greenhouse gas regulations or otherwise, may delay capital projects, decrease demand for our products and cause downward pressure on the prices we charge for our products, which, in turn, could have a material adverse effect on our business, financial condition, results of operations and the market price of our common stock.

The markets we serve are subject to general economic conditions and cyclical demand, which could harm our business and lead to significant shifts in our results of operations from quarter to quarter that make it difficult to project long-term performance.

Our results of operations have been, and may in the future be, adversely affected by general economic conditions and the cyclical pattern of certain industries in which our customers and end-users operate. Demand for our products and services depends in large part upon the level of capital and maintenance expenditures by many of our customers and end-users, in particular those in the energy, petrochemical, and power generation industries, and firms that design, construct, and operate facilities for these industries.

These customers' expenditures have historically been cyclical in nature and vulnerable to economic downturns. In particular, profitability in the energy industry is highly sensitive to supply and demand cycles and commodity prices, which historically have been volatile; and our customers in this industry historically have tended to delay large capital projects, including expensive maintenance and upgrades, during industry downturns. Delays in customer projects may cause fluctuations in the timing or the amount of revenue earned and our results of operations in a particular period. Prolonged periods of little or no economic growth could decrease demand for oil and gas, which, in turn, could result in lower demand for our products and a negative impact on our results of operations and cash flows. This risk increases as we seek to increase the project-based revenue as a percentage of the total revenue. In addition, this cyclical demand and potential customer project delays may lead to significant shifts in our results of operations from quarter to quarter and from year to year, which limits our ability to make accurate long-term predictions about our future performance. We estimate that sales to end-user customers in the energy industry accounted for approximately 90% of our 2021 revenues and we expect that they will continue to account for a significant portion of our future revenues.

The market for insulation products incorporating aerogel blankets is relatively undeveloped and our products may never be widely adopted, which would have a material adverse effect on our business.

The market for insulation products utilizing aerogel blankets is relatively undeveloped. Accordingly, our future results of operations will depend in large part on our ability to gain market share of the global energy infrastructure and building materials insulation markets. Our ability to gain market share in these markets is highly dependent on the acceptance of our products by large, well-established end-users, distributors, contractors, and OEMs. The insulation market has historically been slow to adopt new technologies and products. Most insulation types currently in use in the energy infrastructure and building materials markets were developed over 50 years ago. In addition, there is a tendency of end-users in some of our markets to opt for the lower short-term costs associated with traditional insulation materials. If we fail to educate existing and potential end-users, distributors, contractors, and OEMs of the benefits and value offered by our aerogel products, or if existing users of our products no longer rely on aerogel insulation for their insulation needs, our ability to sell our products and grow our revenue could be limited.

Our business strategy also includes the development of next generation products with the performance characteristics and price points required by markets outside of the energy infrastructure and sustainable building materials markets, including the electric vehicle market. These performance and price requirements can be more demanding than those we faced in energy infrastructure and sustainable building materials markets. In the event that we are unable to develop products that meet market needs, we may be unable to penetrate such markets. In addition, the development of innovative product and manufacturing methods requires the dedication of significant human, technical and financial resources, with no certainty of success or recovery of our related investment. As a result, we may be unable to grow our business in markets outside of the energy infrastructure and sustainable building materials markets, which could adversely affect our financial performance.

Because we are often a new supplier offering new types of materials to our end-user customers, we also may face concerns from these end-user customers about our reliability and our ability to produce our products in a volume sufficient to meet their supply and quality control needs. As a result, we may experience a reluctance or unwillingness by existing end-user customers to expand their use of our products and by potential end-user customers to begin using our products. Our products may never reach mass adoption, and changes or advances in technologies could adversely affect the demand for our products.

A failure to increase, or a decrease in, demand for aerogel insulation products caused by lack of end-user, market or distribution channel acceptance, technological challenges or competing technologies and products would result in a lower revenue growth rate or decreased revenue, either of which could have a material adverse effect on our business and our results of operations.

If we do not respond appropriately, the evolution of the automotive industry towards mobility on demand services could adversely affect our business.

There has been an increase in consumer preferences for mobility on demand services, such as car- and ride-sharing, as opposed to automobile ownership, which may result in a long-term reduction in the number of vehicles per capita and in turn result in lower demand for our products in the EV market. These evolving areas have also attracted increased competition from entrants outside the

traditional automotive industry. If we do not continue to respond quickly and effectively to this evolutionary process, our results of operations could be adversely impacted.

Declines in the market share or business of our large customers may adversely impact our revenues and profitability.

In the future, we anticipate receiving a large proportion of our revenue in the EV market, particularly from automotive OEM customers. Accordingly, our revenues may be adversely affected by decreases in any of their businesses or market share. For instance, the COVID-19 pandemic and the worldwide semiconductor shortage adversely impacted the automotive industry in 2021 and 2020, resulting in reduced vehicle production schedules and sales from historical levels. Such events in the future could adversely impact our financial condition, operating results and cash flows and could reduce the value of the awarded business and our revenue targets. Furthermore, because our customers typically have no obligation to purchase a specific quantity of parts, a decline in the production levels of any of our major customers, particularly with respect to EV models for which we become a significant supplier, could reduce our sales and thereby adversely affect our financial condition, operating results and cash flows and could reduce the value of the awarded business and our revenue targets.

Employee strikes and labor-related disruptions involving us or one or more of our automotive OEM customers or suppliers may adversely affect our operations.

Our business is labor-intensive. A strike or other form of significant work disruption by our employees would likely have an adverse effect on our ability to operate our business. A labor dispute involving us or one or more of our automotive OEM customers or suppliers, or that could otherwise affect our operations, could reduce our sales and harm our profitability. A labor dispute involving another supplier to our automotive OEM customers that results in a slowdown or a closure of our automotive OEM customers' assembly plants where our products are included in the assembled parts or vehicles could also adversely affect our business and harm our profitability. In addition, our inability or the inability of any of our automotive OEM customers, our suppliers or our customers' suppliers to negotiate an extension of a collective bargaining agreement upon its expiration could reduce our sales and harm our profitability. Significant increases in labor costs as a result of the renegotiation of collective bargaining agreements could also adversely affect our business and harm our profitability. Recently, labor shortages have persisted throughout the economy and our industry is no different. If we are unable to address any labor shortages or increased labor costs adequately, we may not be able to meet demand for our product, which may impact our results of operations and the value of the awarded business.

Our growth in the electric vehicle market is dependent upon consumers' willingness to purchase and use electric vehicles.

Our growth in the electric vehicle market is highly dependent upon the purchase and use by consumers of electric vehicles. If the market for electric vehicles does not gain broad market acceptance or develops more slowly than we anticipate, our business, prospects, financial condition, and operating results will be harmed. The market for electric vehicles is relatively new, rapidly evolving, characterized by rapidly changing technologies, price competition, additional competitors, evolving government regulation and industry standards, frequent new vehicle announcements, long development cycles for electric vehicles OEMs, and changing consumer demands and behaviors. Factors that may influence the purchase and use of electric vehicles include:

- perceptions about electric vehicle quality, safety (in particular with respect to lithium-ion battery packs), design, performance and cost, especially if adverse events or accidents occur that are linked to the quality or safety of electric vehicles;
- perceptions about vehicle safety in general, in particular safety issues that may be attributed to the use of advanced technology, including vehicle electronics and regenerative braking systems;
- the decline of an EV's range resulting from (i) deterioration over time in the battery's ability to hold a charge or (ii) operation in colder weather;
- concerns about electric grid capacity and reliability, which could derail efforts to promote electric vehicles as a practical solution to vehicles that require gasoline;
- the environmental consciousness of consumers;
- volatility in the cost of oil and gasoline;
- safety concerns around electric vehicles generally and battery systems in particular; and
- access to charging stations, standardization of electric vehicles charging systems and consumers' perceptions about convenience and cost to charge an electric vehicle;

The influence of any of the factors described above may cause current or potential customers not to purchase electric vehicles and could impact the widespread consumer adoption of electric vehicles, which would materially adversely affect our business, operating results, financial condition and prospects.

Our products are expensive relative to other insulation products, which could make it more difficult for us to grow our revenue and achieve broader adoption of our aerogel products.

While we believe our products have superior performance attributes and may sometimes have the lowest cost on a fully installed basis or offer life-cycle cost savings, our competitors offer many traditional insulation products that are priced below our products. Our products are expensive relative to alternative insulation products and end-user customers may not value our products' performance attributes sufficiently to pay their premium price. This could make it more difficult for us to grow our revenue and achieve broader adoption of our aerogel products. While we seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs, we may not be successful in doing so. In addition, some of the benefits of our products are based on reduced installation time and related labor expense. In regions where labor costs are significantly lower than in the United States and Europe, the cost benefits of reduced installation times may not be adequate to overcome the relatively high price of our products and may make it more difficult for us to grow our revenue in those regions.

The insulation markets we serve are highly competitive. If we are unable to compete successfully, we may not be able to increase or maintain our market share and revenues.

We face strong competition primarily from established manufacturers of traditional insulation materials. Large producers of traditional insulation materials, such as Johns Mansville, Saint-Gobain, Knauf Gips, Owens Corning and Rockwool, dominate the insulation market. In addition, we face increasing competition from other companies seeking to develop high-performance insulation materials, including aerogel insulation. For example, Cabot Corporation manufactures, markets and sells a different form of aerogel insulation that is competitive with our products, particularly in the offshore oil and gas sector for use in pipe-in-pipe applications. We are also aware of competitors including Armacell International S.A., Beerenberg AS, Guangdong Alison Hi-Tech Co, Ltd, Nano Tech Co, Ltd, and other Asia-based companies that manufacture and/or market aerogel insulation products in blanket form. Many of our competitors are substantially larger and better capitalized than we are and possess greater financial resources. Our competitors could focus their substantial financial resources to develop new or additional competing products or develop products that are more attractive to potential customers than the products that we offer. We expect to face an increasing amount of competition in the aerogel insulation market over the next several years as existing competitors and new entrants seek to develop and market their own aerogel products.

Because some insulation manufacturers are substantially larger and better capitalized than we are, they may have the ability to sell their products at substantially lower costs to a large, existing customer base. Our products are expensive relative to other insulation products and end-user customers may not value our products' superior performance attributes sufficiently to pay their premium price. In addition, from time to time, we may increase the prices for our products and these price increases may not be accepted by our end-user customers and could result in a decreased demand for our products. Similarly, we may make changes to our products in order to respond to customer demand or to improve their performance attributes and these changes may not be accepted by our end-use customers and could result in a decrease in demand for our products. These competitive factors could:

- make it more difficult for us to attract and retain customers;
- cause us to slow the rate of increase of our prices, delay or cancel planned price increases, lower our prices or discount our prices in order to compete; and
- reduce our market share and revenues.

Any of these outcomes could have a material adverse effect on our results of operations, financial condition and cash flows.

Furthermore, we are in the early stages of developing battery materials for lithium-ion battery systems in electric vehicles, using our carbon aerogel technology. Even assuming successful development of such battery materials for the electric vehicles market, we will face substantial competition in commercializing such materials. We will compete with other companies, many of whom are developing, or can be expected to develop, products similar to ours. This market is large with many competitors. Many of our competitors in this market are more established than we are, and have significantly greater financial, technical, marketing, and other resources than we presently possess. Some of our competitors have greater name recognition and a larger customer base. These competitors may be able to respond more quickly to new or changing opportunities and customer requirements and may be able to undertake more extensive promotional activities, offer more attractive terms to customers, and adopt more aggressive pricing policies. We will not only compete with providers of other long-term solutions, such as lithium metal anode, but also with other well-

engineered silicon rich anode materials provided by well-capitalized startups with longer experience with silicon-based anodes. Thus, competing silicon-rich anode solutions, even if more expensive, may provide better mid-term solutions for increased energy densities before long-term solutions such as lithium metal anodes become viable. We cannot provide any assurance that we will be able to compete effectively with current or future competitors or that the competitive pressures we face will not harm our business, particularly as it relates to the electric vehicles market.

Failure by us to develop, maintain and strengthen strategic relationships with industry leaders to commercialize our products in the electric vehicle market may adversely affect our results of operations and our ability to grow our business.

Our business strategy requires us to align the design and performance attributes of our products and technologies to the evolving needs of the market. To facilitate this process, we have sought out partnerships and relationships with industry leaders in order to assist in the development and commercialization of our products. We face competition from other manufacturers of insulation, thermal barriers, battery materials, and similar products in seeking out and entering into such partnerships and relationships with industry leaders in our targeted electric vehicle market and we may therefore not be successful in establishing strategic relationships in those markets.

In the electric vehicle market, we are seeking to engage with industry leaders to assist in the optimization of our proprietary and patented carbon aerogels to improve the performance and cost of lithium-ion batteries. We have entered into an evaluation agreement with SKC Co., Ltd. to explore the potential use of Aspen's silicon-rich carbon aerogel materials in the anode of lithium-ion batteries. We are also exploring various silicon materials for use with our solutions, including materials from a subsidiary of Evonik Industries AG. With the support of such third parties, we are seeking to focus our technical development and accelerate the potential commercialization of these carbon aerogel materials in the electric vehicle market. In addition, we are expanding our efforts with several battery and electric vehicle manufacturers to engineer silica aerogel thermal barriers to manage the risk of thermal runaway specific to the design of their lithium-ion battery packs and systems.

Unlike the other markets for which we have previously developed thermal solutions, the electric vehicle market may be more demanding technically, financially, and in other ways. Additionally, the automotive industry may be more risk averse, may have longer product development and testing cycles or otherwise require resources which we cannot muster in a timely manner to develop and market products and solutions. Furthermore, as we develop an anode active material for the electric vehicle market, we will be required to rely on industry partners in evaluating our materials in their respective anodes in combination with matching cathodes to produce cost effective and compelling cells for next generation electric vehicles. We may not be able to find the right partners to achieve our objectives or our interest and our partners' interest may not be well aligned.

We will continue to seek to engage with additional battery material and electric vehicle manufacturers to realize the full potential of our aerogel technology platform within the electric vehicle market. In the event that we are unable to engage with additional industry leaders or to develop products that meet market needs, we may be less able or unable to penetrate that market. As a result, we may lessen or lose our ability to grow our business in the electric vehicle market that could adversely affect our business, financial condition and results of operations, including impairing our profitability.

We have entered into and may enter into future agreements that may limit our ability to broadly market our products or could involve future obligations, which could make it more difficult for us to commercialize certain of our products and negatively affect our business and results of operations.

In order to develop and commercialize our products, we may enter into joint development agreements or commercial arrangements. We cannot be certain that any products will be successfully developed under any such agreement or, even if developed, that they will be successfully produced or commercialized. These agreements may contain exclusivity, ownership of intellectual property, and other terms that may limit our ability to commercialize any products or technology developed in connection with such agreements, including in ways that we do not envision at the time of entering into the agreement. In addition, these agreements may not obligate either party to make any purchases and may contain technical specifications that must be achieved to the satisfaction of our partner, which we cannot be certain we will be able to achieve. If our ability to commercialize products or technology developed in connection with these agreements is limited or if we fail to achieve the technical specifications that may be required, then our business, financial condition, and results of operations could be materially adversely affected.

We may not be able to successfully develop and introduce new products in a timely manner at competitive prices, which would limit our ability to grow and maintain our competitive position and could adversely affect our financial conditions, results of operations and cash flow.

Our growth depends, primarily, on continued increase in the sales of existing products, including by improving the performance of existing products, as well as the successful development and introduction of new products, including new products for applications within the electric vehicle market, which face the uncertainty of customer acceptance and reaction from competitors. New product development requires considerable resources and attention that may shift our focus from and may disrupt our current operations, given that we have fewer resources than many of our competitors. We may not be able to sustainably manufacture new products with attractive margins and we may experience higher production inefficiencies than expected. Any delay in the development or launch of a new product could result in our not being the first to market, which could compromise our competitive position. Even if we manage to develop and introduce new products, such products may not address market needs or otherwise compete with third-party products. Even if our new products are adopted by the market, we may not achieve the growth in revenue that we expect from such new products and our investment in these efforts may not be proportional to our expected or actual revenue growth. If we are unable to develop and introduce new products in a cost-effective manner or otherwise manage effectively the operations related to new products, our results of operations and financial condition could be adversely impacted.

If we do not continue to develop and maintain distribution channels for our products and to meet our customers' demand for our products, our results of operations could be adversely affected.

For a significant portion of our revenues, we rely on sales to distributors who then sell our products to end-users in our target markets. Our success depends, in part, on our maintaining satisfactory relationships with these distributors and develop new relationships in new geographies. Our distributors require us to meet expectations of delivery, quality, and pricing of our products, at both the distribution channel level and at the level of the end-user of our products. If we fail to meet expected standards, our revenues would decline and this could materially adversely affect our business, results of operations, and financial condition. In addition, we have been unable at times to produce sufficient amounts of our products to meet demand from our distributors and customers and we may not be able to avoid capacity constraints in the future if demand exceeds our expectations or we fail to expand our capacity in our planned second manufacturing facility in Bulloch County, Georgia, in a timely manner. If we are unable to deliver our products within such short timeframes, we may be at risk of losing direct or end-user customers. Accordingly, shortfalls in sales could materially adversely affect our business and results of operations.

The qualification process for our products can be lengthy and unpredictable, potentially delaying adoption of our products and causing us to incur significant expense potentially without recovery.

Qualification of our products by many of our direct and end-user customers can be lengthy and unpredictable and many of these direct and end-user customers have extended budgeting and procurement processes. This extended sales process requires the dedication of significant time by our personnel and our use of significant financial resources, with no certainty of success or recovery of our related expenses. Furthermore, even after an extensive qualification process, our products may fail to meet the standards sought by our end-user customers and may not be qualified for use by such end-user customers. Additionally, our continued process improvements and cost-reduction efforts may require us or the end-users to re-qualify our products. Failure to qualify or re-qualify our products may result in us losing such companies as end-users of our products, which would cause a decrease in our revenue or revenue growth rate, either of which could materially adversely affect our business and results of operations.

Our revenue may fluctuate, which may result in a high degree of variability in our results of operations and make it difficult for us to plan based on our future outlook and to forecast our future performance.

Our revenue may fluctuate from period to period due to a wide variety of factors. Since we rely on sales to a limited number of direct customers/distributors and end-user customers, changes in demand from one or more direct customers or end-users can significantly impact our revenue from period to period. In addition, the sales cycles for our products, including their qualification for use, are long and can result in unpredictability in our revenues. We expect to have an increasing percentage of our products sold for use in capital projects in the energy infrastructure market, which orders tend to be larger and more sporadic. This will further increase this unpredictability and the difficulty for us in forecasting quarterly or annual performance. Because of these factors, we have a limited basis on which to predict our quarterly revenue. Our profitability from period-to-period may also vary due to the mix of products that we sell in different periods. These factors may result in a high degree of variability in our results of operations and will make it difficult for us to accurately evaluate and forecast quarterly or annual performance and to plan based on our future outlook.

The results of our operations could be materially adversely affected if our operating expenses incurred do not correspond with the timing of our revenues.

Most of our operating expenses, such as manufacturing facility expenses, employee compensation and research expenses, are either relatively fixed in the short-term or incurred in advance of sales. In addition, our spending levels are based in part on our expectations regarding future revenues. As a result, if revenues for a particular quarter are below expectations, we may not be able to

proportionately reduce operating expenses for that quarter. Our reliance on sales to a limited number of direct customers, distributors and end-user customers, the length of our sales cycles and the potentially increasing percentage of our products sold for use in capital projects each can cause sporadic demand for our products that would limit our ability to predict future sales. This limitation could result in our being unable to reduce spending quickly enough to compensate for reductions in sales and could therefore adversely affect our results of operations for any particular operating period. Additionally, as we pursue rapidly evolving opportunities in the electric vehicle market, we have been hiring and will continue to hire additional personnel and incur additional expenses as we seek to implement and increase our capabilities and production capacity. The costs associated with these measures are being and will continue to be incurred in advance of our anticipated revenue opportunities, which will negatively impact our results of operations and profitability.

If we lose key personnel upon whom we are dependent, or if we are unable to successfully recruit and retain skilled employees, we may not be able to manage our operations and meet our strategic objectives.

Our continued success depends to a considerable degree upon the continued services of a small number of our employees with critical knowledge of our products, our manufacturing process, our intellectual property, our customers, and our global operations. The loss or unavailability of any of these individuals could harm our ability to execute our business plan, maintain important business relationships, and complete certain product development initiatives, which could harm our business. In the event that any of these key individuals leave their employment with us or take new employment with a competitor, our business and results of operations could be materially adversely affected. In addition, our continued success depends upon the availability, contributions, vision, skills, experience, and effort of our senior management, financial, sales and marketing, engineering, and production teams and our ability to recruit additional experienced personnel, particularly as we pursue growth opportunities in the EV market. We do not maintain “key person” insurance on any of our employees. We have entered into employment agreements with certain members of our senior management team, but none of these agreements guarantee the services of the individual for a specified period of time. All of the agreements with members of our senior management team provide that employment is at-will and may be terminated by the employee at any time and without notice.

The loss of the services of any of key employees or our inability to recruit and retain qualified personnel or advisors might impede our operations or the achievement of our strategic and financial objectives. The loss or interruption of the service of any of these individuals or our inability to attract or retain other qualified personnel or advisors could have a material adverse effect on our business, financial condition, and results of operations and could significantly reduce our ability to manage our operations and implement our strategy.

We are exposed to the credit risk of some of our direct customers, including distributors, contractors and OEMs, which subjects us to the risk of non-payment for our products.

We distribute our products, in part, through a network of distributors, contractors and OEMs, some of which may not be well capitalized and may be of a lower credit quality. This direct customer network subjects us to the risk of non-payment for our products. In addition, we operate in a number of countries characterized by intermittent governmental, market and financial crises. During 2019, we determined that collection of the remaining unpaid accounts receivable from a Brazilian contractor of \$2.6 million was unlikely and recorded a write-off of the accounts receivable and the corresponding allowance for doubtful accounts. During 2020, we established an estimated reserve for uncollectible accounts receivable for \$0.3 million. In addition, during periods of economic downturn in the global economy, our exposure to credit risks from our direct customers may increase, and our efforts to monitor and mitigate the associated risks may not be effective. In the event of additional non-payments by one or more of our direct customers, our business, financial condition and results of operations could be materially adversely affected.

If we fail to achieve the increase in production capacity that our long-term growth requires in a timely manner, or at all, our growth may be hindered and our business or results of operations may be materially adversely affected.

If, for any reason, including our inability to obtain financing, our planned expansion of capacity in a second plant in Bulloch County, Georgia or the construction of an automated fabrication facility in Mexico should fail to be completed in a timely manner, or at all, or any of the production lines in our existing or future manufacturing facilities do not operate according to our expectations, sales and or profitability may be impeded, our growth may be hindered and our business or results of operations may be materially adversely affected.

Many factors could delay, impede or prevent the construction and operation of future, potential manufacturing facilities, including in Bulloch County, Georgia or Mexico, or cause us to reduce the scale or scope of the expansion projects, including:

- our inability to obtain financing on favorable terms, or at all;
- design, engineering and construction difficulties or delays;
- our failure or delay in obtaining necessary legal, regulatory and other approvals and permits;
- interruptions in the supply of the necessary equipment, or construction materials or labor or an increase in their respective prices;
- opposition of local interests; and
- natural disasters, accidents, political unrest or unforeseen events, man-made or otherwise.

Many factors could prevent our existing and future potential manufacturing facilities from producing at expected, projected or targeted nameplate capacities or could cause us to reduce the scale or scope of future capacity expansions or facilities, including:

- design and engineering failures;
- inability to retain, manage and train a skilled workforce;
- the challenges of operating technically advanced or higher volume equipment than currently employed at our existing facility in East Providence, Rhode Island;
- improper operation of the manufacturing equipment;
- decreases in our manufacturing yields due to the inefficient use of the materials needed to make our products in our manufacturing process;
- the availability of raw materials at reasonable costs to support the levels of production that we anticipate at these facilities;
- strikes or labor disputes; and
- damage to the manufacturing equipment due to design and engineering flaws, construction difficulties or operator error.

Any such capacity expansion will place a significant strain on our senior management team and our financial and other resources. The costs associated with and the resources necessary for our capacity expansion plans could exceed our expectations and result in a materially adverse impact on our business, results of operations, financial condition, and cash flows.

If we are unable to complete the projects as contemplated, the costs incurred in connection with such projects may not be recoverable. For example, during 2013, we redesigned and reduced the planned scale of the third production line in our East Providence, Rhode Island facility. We recorded an associated \$3.4 million impairment charge during 2013 to write off certain construction in progress assets. In addition, during 2018, we determined that our engineering plans, designs and drawings for a second manufacturing facility in Bulloch County, Georgia, would not be used due principally to our decision to significantly delay construction of the facility and intervening technical developments. Accordingly, we recorded an impairment charge of \$7.4 million in 2018 on pre-construction and related costs for the Georgia facility.

A redesign of, change in scale of, or failure to initiate and complete the construction of potential manufacturing facilities and other similar impairments of our assets in the future could result in a materially adverse impact on our business, results of operations, and financial condition.

Furthermore, manufacturing of our silicon-rich carbon aerogel anode materials at the required scale and at a competitive cost may be challenging. Our silicon-rich anode materials are designed to replace graphite partially or completely in current graphitic anodes. Graphite prices are at least an order of magnitude lower than projected cost of our silicon-rich materials. In order to participate in the silicon-rich anode market with any meaningful market share, we need to rapidly scale up our processes to make hundreds of tons per year. Though we have had prior experience successfully scaling up silica-based aerogels, carbon aerogels and silicon-carbon composite aerogels may present their own unique technical and supply chain challenges that may be difficult to overcome in short order, which may adversely impact our business.

If the expected growth in the demand for our products does not follow after each of our planned capacity expansions, then our business will be materially adversely affected.

Our long-term growth plan requires that we continue to increase our production capacity. As we pursue our capacity expansion plans, we will incur significant capital expenditures and increased levels of manufacturing expenses in anticipation of expected growth

in demand for our products. In particular, we expect that these substantial additional expenditures will be made by us significantly in advance of the existence of the level of demand that would ensure the most efficient use of our planned new capacity. As a result, if the expected growth in demand for our products fails to materialize within a reasonable amount of time following each of our planned capacity expansions, whether because of low oil and gas prices, the failure of our automotive OEM customers to place firm orders at levels anticipated based on our awarded business expectations, the loss of a significant customer, our inability to grow our sales of EV products, the failure to develop new markets or for any other reason, then we would suffer decreased levels of cash flow and our financial condition and results of operations would be adversely affected.

Growth has placed significant demands on our management systems and our infrastructure. If we fail to manage our long-term growth effectively, we may be unable to execute our business plan, address competitive challenges and meet applicable product specifications and technical and delivery requirements.

We may be unable to manage our growth. To manage our anticipated future growth, we must continue to:

- improve and expand our manufacturing, sales and marketing, and engineering organizations;
- enhance our research and development capabilities and resources;
- improve regulatory compliance, financial control and reporting systems;
- expand our manufacturing, fabrication and distribution facilities and capacity; and
- recruit, train and retain additional qualified personnel to enhance our managerial capabilities.

All of these measures will require significant expenditures and will demand the attention of management. At certain points in the past, significant growth in demand for our products has put our management and operating systems under strain. In addition, the physical expansion of our operations may lead to significant costs and may divert our management and business development resources. Furthermore, we compete for personnel and advisors with other companies and other organizations, many of which are larger and have greater name recognition and financial and other resources than we do. Due to our limited resources, we may not be able to effectively manage the expansion of our operations or adequately recruit, train, and retain qualified personnel. Any inability to manage growth could result in a loss of existing customers and revenues, delays in the execution of our business plans, and disruption of our operations. If we fail to achieve the necessary level of efficiency in our organization as it grows, it could have a material adverse impact on our business, results of operations and financial conditions.

We allocate our manufacturing operations, sales and marketing, research and development, general and administrative and financial resources based on our business plan, which includes assumptions about current and future orders and revenues from customers. However, the factors involved in such projections are uncertain. If our assumptions regarding these factors prove to be incorrect or if competing products gain further market share, then actual demand for our aerogel products could be significantly less than the demand we anticipate and we may not be able to grow our revenue or achieve profitability.

A substantial portion of our revenue comes from sales in foreign countries and we are planning to expand our operations outside of the United States, which subjects us to increased economic, trade, foreign exchange, operational and political risks that could materially adversely impact our business, financial conditions and results of operations and also increase our costs and make it difficult for us to operate profitably.

A substantial portion of our sales are to destinations outside of the United States, including France, Norway, Thailand, Russia, Canada, Germany, Taiwan, Great Britain, Columbia, and South Korea. Total revenue generated from outside of the United States, based on our shipment destination, amounted to \$54.8 million or 45% of total revenue, \$55.5 million or 55% of total revenue and \$81.0 million or 58% of total revenue, for the years ended December 31, 2021, 2020 and 2019, respectively. In addition, we are planning to construct an automated fabrication facility in Mexico and commence operations during 2022.

As a result, we are subject to a number of risks, including, but not limited to:

- the effect of applicable U.S. and foreign tax structures, including tax rates that may be higher than tax rates in the United States or taxes that may be duplicative of those imposed in the United States;
- trade relations among the United States and those foreign countries in which our customers and suppliers have operations, including protectionist measures such as tariffs and import or export licensing requirements, whether imposed by the United States or such foreign countries, in particular the strained trade relations between the United States and China since 2018;

- general economic and political conditions in each country, which may interfere with, among other things, our supply chain, our customers and all of our activities in a particular location;
- difficulty in the enforcement of contractual obligations in non-U.S. jurisdictions and the collection of accounts receivable from foreign accounts;
- different regulatory regimes in the various countries in which we operate or sell our products;
- inadequate intellectual property protection in foreign countries;
- the difficulties and increased expense in complying with multiple and potentially conflicting domestic and foreign laws, regulations, product approvals and trade standards, including the U.S. Foreign Corrupt Practices Act, or FCPA, and similar anti-bribery laws in non-U.S. jurisdictions, as well as the rules and regulations of the U.S. Department of Treasury's Office of Foreign Assets Control, or OFAC, and similar sanctions laws;
- foreign currency exchange controls, restrictions and fluctuations, which could result in reduced revenue and increased operating expense;
- transportation delays or interruptions;
- labor rules and collective bargaining arrangements in foreign jurisdictions;
- difficulty in staffing and managing (including ensuring compliance with internal policies and controls) geographically widespread operations; and
- armed conflicts, terrorist activity, and political unrest, particularly given the use of our products at energy facilities.

Additionally, we have generated revenue from LNG projects located in Russia in recent years. The current Russian-Ukrainian conflict and the emerging response from western nations, including sanctions, may have an adverse effect on our revenue and results of operations.

In addition, sales of our products are generally conducted in U.S. dollars and we also bid for foreign projects in U.S. dollars. The strengthening of the U.S. dollar against the local currencies in the countries into which we sell our products may result in our products becoming more expensive relative to competing insulation products priced in local currencies. If the U.S. dollar strengthens, our sales into foreign countries with relatively weaker currencies may be adversely impacted and we may be less competitive in bidding for projects in those markets.

Our success will depend in large part on our ability to manage the effects of continued global political and economic uncertainty, including those related to the ongoing recent tensions between Russia and Ukraine and political instability in Ukraine, especially in our international markets.

Because of our significant international operations, we could be materially adversely affected by violations of the U.S. FCPA and similar anti-corruption, anti-bribery, and anti-kickback laws.

We operate on a global basis, with 45% of our product sales in 2021 made to destinations outside of the United States, including Canada, Mexico, Europe, Asia, South America, and the Middle East. Our business operations and sales in countries outside of the United States are subject to anti-corruption, anti-bribery and anti-kickback laws and regulations, including restrictions imposed by the FCPA, as well as the United Kingdom Bribery Act of 2010, or UK Bribery Act. The FCPA, UK Bribery Act, and similar anti-corruption, anti-bribery and anti-kickback laws in other jurisdictions generally prohibit companies, their intermediaries and their agents from making improper payments to government officials or any other persons for the purpose of obtaining or retaining business. We operate and sell our products in many parts of the world that have experienced governmental corruption to some degree and, in certain circumstances, strict compliance with anti-corruption, anti-bribery and anti-kickback laws may conflict with local customs and practices. We train our employees concerning anti-corruption, anti-bribery, and anti-kickback laws and have policies in place that prohibit employees from making improper payments. We continue to implement internal controls and procedures designed to ensure that we comply with anti-corruption, anti-bribery, and anti-kickback laws, rules and regulations and mitigate and protect against corruption risks. We cannot provide assurance that our internal controls and procedures will protect us from reckless, criminal or other acts committed by our employees or third-parties with whom we work. If we are found to be liable for violations of the FCPA or similar anti-corruption, anti-bribery, and anti-kickback laws in international jurisdictions, either due to our own acts or out of inadvertence, or due to the acts or inadvertence of others, we could suffer criminal or civil fines or penalties or other repercussions, including reputational harm, which could have a material adverse effect on our business, results of operations, and financial condition.

A failure to comply with export control or economic sanctions laws and regulations could have a material adverse impact on our business, results of operations or financial condition. We may be unable to ensure that our distributors comply with applicable sanctions and export control laws.

We operate on a global basis, with 45% of our product sales in 2021 made to destinations outside of the United States, including Canada, Mexico, Europe, Asia, South America and the Middle East. We face several risks inherent in conducting business internationally, including compliance with applicable economic sanctions laws and regulations, such as laws and regulations administered by OFAC, the United States Department of State and the United States Department of Commerce. We must also comply with all applicable export control laws and regulations of the United States and other countries. Violations of these laws or regulations could result in significant additional sanctions including criminal or civil fines or penalties, more onerous compliance requirements, more extensive debarments from export privileges or loss of authorizations needed to conduct aspects of our international business.

In certain countries, we may engage third-party agents or intermediaries, such as customs agents, to act on our behalf. If these third-party agents or intermediaries violate applicable laws, their actions may result in criminal or civil fines or penalties or other sanctions being assessed against us. We take certain measures designed to ensure our compliance with U.S. export and economic sanctions law and we believe that we have never sold our products to Iran, Cuba, Sudan, or Syria through third-party agents or intermediaries or made any effort to attract business from any of these countries. However, it is possible that some of our products were sold or will be sold to distributors or other parties that, without our knowledge or consent, re-exported or will re-export such products to these countries. Although none of our non-U.S. distributors are located in, or to our knowledge, conduct business with Iran, Cuba, Sudan, or Syria, we may not be successful in ensuring compliance with limitations or restrictions on business with these or other countries subject to economic sanctions. There can be no assurance that we will be in compliance with export control or economic sanctions laws and regulations in the future.

Any such violation could result in significant criminal or civil fines, penalties or other sanctions and repercussions, including reputational harm that could have a material adverse impact on our business, results of operations or financial condition.

We rely on sales to a limited number of direct customers, including distributors, contractors, OEMs, partners and end-user customers for the substantial majority of our revenue, and the loss of one or more significant direct customers or several of our smaller direct customers could materially harm our business. In addition, we understand from our customers that a substantial majority of their sales of our products are to a small number of end-user customers and the loss of one or more significant end-user customers or several of our smaller end-user customers could materially harm our business.

A substantial majority of our revenue is generated from sales to a limited number of direct customers, including distributors, contractors, OEMs, partners and end-user customers. For the years ended December 31, 2021, 2020 and 2019, total revenue from our top ten direct customers represented 68%, 66%, and 68% of our revenues, respectively. Distribution International, Inc. represented 28% of our total revenue in 2021; Distribution International, Inc. and SPCC Joint Venture represented 21% and 15% of our total revenue in 2020; Distribution International, Inc. and SPCC Joint Venture represented 20% and 13% of our total revenue in 2019. Although the composition of our significant distributors, contractors, OEMs, partners and end-user customers will vary from period to period, we expect that most of our revenues will continue, for the foreseeable future, to come from sales to a relatively small number of direct customers. In addition, we understand from our direct customers that a substantial majority of their sales of our products are to a small number of end-user customers.

Our direct customer concentration also creates accounts receivable concentrations and related risks. As of December 31, 2021, Distribution International, Inc. and General Motors, LLC accounted for 27% and 17% of our accounts receivable respectively.

A majority of our expected sales in the EV market in 2022 and a substantial amount in 2023 are expected to be to a single customer. The substantial majority of our sales to distributors are transacted on a purchase order basis. The contracts we enter into with our direct customers generally do not include long-term commitments or minimum volumes that ensure future sales of our products. In addition, we understand that our direct customers' contracts with end-user customers also generally do not include such commitments or minimums. Consequently, our results of operations may fluctuate significantly from period-to-period based on the actions of one or more significant direct customers or end-user customers.

A direct customer may take actions that affect us for reasons that we cannot anticipate or control, such as reasons related to an end-user customer's financial condition, contractual arrangements with end-user customers, changes in business strategy or operations, the introduction of alternative competing products, or as the result of the perceived quality or cost-effectiveness of our products. Our agreements with these direct customers may be cancelled if we fail to meet certain product specifications or materially breach the agreement or for other reasons outside of our control. In addition, our direct customers may seek to renegotiate the terms of current agreements upon maturity or renewal. The loss of, or a reduction in sales or anticipated sales to, one or more of our significant direct customers or end-user customers or several of our smaller direct customers or end-user customers could have a material adverse effect on our business, financial condition, and results of operations.

If we are unable to maintain our technological advantage over our competitors, our business may be materially adversely affected.

We research, develop, manufacture and sell high-performance aerogel insulation products. Rapid and ongoing changes in technology and product standards could quickly render our products less competitive, or even obsolete, particularly if we fail to continue to improve the performance of our insulation products. We are currently developing new applications for our existing products as well as new aerogel technologies; however, our efforts may not be successful and new applications or technologies may not be commercially useful. Other companies that are seeking to enhance traditional insulation materials have recently introduced or are developing other emerging insulation technologies. These competitors are engaged in significant development work on these various insulation products. Competing technologies that outperform our insulation in one or more performance attributes could be developed and successfully introduced.

We are also aware of certain companies, including Armacell International S.A., Beerenberg AS, Guangdong Alison Hi-Tech Co, Ltd., Nano Tech Co, Ltd, and a variety of other companies based in Asia that have developed or are developing and/or marketing products using aerogel technology similar to our technology and these or other companies have introduced or could introduce aerogel products that compete directly with our products and could in the future outperform our products in one or more performance attributes, could be offered to our customers as a cheaper alternative to our products or may result in increased pricing pressure on our products. As a result of increasing competitive activity by other companies in the aerogel insulation market, both now and in the future, we may not be able to sustain our competitive position in our target markets. Any degradation in our competitive position could have a material adverse effect on our business, financial condition and results of operations.

In addition, certain technological advancements may render our products obsolete. In particular, the future direction of electric vehicle battery packs may strike a commercially reasonable balance between the need for higher energy densities and the need for better safety outcomes. A rapid progress towards technologies such as solid electrolytes, safer electrode active materials (such as LFP cathodes) may provide a better balance of energy density and safety, render our premium thermal barriers obsolete and have a material adverse effect on our business, financial condition and results of operations.

Negative perceptions regarding the safety, quality or other attributes of our products or a failure or a perceived failure of our products could have a material adverse effect on our results of operations and could make us unable to continue our business.

Given the history of asbestos as an insulation material, we believe that there is an elevated level of attention towards perceived health and safety risks in the insulation industry. As a consequence, it is essential to our existing business and to our future growth that our products are considered safe. Even modest perceptions by existing or potential distributors, contractors or end-user customers in our target markets that our products are not safe could have a critical impact on our ability to sell our products and to continue as a business. Further, our competitors have in the past, and may in the future, seek to create or perpetuate such perceptions. There is risk of an actual or perceived failure of our products or other negative perceptions regarding our products, such as perceived health hazards. For example, dust is produced by our products during their installation and use, which increases the likelihood of the perception of a hazard. Another example is the potential in very high temperature applications for material failure. Like most insulation products, our Pyrogel XT and XTE products will normally go through a controlled burn-in process immediately after exposure to high temperatures. If installed improperly, the burn-in may proceed too rapidly and the material may become damaged. In addition, the thermal performance of our materials may degrade over time due to a variety of operational or environmental conditions. We take steps to educate our distributors, contractors, OEMs and end-user customers on the nature of our products and the proper installation and operating procedures in order to mitigate these risks. Such an event, or the perception of such an event, could quickly result in our direct and end-user customers replacing our products with traditional insulation materials which could have a material adverse effect on our results of operations.

Our activities and operations are subject to numerous health and safety laws and regulations. If we violate such regulations, we could face penalties and fines or be required to curtail or cease operations.

We are subject to numerous health and safety laws and regulations in each of the jurisdictions in which we operate. These health and safety laws and regulations apply to us including with regard to hazardous substances that we use in our manufacturing process and that certain of our products contain. These substances include titanium dioxide, iron oxide, ethanol, and carbon black, each of which has been determined, in certain forms, with certain contaminants and at certain levels, to be hazardous, possibly carcinogenic, or otherwise harmful to humans. We may also consider and adopt the use of other hazardous substances or substances potentially containing hazardous contaminants, with similar or higher risks in connection with new products or modifications to our current products and related manufacturing.

Our processes also require the use of other regulated substances in raw material delivery and manufacturing, including among others, ethanol. Applicable laws and regulations require us to obtain and maintain permits and approvals and implement health and safety programs and procedures to control risks associated with our operations. Compliance with those laws and regulations can require us to incur substantial costs. Moreover, if our compliance programs are not successful, we could be subject to penalties or to revocation of our permits, which may require us to curtail or cease operations of the affected facilities. In particular, the construction of future, potential facilities will require us to obtain and maintain new permits from various regulatory authorities and if the issuance of such permits is delayed or denied, it would slow or potentially prevent the expansion of our manufacturing capacity. Violations of laws, regulations and permit requirements may also result in criminal sanctions, injunctions and the denial or revocation of our various permits.

While we use hazardous substances, including titanium dioxide, carbon black, and similar chemicals, in forms and at levels that are subject to current rules and regulations, such rules and regulations may become more stringent such that we are required to modify our manufacturing process and such that our customers' use of our products may be impacted. Regulatory changes contemplated in several countries, particularly in Europe, may substantially increase these risks. Changes in the products or manufacturing processes may require the customers to perform an extensive re-qualification process, which our customers may not want to undertake for various reasons, resulting in the customer switching to competing products. In addition, changes in our production or manufacturing process may result in uses above currently permitted levels. Such uses or changes in rules or regulations could materially adversely affect our business, financial condition, and results of operations.

Health and safety laws, regulations and permit requirements may become more stringent or otherwise change. Any such changes could require us to incur materially higher costs than at present. Our costs of complying with current and future health and safety laws, regulations and permit requirements, and any liabilities, fines or other sanctions resulting from violations of them, could adversely affect our business, financial condition, and results of operations.

We may face certain product liability or warranty claims on our products, including from improper installation of our products by third parties. As a consequence, we could lose existing and future business and our ability to develop, market and sell our insulation could be harmed.

The design, development, production and sale of our products involve an inherent risk of product liability claims and associated adverse publicity. We seek to lower our manufacturing costs, while maintaining appropriate performance characteristics, and to improve the per square foot costs of our silica aerogel blankets by optimizing our formulations to reduce material costs. If our products do not function as represented as a result of such changes in formulations, we may face warranty claims on our products. In addition, we may be named directly in product liability suits relating to our products, even for defects resulting from errors of our distributors, contractors, OEMs, partners, or end-user customers. These claims could be brought by various parties, including distributors, contractors, OEMs, partners, and other direct end-user customers who are purchasing products directly from us, or end-user customers who purchase our products from our distributors. We could also be named as co-parties in product liability suits that are brought against the distributors, contractors, OEMs, partners, and end-user customers. Our products are often installed in our end-user customers' complex and capital-intensive facilities in inherently hazardous or dangerous environments, including in the energy, petrochemical, and power generation industries, where the potential liability from risk of loss could be substantial. The failure of our products to perform to customer expectations, whether or not because of improper installation, could give rise to warranty claims against us. We take steps to educate our distributors, contractors, OEMs, partners, and end-user customers about the proper installation procedures to mitigate the risk of an uncontrolled burn-in for very high temperature applications of Pyrogel XT and XTE. However, installation of our products is handled by third parties over whom we have no control and errors or defects in their installation may also give rise to claims against us, diminish our brand, or divert our resources from other purposes. Any of these claims, even if without merit, could result in costly litigation or divert management's attention and resources. In addition, many of our products are integrated into the final products of our customers. The integration of our products may entail the risk of product liability or warranty claims based on malfunctions or hazards from both our products and the final products of our customers.

A material product liability claim may seriously harm our results of operations, as well as damage our customer relationships and reputation. Although we carry general liability insurance, our current insurance coverage could be insufficient to protect us from all liability that may be imposed under these types of claims. In addition, our distributors, contractors, OEMs, partners, and end-user customers may not have adequate insurance to cover against potential claims. If claims or losses exceed our liability insurance coverage, we may go out of business. In addition, insurance coverage is expensive, may be difficult to obtain and may not be available in the future on acceptable terms or at all. A significant increase in the cost of insurance coverage could adversely affect our business, financial condition and results of operations.

Furthermore, if any of our products are or are alleged to be defective, particularly the products that we sell to our OEM customers, we may be required to participate in a recall involving such products. Each automotive manufacturer has its own practices regarding product recalls and other product liability actions relating to its suppliers. However, as suppliers become more integrally involved in the vehicle design process and assume more of the vehicle assembly functions, OEMs continue to look to their suppliers for contribution when faced with recalls and product liability claims. OEMs also require their suppliers to guarantee or warrant their products and bear the costs of repair and replacement of such products under new vehicle warranties. Depending on the terms under which we supply products to an automotive OEM, an automotive OEM may attempt to hold us responsible for some or all of the repair or replacement costs of products under new vehicle warranties when the OEM asserts that the product supplied did not perform as warranted.

In addition, as we adopt new technology, we face an inherent risk of exposure to the claims of others that we have allegedly violated their intellectual property rights. We cannot ensure that we will not experience any material warranty, product liability or intellectual property claim losses in the future or that we will not incur significant costs to defend such claims.

We may incur significant costs complying with environmental, health and safety laws, and related claims, and failure to comply with these laws and regulations could expose us to significant liabilities, which could materially adversely affect our results of operations.

Costs of compliance with regional, national, state, and local existing and future environmental, health and safety laws, and regulations could adversely affect our cash flow and results of operations. We are required to comply with numerous environmental laws and regulations and to obtain numerous governmental permits in order to operate our facilities and in connection with the design, development, manufacture, and transport of our products and the storage, use, handling, and disposal of hazardous substances, including environmental, health and safety laws, regulations and permits governing air emissions or water usage and disposal. We may incur significant additional costs to comply with these requirements, which are becoming stringent in a progressive manner. If we fail to comply with these current and new requirements, we could be subject to civil or criminal liability, damages and fines, require substantial capital investment to remedy non-compliance, and our operations could be curtailed, suspended, or shutdown. In addition, certain foreign laws and regulations may affect our ability to export products outside of the United States. Existing environmental, health and safety laws, and regulations could be revised or reinterpreted and new laws and regulations could be adopted or become applicable to us or our products, and future changes in environmental, health and safety laws, and regulations could occur. These factors may materially increase the amount we must invest to bring our processes into compliance and impose additional expense on our operations.

Among the changes to environmental laws and regulations that could occur is the adoption of regulatory frameworks to reduce greenhouse gas emissions, which a number of countries, particularly in the European Union, have adopted, or are considering adopting, including the 2015 Paris Agreement on Climate Change. These include adoption of cap and trade regimes, carbon taxes, restrictive permitting, increased efficiency standards, and incentives or mandates for renewable energy, any of which could increase the costs of manufacturing our products and increase our compliance costs, and/or reduce demand for our products from our customers in the energy industry, all of which could materially adversely affect our business and results of operations.

In addition, private lawsuits, including claims for remediation of contamination, personal injury or property damage, or actions by regional, national, state and local regulatory agencies, including enforcement or cost-recovery actions, may materially increase our costs. Certain environmental laws make us potentially liable on a joint and several basis for the remediation of contamination at or emanating from properties or facilities that we currently or formerly owned or operated or properties to which we arranged for the disposal of hazardous substances. Such liability may require us to pay more than our fair share and could require us to address contamination caused by others. For example, the site of our East Providence facility contains certain levels of contamination caused by prior third-party activities on and near the site. Such contamination remains in place under a state-approved deed restriction, and we are required to comply with such deed restriction and the accompanying soil management plan. In general, the deed restriction prohibits the residential use of the property and the use of groundwater as potable water, and requires the maintenance of engineering controls and annual inspections to help prevent exposure to contaminated soils. The soil management plan requires us to notify the state environmental agency with respect to any soil excavation, stockpiling, sampling, and off-site disposal of excavated soil. Although we have not had to make material expenditures to satisfy these requirements to date, in the future, we may incur additional

costs to comply with these requirements and failure to do so could disrupt the operation of our facility or could subject us to liability for environmental remediation. We may incur liability relating to the remediation of contamination, including contamination we did not cause. Furthermore, ethanol, one of the materials that we handle in large quantities in our manufacturing process is subject to additional laws and regulations including those administered by the U.S. Alcohol and Tobacco Tax and Trade Bureau. While we seek to comply with the stringent requirements of these laws and regulations, these laws and regulations are complex and are subject to interpretation. Any changes in these laws or regulations or any interpretation thereof, or changes in our manufacturing processes may require us to request changes to our existing permits or obtain new permits. Any requests to change our existing permits or obtain new permits may be delayed or denied and may require us to modify our manufacturing processes, which could be costly and time consuming and could adversely affect our business and results of operations.

We may not be able to obtain or maintain, from time to time, all required environmental regulatory approvals. A delay in obtaining any required environmental regulatory approvals or failure to obtain and comply with them could materially adversely affect our business and results of operations.

Breakdowns, security breaches, loss of data, and other disruptions of our information technology systems could compromise sensitive information related to our business, prevent us from accessing critical information, and expose us to liability, which would cause our business and reputation to suffer.

In the ordinary course of our business, we collect and store sensitive data, including intellectual property, our proprietary business information and that of our suppliers, customers and business partners, and personally identifiable information about our employees and business contacts. We manage and maintain our applications and data utilizing on-site and off-site systems. These applications and data encompass a wide variety of business-critical information including research and development information, commercial information, and business and financial information. We face four primary risks relative to protecting this critical information: loss of access; inappropriate or unauthorized disclosure; inappropriate or unauthorized modification; and inadequate monitoring of our controls over the first three risks.

The secure processing, storage, maintenance, and transmission of this critical information is vital to our operations and business strategy, and we devote resources to protecting such information. Although we take measures to protect sensitive information from unauthorized access or disclosure, our information technology and infrastructure may be vulnerable to breakdowns, attacks by hackers, viruses, breaches or interruptions due to employee error, malfeasance or other disruptions, faulty password management or lapses in compliance with privacy and security mandates. Any such virus, breakdown, attack, breach, or interruption could compromise our networks and the information stored there could be accessed by unauthorized parties, publicly disclosed, lost, or stolen. Third parties may attempt to fraudulently induce employees or other persons into disclosing usernames, passwords or other sensitive information, which may in turn be used to access our information systems, commit identity theft or carry out other unauthorized or illegal activities. Any such breach could compromise our networks and the information stored there could be accessed, publicly disclosed, lost or stolen. We engage third-party vendors and service providers to store and otherwise process some of our data, including sensitive and personal information. Our vendors and service providers may also be the targets of the risks described above, including cyberattacks, ransomware, malicious software, phishing schemes, and fraud. From time to time, we get notifications that such vendors experienced cyber security breaches. For example, in 2021, we were notified by a third-party vendor that it had experienced a ransomware attack and some of our technical information may have been inappropriately disclosed. While we have no reason to believe that significant or sensitive information was compromised in such breach, if that were to occur, our ability to operate in a competitive manner would be significantly affected in an adverse manner. Our ability to monitor our vendors and service providers' data security is limited, and, in any event, third parties may be able to circumvent those security measures, resulting in the unauthorized access to, misuse, disclosure, loss or destruction of our data, including sensitive and personal information, and disruption of our or third-party service providers' systems. We and our third-party service providers may face difficulties in identifying, or promptly responding to, potential security breaches and other instances of unauthorized access to, or disclosure or other loss of, information. Any hacking or other attack on our or our third-party service providers' or vendors' systems, and any unauthorized access to, or disclosure or other loss of, information suffered by us or our third-party service providers or vendors, or the perception that any of these have occurred, could result in legal claims or proceedings, loss of intellectual property, liability under laws that protect the privacy of personal information, negative publicity, disruption of our operations and damage to our reputation, which could divert our management's attention from the operation of our business and materially and adversely affect our business, revenues and competitive position. Moreover, we may need to increase our efforts to train our personnel to detect and defend against cyber- or phishing-attacks, which are becoming more sophisticated and frequent, and we may need to implement additional protective measures to reduce the risk of potential security breaches, which could cause us to incur significant expenses. Recently, Russian ransomware gangs have threatened to increase hacking activity against critical infrastructure of any nation or organization that retaliates against Moscow for its invasion of Ukraine. Any such increase in such attacks on our third-party provider or other systems could adversely affect our network systems or other operations. We have measures in place that are designed to detect and respond to such security incidents and breaches of privacy and security mandates, but there can be no assurance that our efforts will prevent or detect such breakdowns or breaches in our systems, if at all.

Any such security breach or interruption, as well as any action by us or our employees or contractors that might be inconsistent with the rapidly evolving data privacy and security laws and regulations applicable within the United States and elsewhere where we conduct business, could result in enforcement actions by U.S. states, the U.S. federal government or foreign governments, liability or sanctions under data privacy laws that protect personally identifiable information, regulatory penalties, other legal proceedings such as but not limited to private litigation, the incurrence of significant remediation costs, disruptions to our development programs, business operations and collaborations, diversion of management efforts and damage to our reputation, which could harm our business and operations. Because of the rapidly moving nature of technology and the increasing sophistication of cybersecurity threats, our measures to prevent, respond to and minimize such risks may be unsuccessful.

In addition, our insurance may be insufficient to cover our losses resulting from cyber-attacks (including ransomware), breaches, or other interruptions, and any incidents may result in loss of, or increased costs of, such insurance. The successful assertion of one or more large claims against us that exceed available insurance coverage, the occurrence of changes in our insurance policies, including premium increases or the imposition of large deductible or co-insurance requirements, or denials of coverage, could have a material adverse effect on our business, including our financial condition, results of operations and reputation.

Our contracts with U.S. government agencies may subject us to audits, criminal penalties, sanctions, and other expenses and fines.

We perform contract research services for U.S. government agencies and our products are sold to customers that may incorporate them into government projects. U.S. government agencies, including the Defense Contract Audit Agency and the Department of Labor, routinely audit government contractors. These agencies review a contractor's compliance with contract terms and conditions, performance under its contracts, cost structure and compliance with applicable laws, regulations and standards. The U.S. government also may review the adequacy of a contractor's systems and policies, including a contractor's purchasing, property, estimating, billing, accounting, compensation and management information systems. Any costs found to be overcharged or improperly allocated to a specific contract or any amounts improperly billed or charged for products or services will be subject to reimbursement to the government. As a government contractor, we are required to disclose to the U.S. government credible evidence of certain violations of law and contract overpayments. If we are found to have participated in improper or illegal activities, we may be subject to civil and criminal penalties and administrative sanctions, including termination of contracts, forfeiture of profits, suspension of payments, fines and suspension or prohibition from doing business with the U.S. government. Any negative publicity related to such contracts, regardless of the accuracy of such publicity, may adversely affect our business or reputation.

Our ability to use our net operating loss carryforwards may be subject to limitation, which could result in a higher effective tax rate and adversely affect our financial condition and results of operations.

During 2014, we performed analyses pursuant to Section 382 of the Internal Revenue Code of 1986, as amended, or the Internal Revenue Code, as well as similar state provisions, in order to determine whether any limitations might exist on the utilization of net operating losses and other tax attributes. Generally, a change of more than 50% in the ownership of a company's stock, by value, over a three-year period constitutes an ownership change for U.S. federal income tax purposes. An ownership change may limit a company's ability to use its net operating loss carryforwards attributable to the period prior to such change. Based on these analyses, we determined that it is more likely than not that an ownership change occurred on June 18, 2014 upon the closing of our IPO, resulting in an annual limitation on the use of our net operating losses and other tax attributes as of such date. As a result, our prior net operating losses were limited to \$155.2 million, including built-in gains of \$42.0 million at the date of that ownership change. The use of our net operating loss carryforwards may be restricted further in the event of any changes in our ownership, including with respect to the 2022 Offering and conversion of the convertible notes issued in 2022.

Trends in adoption of cathode chemistries may adversely affect the adoption of silicon-rich carbon aerogels that we are developing for use in anodes.

Success in adoption of our silicon rich anode materials that we are developing for use in anodes depends on the need for matching cathode chemistries requiring high anode performance. Cathodes typically comprise oxides of metals such as nickel, manganese, aluminum and cobalt. One current trend is towards developing a higher nickel and lower (or no) cobalt-based cathode. Such cathodes require a matching higher performance anode like those manufactured with our silicon-rich carbon aerogel materials. Another trend is to use lower capacity, but safer cathode chemistries such as lithium iron phosphate (LFP). Certain battery manufacturers and automotive OEMs have already brought vehicles to the market with LFP cathodes. While vehicles with LFP cathodes may have lower energy densities leading to lower driving ranges, they are safer and have lower costs. If mass-market adoption of lower performance chemistries such as LFP continues, the demand for higher performing anodes including those containing our silicon-rich carbon aerogel materials will be reduced or limited to higher end vehicles, thus limiting our market participation.

Risks Related to Our Intellectual Property

Our inability to protect our intellectual property rights could negatively affect our business and results of operations.

Our ability to compete effectively depends in part upon developing, maintaining and/or protecting intellectual property rights relevant to our aerogel product forms, applications, manufacturing technologies, and brand names. We rely principally on a combination of patent protection, trade secret laws, confidentiality and nondisclosure agreements, trademark registrations, common law rights, and licensing arrangements to establish and protect the intellectual property rights relevant to our business. However, these measures may not be adequate in every given case to permit us to gain or keep any competitive advantage, particularly in those countries where the laws do not protect our proprietary rights as fully as or where the enforcement tools are weaker or less effective than those in the United States. In particular, since aerogels were developed approximately 80 years ago, there has been a wide range of research, development and publication related to aerogels, which makes it difficult to establish intellectual property rights to many key elements of aerogel technology and to obtain patent protection. Accordingly, much of the general technology that we use in our manufacture of aerogel blankets is not protected by patents.

Where we consider it appropriate, our strategy is to seek patent protection in the United States and other countries on technologies used in or relating to our aerogel product forms, applications and manufacturing technologies. As of December 31, 2021, we had 63 issued U.S. patents and 130 issued foreign patents, including eight U.S. patents and 28 foreign patents that we co-own with third parties. The issuance of a patent is not conclusive as to its scope, validity or enforceability. Thus, any patent held by us or to be issued to us from a pending patent application, could be challenged, invalidated or held unenforceable in litigation or proceedings before the USPTO and/or other patent tribunals in the United States or in foreign jurisdictions. Third parties could develop technologies that circumvent the patent protection we have secured. No consistent policy regarding the breadth of patent claims has emerged to date in the United States and the landscape could become more uncertain in view of future rule changes by the USPTO, the introduction of patent reform legislation and decisions in patent law cases by the federal courts including the United States Supreme Court.

The patent landscape outside of the United States is even less predictable. As a result, the validity and enforceability of patents cannot be predicted with certainty. For example, we are aware of competitors that manufacture and market aerogel insulation products in China, where it may be difficult for us to enforce our intellectual property rights against these or other competitors.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In the ITC complaint, we alleged that these two China-based companies have engaged and are engaging in unfair trade practices by importing aerogel products in the United States that infringe, and/or are manufactured by processes that infringe, several of our patents in violation of Section 337 of the Tariff Act of 1930. In the ITC complaint, we sought exclusion orders from the ITC that direct the United States Customs and Border Protection to stop the importation of these infringing products. In February 2018, the ITC issued its final determination confirming the ALJ's previous initial determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison unsuccessfully appealed the ITC determination with respect to a product patent to the CAFC, which affirmed the validity of Aspen's patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect. Additionally, the USPTO denied Alison's requests to invalidate the claims of four of Aspen's patents in Inter-Partes Review. Alison also filed multiple similar requests with the SIPO, seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those request, not withdrawn previously by Alison, the PRB, issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. After the oral hearing at the Beijing IP court, we are awaiting the decision by the court. Nano has also filed a request seeking invalidation of a product patent at PRB of SIPO on which oral hearing took place in July 2019. After the oral hearing, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose prior validity opinion by PRB is currently on appeal at the Beijing IP Court. After conducting an oral hearing, PRB issued a decision on January 23, 2020 denying Alison's latest invalidation request of this patent.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case.

- In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a

settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active.

- On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.
- The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding.
- The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.
- Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it. Upon our appeal of the opposition division's decision and after conducting an oral hearing on January 21, 2021, the Board of Appeals of EPO set aside the opposition division's December 2018 decision based on amended set of claims and remitted the case back to the opposition division for further prosecution.
- On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent, which action Nano subsequently failed to pursue.
- On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled "Continuous Sheet of Gel Materials and Continuous Sheet of Aerogel" (983 Patent). On December 22, 2021, based on the oral hearing conducted on November 12, 2021, opposition division of EPO found the amended claims of 983 Patent to be valid. This decision is further subject to an appeal to the Board of Appeals within two months of the notification of the opposition division's decision.
- On January 28, 2021, a search order was executed and relevant evidence secured at the principal places of business of AMA S.p.A. and AMA Composites S.r.l. (collectively, AMA) in San Martino in Rio and Campogalliano, respectively, based on an ex-parte search order issued by the Court of Genoa, Italy at our request in connection with alleged infringement of the Italian part of our patents previously asserted successfully against Nano and Alison in Germany. The Court of Genoa subsequently held a hearing and confirmed the validity of the search order and its execution. While the search proceedings do not take a position on the infringement issues, we may use any evidence collected during the search proceedings to prove infringement. As a result, on May 3, 2021, we filed an infringement complaint, a writ of summons, as known in Italy, at the Court of Genoa alleging that AMA has infringed the Italian part of three European patents (same patents asserted in the German litigation) and a patent on composition of aerogel-based composites in connection with AMA's resale of aerogel products supplied by Chinese companies and sale of any products derived therefrom. We are seeking monetary damages and preliminary injunction of AMA's alleged infringing activities. We expect the Court of Genoa to assess our claims and AMA's defense through appointment of an expert after the submission of relevant writs and evidence. We issued a press release on May 6, 2021 describing the patent enforcement action of May 3, 2021 (Press Release). On June 7, 2021, AMA served us a copy of a request it previously filed with the Court of Genoa seeking an ex-parte preliminary injunction (PI) against us alleging the Press Release constituted anti-competitive conduct and that it infringed AMA's trademark rights. The service of the request followed the court's prior denial of the ex-parte order and an order requiring AMA to serve the request on us. The court subsequently conducted an oral hearing on June 15, 2021. On June 24, 2021, the court denied AMA's request for a PI, reasoning that our Press Release was factually accurate, was not misleading, distinguished facts

from opinions and that it was neither anti-competitive nor did it infringe trademark rights of AMA. The Court also ordered AMA to pay certain of our legal fees. On July 5, 2021, AMA informed us that it has decided not to appeal the denial of June 24, 2021. We subsequently learned that AMA had also made a criminal complaint against our chief executive officer for defamation in connection with the Press Release. On December 31, 2021, the local prosecutor after reviewing the underlying facts, rejected AMA's arguments and requested the judge overseeing the matter to dismiss the complaint against our chief executive officer. In response to our infringement complaint, AMA has also added as a counter-claim in connection with its claims regarding the Press Release, those same claims that it previously sought a preliminary injunction which was denied by the court. The patent infringement proceedings are ongoing.

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers and invalidating claims for aerogel sheets not incorporating fibers. On January 14, 2021, the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter-parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time a party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

In addition, we may fail to apply for patents on important technologies or innovative products in a timely fashion, if at all, and our existing and future patents may not be sufficiently broad to prevent others from practicing our technologies or from developing competing products or technologies, in particular given the long history of aerogel development. Furthermore, third parties could practice our intellectual property rights in territories where we do not have patent protection or where processes for remedies for infringement of intellectual property are unclear or still evolving. Such third parties may then try to import products made using our intellectual property rights into the United States or other countries. We may not be able to prevent such imports practically even if we obtain appropriate legal remedies. Our strategy is to seek registration of trademarks for our brands in many, but not all, of the jurisdictions in which we sell our products based on various factors, including our sales volumes in the jurisdiction, our ability to enforce local laws, and cost. Our strategy may not be adequate to protect our brands in all circumstances, especially in foreign jurisdictions. In certain jurisdictions, third parties may seek to register trademarks on the names of our products and brands before we do, thus requiring us to change branding strategies or otherwise deal with the issue.

As of December 31, 2021, we had 45 pending U.S. patent applications and 136 pending foreign patent applications, including one pending U.S. patent application and five foreign pending patent applications that we co-own with other third parties. Our pending patent applications are directed to various enabling technologies for the product forms, applications and manufacturing technologies that support our current business, as well as aspects of products under development or contemplated for the future. The issuance of patents from these applications involves complex legal and factual questions and, thus, we cannot provide assurance that any of our pending patent applications will result in the issuance of patents to us. The USPTO, relevant foreign patent offices and other relevant patent tribunals may deny or require significant narrowing of claims in our pending patent applications. Patents issued as a result of any of our pending patent applications may not cover our enabling technology and/or the products or processes that support our current or future business or afford us with significant commercial protection against others with similar technology. Proceedings before the USPTO could result in adverse decisions as to the priority of our inventions and the narrowing or invalidation of claims in issued patents. In addition, our pending patent applications filed in foreign countries are subject to laws, rules and procedures that differ from those of the United States, and thus foreign patent applications may not be granted even if counterpart United States patents are issued.

We have initiated intellectual property litigation that is and will continue to be costly, and could limit or invalidate our intellectual property rights, divert time and efforts away from business operations, require us to pay damages and/or costs and expenses and/or otherwise have a material adverse impact on our business, and we could become subject to additional such intellectual property litigation in the future.

The success of our business is highly dependent on protecting our intellectual property rights. Unauthorized parties may attempt to copy or otherwise obtain and use our products and/or enabling technology. Policing the unauthorized use of our intellectual property rights is difficult and expensive, as is enforcing these rights against unauthorized use by others. Identifying unauthorized use of our intellectual property rights is difficult because we may be unable to monitor the technologies and/or materials being employed by other parties. The steps we have taken or will take may not prevent unauthorized use of our intellectual property rights, particularly in foreign countries where enforcement of intellectual property rights may be more difficult than in the United States.

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case. In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active. On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.

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Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019, upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021 the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

Our continued commercial success will also depend in part upon not infringing the patents or violating other intellectual property rights of third parties. We are aware of patents and patent applications generally relating to aspects of our technologies filed by, and issued to, third parties. Our knowledge of the patent landscape with respect to the technologies currently embodied within our aerogel products and the technologies that we practice in manufacturing those products indicates that the third-party patent rights most relevant to our business are those owned by Cabot and licensed to us under the cross license agreement with Cabot. Nevertheless, we cannot determine with certainty whether patents or patent applications of other parties may materially affect our ability to conduct our business. There may be existing patents of which we are unaware that we may inadvertently infringe, resulting in claims against us or our customers. In recent years, Chinese, Japanese and South Korean entities have filed a significant number of patent applications related to aerogel products in both their home countries and in foreign countries. These patents in application areas of aerogels may make it more difficult for OEMs and end-user customers in these countries to use our products in new and different applications, which in turn may limit our ability to penetrate new markets.

In the event that the manufacture, use and/or sale of our products or technologies is challenged, or if our product forms or technologies conflict with patent rights of others, or our operations conflict with trademark or similar rights of others, third parties could bring legal actions against us in the United States, Europe or other countries, claiming damages and seeking to enjoin the manufacturing and/or marketing of our products. In addition, it is not possible to predict with certainty what patent claims may arise from pending patent applications of third parties. In the United States, for example, patent prosecution can proceed in secret prior to issuance of a patent, provided such application is not filed in a foreign jurisdiction. For U.S. patent applications that are also filed in foreign jurisdictions, such patent applications will not be published until 18 months from the filing date of the application. As a result, third parties may be able to obtain patents with claims relating to our product forms, applications and/or manufacturing processes which they could attempt to assert against us or our end-users.

In the case of any of the above, litigation may be necessary to enforce, protect or defend our intellectual property rights or to determine the validity and scope of the intellectual property rights of others. Any such litigation, including our ongoing patent enforcement actions described above, could be unsuccessful, cause us to incur substantial costs, divert resources and the efforts of our personnel away from daily operations, harm our reputation, and/or result in the impairment of our intellectual property rights. In some cases, litigation may be threatened or brought by a patent holding company (otherwise known as non-practicing entities or patent “trolls”) or other adverse patent owner who has no relevant product revenues and against which our patents may provide little or no deterrence. If we are found to infringe any patents, regardless of whether litigation is brought against us by third parties or, as in the case of our ongoing patent enforcement actions described above, brought by us against third parties, we could be required to:

- pay substantial monetary damages, including lost profits, reasonable royalties and/or treble damages if an infringement is found to be willful;
- totally discontinue or substantially modify any products or processes that are found to be in violation of another party’s intellectual property rights; and/or
- seek a license to continue making and selling our products and/or using our manufacturing processes, which we may not be able to obtain on reasonable terms, if at all, which could significantly increase our operating expenses and/or decrease our revenue.

In the actions brought by us against third parties, including our ongoing patent enforcement actions described above, we may be required to pay costs and expenses of opposing parties, including attorney fees, if we lose.

If our competitors are able to use our technology without payment to us, our ability to compete effectively could be materially harmed. Our contracts generally indemnify our customers for third-party claims of intellectual property infringement related to the manufacture and use of our products, and typically up to the amount of the purchase price paid for the product, which could cause us to become involved, and subject to liability, in litigation between our customers and third parties. The expense of defending these claims may adversely affect our results of operations.

Patents covering technologies that are similar or superior to our technologies may be developed or obtained by third parties. We may need to seek licenses to these technologies, which could limit our ability to manufacture our products and have a material adverse effect on our business and results of operations.

Competitors or other third parties may independently develop and obtain patents covering technologies that are similar or superior to the product forms, applications or manufacturing technologies that we employ. In such event, we may need to obtain licenses for these technologies. However, we may not be able to obtain licenses on reasonable terms, if at all, which could limit our ability to manufacture our current and/or future products and operate our business.

Our contracts with the U.S. government and other third parties could negatively affect our intellectual property rights.

To further our product development efforts, our scientists and engineers work closely with customers, the U.S. government, and other third parties to research and develop advancements in aerogel product forms, applications, and manufacturing technologies. We have entered into agreements with private third parties and have been awarded numerous research contracts with the U.S. government to independently or jointly research, design, and develop new devices and systems that incorporate aerogel material. In some instances, the research and development activities that we conduct under contract with the U.S. government and/or with private third parties may produce intellectual property to which we may not have ownership or exclusive rights and will be unable to protect or monetize.

Moreover, when we develop new technologies using U.S. government funding, the government may obtain certain rights in any resulting patents, technical data, and/or other confidential and proprietary information, generally including, at a minimum, a non-exclusive license authorizing the U.S. government to use the invention, technical data, or software for non-commercial purposes. Federal government funding may limit when and how we can deploy our technology developed under those contracts. In addition, inventions must be reported promptly to the funding agencies, the federal funding must be disclosed in any resulting patent applications, and our rights in such inventions will normally be subject to government license rights, periodic post-contract utilization reporting, foreign manufacturing restrictions, and “march-in” rights. March-in rights refer to the right of the U.S. government to require us to grant a license to the technology to a responsible applicant or, if we refuse, the government may grant the license itself. The U.S. government may exercise its march-in rights if it determines that action is necessary because we fail to achieve practical application of any technology developed under contract with the government or because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations, or to give preference to United States industry. The U.S. government may also have the right to disclose our confidential and proprietary information to third parties. In addition, failure to comply with all the government contract requirements may result in us losing the patent rights.

Our U.S. government-sponsored research contracts are also subject to audit and require that we provide regular written technical updates on a monthly, quarterly, or annual basis, and, at the conclusion of the research contract, a final report on the results of our technical research. Because these reports are generally available to the public, third parties may obtain some aspects of our confidential and proprietary information relating to our product forms, applications, and/or manufacturing processes. If we fail to provide these reports or to provide accurate and complete reports, the U.S. government could obtain rights to any intellectual property arising from the related research.

Furthermore, there could be disputes between us and a private third party as to the ownership rights to any inventions that we develop in collaboration with such third party. Any such dispute may cause us to incur substantial costs including potential license obligations, and could place a significant strain on our financial resources, divert the attention of management from our core business, and harm our reputation.

We rely on trade secrets to protect our technology, and our failure to obtain or maintain trade secret protection could materially adversely affect our competitive business position.

We rely in part on trade secret protection to protect confidential and proprietary information relating to our technology, particularly where we do not believe patent protection is appropriate or obtainable. We continue to develop and refine the manufacturing technologies used to produce our aerogel products and believe that we have already developed, and will continue to develop, significant know-how related to these technologies. However, trade secrets can be difficult to protect. We may not be able to maintain the secrecy of this information and competitors may develop or acquire equally or more valuable information related to the manufacture of comparable aerogel products. Our strategy for scale-up of commercial production will continue to require us to share confidential and proprietary information with the U.S. government and other third parties. While we take reasonable efforts to protect our trade secrets, our employees, consultants, contractors or scientific and other advisors, or those of our business partners, may intentionally or inadvertently disclose our confidential and proprietary information to competitors. Any enforcement of claims by us that a third party has obtained and is using our trade secrets is expensive, time consuming and uncertain. In addition, foreign courts are sometimes less willing than United States courts to protect trade secrets.

We require all employees and consultants to execute confidentiality and/or nondisclosure agreements upon the commencement of an employment or consulting arrangement with us, which agreements generally require that all confidential and proprietary information developed by the individual or made known to the individual by us during the course of the individual's relationship with us be kept confidential and not disclosed to third parties. These agreements further generally provide that inventions conceived by the individual in the course of rendering services to us will be our exclusive property. Nevertheless, these agreements may not be honored and our confidential and proprietary information may be disclosed, or these agreements may be unenforceable or difficult to enforce. We also require customers and vendors to execute confidentiality and/or nondisclosure agreements. However, we have not obtained such agreements from all of our customers and vendors. Moreover, some of our customers may be subject to laws and regulations that require them to disclose information that we would otherwise seek to keep confidential. Our confidential and proprietary information may be otherwise disclosed without our authorization or knowledge. Moreover, third parties could reverse engineer our manufacturing processes, independently develop substantially equivalent confidential and proprietary information or otherwise gain access to our trade secrets. Additionally, cyber security threats, especially originating from countries such as China, Russia, Iran, and North Korea as broadly reported in the media, pose a significant risk to maintaining control of our trade secrets. Failure to maintain trade secret protection could enable others to produce competing products and adversely affect our competitive business position.

Loss of the intellectual property rights that we license from Cabot Corporation would have a material adverse impact on our business.

We have licensed certain intellectual property rights from Cabot under a cross license agreement. These intellectual property rights have been critical to the manufacture of our existing products and may also be important to our research, development and manufacture of new products. Any loss of the intellectual property rights granted to us thereunder, including as a result of ineffective protection of such rights by Cabot, abandonment or expiration of the involved patents or a breach of or dispute under the agreement by either party would have a material adverse impact on our financial condition, results of operations and growth prospects, and might prevent us from continuing our business.

Risks Related to Our Data Privacy and Other Personal Information

We may be subject to, or may in the future become subject to, U.S. federal and state, and foreign laws and regulations imposing obligations on how we collect, use, disclose, store, and process personal information. Our actual or perceived failure to comply with such obligations could result in liability or reputational harm and could harm our business. Ensuring compliance with such laws could also impair our efforts to maintain and expand our customer base, and thereby decrease our revenue.

We are subject to data protection laws and regulations that address privacy and data security. The legislative and regulatory landscape for data protection continues to evolve, and in recent years there has been an increasing focus on privacy and data security issues. In the United States, numerous federal and state laws and regulations, including state data breach notification laws, state health information privacy laws and federal and state consumer protection laws govern the collection, use, disclosure and protection of health-related and other personal information. Failure to comply with data protection laws and regulations could result in government enforcement actions, which could include civil or criminal penalties, private litigation and/or adverse publicity and could negatively affect our operating results and business. For example, in January of 2020, the California Consumer Privacy Act, or CCPA, went into effect, which marked the first U.S. state to adopt comprehensive privacy legislation. The CCPA establishes a new privacy framework for covered businesses by creating an expanded definition of personal information, establishing new data privacy rights for California residents, and creating a new and potentially severe statutory damages framework for violations of the CCPA and for businesses that fail to implement reasonable security procedures and practices to prevent data breaches. Additionally, a new privacy law, the California Privacy Rights Act, or CPRA, was approved by California voters in November of 2020, and certain provisions are effective as of January 1, 2022, with full effectiveness as of 2023. The CPRA significantly modifies the CCPA, potentially resulting in further uncertainty, additional costs and expenses in an effort to comply and additional potential for harm and liability for failure to comply. Among other things, the CPRA established a new regulatory authority, the California Privacy Protection Agency, which is tasked with enacting new regulations under the CPRA and will have expensed enforcement authority. In addition, in 2021 both Virginia and Colorado enacted new data privacy laws which will take effect in 2023 that have similarities to the CCPA and CPRA, but also have significant differences, creating compliance challenges across different jurisdictions. Other states, including Massachusetts, are considering expansive data privacy laws.

Numerous other countries have, or are developing, laws governing the collection, use and transmission of personal information as well. EU member states and other jurisdictions have adopted data protection laws and regulations, which impose significant compliance obligations.

On May 25, 2018, the GDPR went into effect, implementing a broad data protection framework that expanded the scope of EU data protection law, including to non-EU entities that process, or control the processing of, personal data relating to individuals located in the EU, including clinical trial data. The GDPR sets out a number of requirements that must be complied with when handling the personal data of EU based data subjects, including: providing expanded disclosures about how their personal data will be used; higher standards for organizations to demonstrate that they have obtained valid consent or have another legal basis in place to justify their data processing activities; the obligation to appoint data protection officers in certain circumstances; new rights for individuals to be "forgotten" and

rights to data portability, as well as enhanced current rights (e.g. access requests); the principal of accountability and demonstrating compliance through policies, procedures, training and audit; and a new mandatory data breach regime. In particular, medical or health data, genetic data and biometric data where the latter is used to uniquely identify an individual are all classified as “special category” data under the GDPR and afford greater protection and require additional compliance obligations. Further, EU member states have a broad right to impose additional conditions—including restrictions—on these data categories. This is because the GDPR allows EU member states to derogate from the requirements of the GDPR mainly in regard to specific processing situations (including special category data and processing for scientific or statistical purposes). For example, we are subject to the GDPR and the German federal data privacy law, the Bundesdatenschutzgesetz, and we are subject to the regulatory authority of the Baden-Württemberg data protection authority. As the EU states continue to reframe their national legislation to harmonize with the GDPR, we will need to monitor compliance with all relevant EU member states’ laws and regulations, including where permitted derogation from the GDPR are introduced.

We are also subject to evolving EU laws on data export, because we transfer data outside the EU to ourselves or third parties. The GDPR only permits exports of data outside the EU where there is a suitable data transfer solution in place to safeguard personal data (e.g. the EU Commission approved Standard Contractual Clauses). On July 16, 2020, the Court of Justice of the EU (CJEU) issued a landmark opinion in the case of Maximilian Schrems vs. Facebook (Case C-311/18) (Schrems II). This decision calls into question certain data transfer mechanisms as between the EU member states and the US. The CJEU is the highest court in Europe and the Schrems II decision heightens the burden on data importers to assess the impact of U.S. national security laws on their business. Future actions which may be initiated by EU data protection authorities are difficult to predict at the this time. Consequently, there is some risk of any data transfers from the EU being halted. If we have to rely on third parties to carry out services for us, including processing personal data on our behalf, we are required under GDPR to enter into contractual arrangements to help ensure that these third parties only process such data according to our instructions and have sufficient security measures in place. Any security breach or non-compliance with our contractual terms or breach of applicable law by such third parties could result in enforcement actions, litigation, fines and penalties or adverse publicity and could cause customers to lose trust in us, which would have an adverse impact on our reputation and business. Any contractual arrangements requiring the processing of personal data from the EU to us in the United States will require greater scrutiny and assessments as required under Schrems II and may have an adverse impact on cross-border transfers of personal data, or increase costs of compliance. The GDPR provides an enforcement authority to impose large penalties for noncompliance, including the potential for fines of up to €20 million or 4% of the annual global revenues of the noncompliant company, whichever is greater.

Applicable data privacy and data protection laws may conflict with each other, and by complying with the laws or regulations of one jurisdiction, we may find that we are violating the laws or regulations of another jurisdiction. Despite our efforts, we may not have fully complied in the past and may not in the future. If we become liable under laws or regulations applicable to us, we may be required to pay significant fines and penalties, our reputation may be harmed, and we may be forced to change the way we operate. That could require us to incur significant expenses, which could significantly affect our business.

The legislative and regulatory landscape for privacy and data security continues to evolve, and there has been an increasing focus on privacy and data security issues which may affect our business. Failure to comply with current and future laws and regulations could result in government enforcement actions (including the imposition of significant penalties), criminal and civil liability for us and our officers and directors, private litigation and/or adverse publicity that negatively affects our business.

Risks Related to Our Common Stock

We have incurred and will continue to incur increased costs and demands upon management as a result of complying with the laws and regulations affecting public companies in the United States, which may adversely affect our results of operations.

As a public company, and particularly now that we are no longer an emerging growth company as of December 31, 2019, we have incurred and will continue to incur significant legal, accounting and other expenses that we did not incur as a private company. The Sarbanes-Oxley Act of 2002, the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of The New York Stock Exchange and other applicable securities rules and regulations impose various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming. We are subject to the reporting requirements of the Exchange Act that require us to file, among other things, quarterly reports on Form 10-Q and annual reports on Form 10-K. Under Section 302 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act, as a part of each of these reports, our chief executive officer and chief financial officer are required to evaluate and report their conclusions regarding the effectiveness of our disclosure controls and procedures and to certify that they have done so. Effective internal controls are necessary for us to provide reliable financial reports and prevent fraud. Under Section 404 of the Sarbanes-Oxley Act, we have included a report of management on our internal control over financial reporting in our Form 10-K for our fiscal year ended December 31, 2021. In addition, since we are no longer an emerging growth company as of December 31, 2019, the independent registered public accounting firm auditing our financial statements is required to attest to and report on the effectiveness of our internal control over financial reporting for the year ended December 31, 2019 and subsequent years. We will also be required to hold a say-on-pay vote and a say-on-frequency vote at our 2021 Annual Meeting of Stockholders. The process of documenting our internal controls and

complying with Section 404 is expensive and time consuming, and requires significant attention of management. As we are no longer an emerging growth company, we are subject to increased regulatory requirements necessitating additional resources and attention from management and will result in increased costs to us, which could include higher legal fees, accounting fees and fees associated with investor relations activities, among others.

Complying with these requirements applicable to public companies may place a strain on our personnel, information technology systems and resources while diverting management's attention from other business concerns. We have engaged outside service providers with appropriate public company compliance experience and technical accounting knowledge to support our compliance efforts. We may need to engage additional service providers to ensure compliance which may cause us to incur additional operating costs.

These and other requirements may also make it more difficult or more costly for us to obtain or maintain certain types of insurance, including directors' and officers' liability insurance. We may be forced to accept reduced policy limits and coverage or incur substantially higher costs to obtain the same or similar coverage.

The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers. Any one of these requirements could have a material adverse effect on our business, financial condition and results of operations.

Because we are a public company, we are obligated to develop and maintain proper and effective internal control over financial reporting. If our internal controls over financial reporting are determined to be ineffective, or if our auditors are otherwise unable to attest to their effectiveness, investor confidence in our company, and our common stock price, may be adversely affected.

Pursuant to Section 404a of the Sarbanes-Oxley Act, we have furnished a report by management on the effectiveness of our internal control over financial reporting for the fiscal year ended December 31, 2021 and will continue to do so in each year thereafter. This assessment is required to include disclosure of any material weaknesses identified by our management in our internal control over financial reporting. Our independent registered public accounting firm is required to formally attest to the effectiveness of our internal control over financial reporting for the year ended December 31, 2019 and subsequent years.

We continue to assess our system of internal controls over financial reporting and successfully completed documentation necessary to perform the annual evaluation required to comply with Section 404. In future periods, we may discover, and not be able to remediate timely, significant deficiencies or material weaknesses. During the evaluation and testing process in 2021, we did not identify any material weaknesses in our internal controls over financial reporting. In future periods, if we were to identify one or more material weaknesses in our internal control, we may be unable to assert that our internal controls are effective. If we are unable to assert that our internal controls over financial reporting are effective, we could lose investor confidence in the accuracy and completeness of our financial reports or it could cause us to fail to meet our reporting obligations, which could have a material adverse effect on the price of our common stock. In addition, any failure to comply with Section 404 could subject us to a variety of administrative sanctions, including SEC action, ineligibility for short form resale registration, the suspension or delisting of our common stock from The New York Stock Exchange, and the inability of registered broker-dealers to make a market in our common stock, which would further reduce our stock price and could harm our business.

The trading market in our common stock has been limited and substantially less liquid than the average trading market for a stock quoted on The New York Stock Exchange.

Since our initial listing on The New York Stock Exchange on June 13, 2014, the trading market in our common stock has been limited and substantially less liquid than the average trading market for companies listed on The New York Stock Exchange. The listing of our common stock on The New York Stock Exchange does not assure that a meaningful, consistent and liquid trading market currently exists or will exist in the future. We cannot predict whether a more active market for our common stock will develop in the future. An absence of an active trading market could adversely affect our stockholders' ability to sell our common stock at current market prices in short time periods, or possibly at all. An inactive market may also impair our ability to raise capital by selling our common stock and may impair our ability to acquire other companies, products or technologies by using our common stock as consideration. Additionally, analyst coverage of our common stock may be limited and such lack of coverage may have a depressive effect on the market price for our common stock. As of December 31, 2021, approximately 15.16% of our outstanding shares of common stock were held by our executive officers, directors, principal stockholders and their respective affiliates, which may adversely affect the liquidity of the trading market for our common stock, in as much as federal securities laws restrict sales of our shares by these stockholders. If our affiliates continue to hold their shares of common stock, there will be a more limited trading volume in our common stock, which may make it more difficult for investors to sell their shares or increase the volatility of our stock price.

We expect that the price of our common stock will fluctuate substantially, which could subject us to securities class action litigation and result in substantial losses to our stockholders.

The price of our common stock fluctuates in a broad range. For example, on January 2, 2019 the closing price of our shares of common stock was \$2.22 and on November 18, 2021, the closing price of our shares of common stock was \$63.66. Such fluctuations may be due to a number of factors, including the following, some of which are beyond our control:

- volume and timing of orders for our products;
- quarterly and yearly variations in our or our competitors' results of operations;
- our announcement or our competitors' announcements regarding new products, product enhancements, significant contracts, number of distributors, acquisitions or strategic investments;
- announcements of technological innovations relating to aerogels, thermal management and energy infrastructure insulation;
- results of operations or projections that vary from the expectations of securities analysts and investors;
- the periodic nature of our sales cycles, in particular for capital projects in the energy infrastructure market;
- our ability to develop, obtain regulatory clearance or approval for and market new and enhanced products on a timely basis;
- future sales of our common stock, including sales by our executive officers, directors and significant stockholders and their respective affiliates;
- announcements by third parties of significant claims or proceedings against us, including with regard to intellectual property and product liability;
- changes in accounting principles; and
- general U.S. and global economic conditions and other factors, including factors unrelated to our operating performance or the operating performance of our competitors.

Furthermore, the U.S. stock market has at times experienced extreme volatility that in some cases has been unrelated or disproportionate to the operating performance of particular companies. These broad market and industry fluctuations may adversely affect the market price of our common stock, regardless of our actual operating performance.

In the past, following periods of market volatility, stockholders have instituted securities class action litigation. If we become involved in securities litigation, it could have a substantial cost and divert resources and the attention of our senior management team from our business regardless of the outcome of such litigation.

Securities analysts may not continue coverage of our common stock or may issue negative reports, which may have a negative impact on the market price of our common stock.

The trading market for our common stock relies in part on the research and reports that industry or financial analysts publish about us or our business. Securities analysts may elect not to provide research coverage of our common stock. If securities analysts do not cover or continue to cover our common stock, the lack of research coverage may cause the market price of our common stock to decline. If one or more of the analysts who elects to cover us downgrades our stock, our stock price would likely decline substantially. If one or more of these analysts ceases coverage of us, we could lose visibility in the market, which in turn could cause our stock price to decline. In addition, rules mandated by the Sarbanes-Oxley Act and a global settlement reached in 2003 between the SEC, other regulatory agencies and a number of investment banks have led to a number of fundamental changes in how analysts are reviewed and compensated. In particular, many investment banking firms are required to contract with independent financial analysts for their stock research. It may be difficult for companies such as ours, with smaller market capitalizations, to attract independent financial analysts that will cover our common stock. This could have a negative effect on the market price of our stock.

Our directors, officers and principal stockholders have significant voting power and may take actions that may not be in the best interests of our other stockholders.

As of December 31, 2021, our executive officers, directors and principal stockholders and their affiliates collectively controlled approximately 15.16% of our outstanding shares of common stock. As a result, these stockholders, if they act together, may be able to control the management and affairs of our company and certain matters requiring stockholder approval, including the election of directors and approval of significant corporate transactions. This concentration of ownership may have the effect of delaying or preventing a change of control and might adversely affect the market price of our common stock. This concentration of ownership may not be in the best interests of our other stockholders.

Anti-takeover provisions in our restated certificate of incorporation and restated bylaws, and Delaware law, could delay or discourage a takeover.

Anti-takeover provisions in our restated certificate of incorporation and restated bylaws and Delaware law may have the effect of deterring or delaying attempts by our stockholders to remove or replace management, engage in proxy contests and effect changes in control. The provisions of our charter documents include:

- procedures for advance notification of stockholder nominations and proposals;
- the inability of our stockholders to call a special meeting of the stockholders and the inability of our stockholders to act by written consent;
- the ability of our board of directors to create new directorships and to fill any vacancies on the board of directors;
- the ability of our board of directors to amend our restated bylaws without stockholder approval; and
- the ability of our board of directors to issue up to 5,000,000 shares of preferred stock without stockholder approval upon the terms and conditions and with the rights, privileges and preferences as our board of directors may determine.

In addition, as a Delaware corporation, we are subject to Delaware law, including Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits a Delaware corporation from engaging in any business combination with any interested stockholder for a period of three years following the date that the stockholder became an interested stockholder unless certain specific requirements are met as set forth in Section 203. These provisions, alone or together, could have the effect of deterring or delaying changes in incumbent management, proxy contests or changes in control.

Our restated certificate of incorporation designates a state or federal court located within the State of Delaware as the exclusive forum for certain types of actions and proceedings that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or employees.

Our restated certificate of incorporation provides that, subject to limited exceptions, a state or federal court located within the State of Delaware will be the exclusive forum for (1) any derivative action or proceeding brought on our behalf, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, (3) any action asserting a claim against us arising pursuant to any provision of the Delaware General Corporation Law, our restated certificate of incorporation or our restated bylaws, or (4) any other action asserting a claim against us that is governed by the internal affairs doctrine. This exclusive forum provision does not apply to suits brought to enforce a duty or liability created by the Exchange Act. It could apply, however, to a suit that falls within one or more of the categories enumerated in the exclusive forum provision and asserts claims under the Securities Act, inasmuch as Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all suits brought to enforce any duty or liability created by the Securities Act or the rule and regulations thereunder. There is uncertainty as to whether a court would enforce such provision with respect to claims under the Securities Act, and our stockholders will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder. Any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock shall be deemed to have notice of and to have consented to the provisions of our restated certificate of incorporation described above. This choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and employees. Alternatively, if a court were to find these provisions of our restated certificate of incorporation inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs associated with resolving such matters in other jurisdictions, which could adversely affect our business and financial condition.

Our shareholders may experience future dilution as a result of future equity offerings.

In addition to the private placement of our common stock we completed on June 30, 2021 resulting in the issuance of 3,462,124 additional shares of our common stock, the at-the-market offering, the February 18, 2022 issuance of convertible notes with a principal amount of \$100.0 million that, along with any accrued principal-in-kind interest, are convertible into shares of our common stock, and our February 15, 2022 agreement to issue 1,791,986 shares of common stock in a private placement, we may offer additional shares of our common stock or other securities convertible into or exchangeable for our common stock in order to raise additional capital in the future, particularly as we look to finance our planned second manufacturing facility in Bulloch County, Georgia. We cannot assure our shareholders that we will be able to sell shares or other securities in any other offering at a price per share that is equal to or greater than the price per share our shareholders paid for our shares. Investors purchasing shares or other securities in the future could have rights, preferences or privileges senior to those of our shareholders and our shareholders may experience dilution. Our shareholders may incur additional dilution upon the exercise of any outstanding stock options or warrants, the issuance of shares of restricted stock, the vesting of restricted stock units, or the issuance, vesting or exercise of other equity awards.

We do not intend to pay cash dividends in the foreseeable future and, consequently, our shareholders' ability to achieve a return on their investment will depend on appreciation in the price of our common stock.

We have never declared or paid cash dividends on our common stock and we do not intend to pay any cash dividends on our common stock in the foreseeable future. We currently expect to retain all available funds and any future earnings for use in the operation and expansion of our business. In addition, the terms of our revolving credit facility restrict our ability to pay dividends and any future credit facilities, loan agreements, debt instruments or other agreements may further restrict our ability to pay dividends. Payments of future dividends, if any, will be at the discretion of our board of directors after taking into account various factors, including our business, results of operations and financial condition, current and anticipated cash needs, plans for expansion and any legal or contractual limitations on our ability to pay dividends. As a result, capital appreciation, if any, of our common stock will be our shareholders' sole source of potential gain for the foreseeable future.

CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS

This report includes forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act that relate to future events or our future financial performance and involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to differ materially from any future results, levels of activity, performance or achievements expressed or implied by these forward-looking statements. Words such as, but not limited to, "believe," "expect," "anticipate," "estimate," "intend," "seek," "may," "plan," "potential," "predict," "project," "targets," "likely," "will," "would," "could," "should," "continue," and similar expressions or phrases, or the negative of those expressions or phrases, are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. Although we believe that we have a reasonable basis for each forward-looking statement contained in this report, we caution you that these statements are based on our projections of the future that are subject to known and unknown risks and uncertainties and other factors that may cause our actual results, level of activity, performance or achievements expressed or implied by these forward-looking statements, to differ. The description of our Business set forth in Item 1, the Risk Factors set forth in this Item 1A and our Management's Discussion and Analysis of Financial Condition and Results of Operations set forth in Item 7 as well as other sections in this report, discuss some of the factors that could contribute to these differences. These forward-looking statements include, among other things, statements about:

- the expected future growth of the market for our aerogel products and our continued gain in market share, in particular in the electric vehicle market, the energy infrastructure insulation market, the lithium-ion battery thermal barrier markets, and other markets we target;
- our beliefs about the competitive strengths and value propositions of our technology and our products and our ability to gain additional market share and enter into new markets based on those strengths;
- our expectation that our investment in incremental manufacturing and operating expense will sustain long-term growth in our existing markets and develop new business opportunities;
- our plans to continue to develop and optimize aerogel products for high-value applications within the sustainable building materials market and our plan to realize revenue from this market;
- our plans and expectations to partner with industry leaders in the battery and electric vehicle market or such partnerships resulting in products and technologies or otherwise resulting in meaningful financial results;

- our expectations about the size and timing of awarded business in the EV market, future revenues and profit margins, arising from our supply relationship and contract with automotive OEMs and our ability to win more business and increase revenue in the EV market;
- our pursuit of high-value opportunities for our aerogel products within different segments of the EV market, the global insulation market, including the sustainable building materials market, and our plans to leverage our aerogel technology platform to develop innovative, aerogel enhanced products for applications in new markets;
- our plans to focus additional resources to continue to grow our share of the EV market and the energy infrastructure insulation market;
- the current or future trends in the energy, energy infrastructure, chemical and refinery, LNG, sustainable building materials, EV thermal barrier, EV battery materials or other markets and the impact of these trends on our business;
- our investments in the electric vehicle market and aerogel technology platform;
- our pursuit of and the expected greater adoption of our products in the LNG and power generation markets and our expectation that product revenue will be generated in large part by demand for insulation associated with scheduled plant shutdowns, or turnarounds, and other maintenance-related projects;
- our expectation that our products will be specified during the design phase in a growing number of new plant construction and capital expansion projects and our expectation that we will have an increasing percentage of our products sold for use in capital projects;
- our expectation that the growth in global energy demand and EV market will result in increased new-build and large capacity expansion projects, driving demand for our aerogel products;
- our plans to continue our strategy of working with innovative companies to target and penetrate additional market opportunities;
- our plans to develop strategic partnerships to facilitate market penetration beyond the energy infrastructure and sustainable building materials market, as well as the expected goals and priorities of such strategic partnerships;
- our belief that an adequate long-term supply of silica-precursors and other raw materials is available and that our plans to reduce reliance on precursors susceptible to significant price fluctuations will be successful;
- our belief that we can strategically increase our capacity to meet the demand or that we will be able to make such capacity increases in a timely manner;
- our expectation in our ability to implement lower cost product formulations and realize material purchasing efficiencies;
- our belief that our portfolio of patents, trade secrets and know-how present a significant barrier to potential new entrants in the production of aerogel blanket insulation;
- our expectation that we will be successful in enforcing and defending our patents against competitors and that such patents are valid and enforceable, as well as our expectations about the costs and consequences of our current or potential future patent litigation and the potential for additional patent litigation;
- our belief that our products possess strong competitive advantages over traditional insulation materials, including the superior thermal performance and the thin, easy-to-use and durable blanket form of our products;
- our belief that we can finance the construction and development of our planned second manufacturing facility in Bulloch County, Georgia with anticipated available credit, cash flows from operations, debt financings, technology licensing agreements, customer prepayments or equity financings;
- our expectations regarding the investment to open a second manufacturing facility in Georgia and the anticipated job creation as a result thereof;
- the anticipated aerogel capacity expansion as a result of the planned second manufacturing facility in Georgia and the expected commencement of production;
- our belief that our end-use customers will continue to invest in major energy infrastructure projects;
- our expectation that we will continue to sell our products in the sustainable building materials and other end markets;
- our expectations that our work with partners will accelerate the commercialization of these carbon aerogel anode materials in the electric vehicle market;

- our belief that the potential for significant technological innovation in traditional insulation materials is limited and that new high-performance materials will be required to meet evolving market requirements for energy efficient insulation systems;
- our belief that our aerogel products and manufacturing processes are proprietary and that we can protect our patents, trade secrets and know-how associated therewith;
- our belief that we can continue to improve the cost efficiency of our manufacturing process, that our current expansion plans offer attractive returns on incremental invested capital, and that we will focus our development efforts on new products and next generation technology with application in new, high value market segments;
- our belief that we will have opportunities to address additional high value applications in the estimated \$3.9 billion global insulation market, and that we are well-positioned to leverage a decade's worth of research and development to design and commercialize disruptive aerogel products for a wide array of new markets;
- our belief that our products have the lowest cost on a fully-installed basis or offer significant life-cycle cost savings in energy infrastructure and certain other applications as compared to traditional insulation materials;
- our plans to continue to expand our global sales force and distribution network to support anticipated growth in customers and demand for our products and our plans to seek to promote greater enterprise-wide utilization of our products by existing end-use customers;
- our expectations and projections about future revenues, revenue growth, costs, expenses, production volumes, manufacturing productivity, gross profit, profitability, net loss, loss per share and Adjusted EBITDA, sources and uses of cash, liquidity, cash flow, capital requirements and the sufficiency of our existing cash balance and available credit;
- our expectations that most of our revenue will continue to come from a relatively small number of customers for the foreseeable future;
- our expectations of long-term revenue growth, with increasing levels of gross profit and improved cash flows from operations and our expectations that we will incur significant capital expenditures related to the expansion of our manufacturing capacity to support this expected long-term growth in demand;
- our expectations that the operating expenses will increase in both absolute dollars and as a percentage of revenue in 2022 but increase in absolute dollars and decrease as a percentage of revenue in the long term, our research and development expenses will increase in both absolute dollars and as a percentage of revenue in 2022 but increase in absolute dollars and decrease as a percentage of revenue in the long term, our sales and marketing expenses will increase in both absolute dollars and as a percentage of revenue in 2022 but increase in absolute dollars and decrease as a percentage of revenue in the long term, and our general and administrative expenses will increase in both absolute dollars and as a percentage of revenue in 2022 but increase in absolute dollars and decrease as a percentage of revenue in the long term;
- our expectation to continue to increase investment in research and development in our efforts to enhance and expand our aerogel technology platform;
- our expectations about the impact of new accounting pronouncements on our consolidated financial statements and related disclosures;
- our belief that our experienced and dedicated leadership team will provide us with a competitive advantage in the industry;
- our belief of our technological and market leadership in aerogels;
- the expected future development of new aerogel technologies; and
- our expectations about limitations of net operating losses.

We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements, and you should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have included important cautionary statements in this report, particularly in the Risk Factors set forth in Item 1A of this Annual Report on Form 10-K, that we believe could cause actual results or events to differ materially from the forward-looking statements that we make. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments we may make.

You should read this report and the documents that we reference in this report and have filed as exhibits to this report completely and with the understanding that our actual future results may be materially different from what we expect. The forward-

looking statements contained in this report are made as of the date of this report, and we do not assume, and specifically disclaim, any obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise.

Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

Our corporate headquarters are located in Northborough, Massachusetts, where we occupy approximately 51,650 square feet under a lease expiring on December 31, 2031. We also own an approximately 143,000 square foot manufacturing facility in East Providence, Rhode Island. We lease additional spaces for research, administrative, and warehousing purposes in three locations in the United States under leases expiring between March 31, 2024 and October 1, 2031. The table below shows a summary of the square footage of these locations as of December 31, 2021:

Leased Properties by Location (In square ft.)	
East Providence, RI	169,675
Marlborough, MA	81,325
Pawtucket, RI	46,400

Item 3. LEGAL PROCEEDINGS

Patent Enforcement Actions

In May 2016, we filed a complaint for patent infringement against Nano Tech Co., Ltd. (Nano), and Guangdong Alison Hi Tech., Ltd. (Alison) in the International Trade Commission, or ITC. In February 2018, the ITC issued its final determination that Nano and Alison had infringed asserted Aspen patents and that they have not proven the patents are invalid except with respect to one dependent product claim, which the ITC found was not infringed. The ITC affirmed that Alison and Nano each violated Section 337 of the Tariff Act and issued a limited exclusion order prohibiting importation of infringing aerogel insulation products manufactured by Alison and Nano. Alison's appeal with respect to a product patent to the United States Court of Appeals for the Federal Circuit (CAFC) was rejected, and resulted in CAFC affirming the validity of our patent. The exclusion order, which is enforced by the United States Customs and Border Protection, is currently in effect.

Additionally, the USPTO denied Alison's requests to invalidate the claims of four of our patents in Inter-Partes Review. Alison also filed multiple similar requests with the Chinese Patent Office (SIPO), seeking to invalidate our Chinese manufacturing process patents and two of our Chinese product patents. With respect to one of those requests, not withdrawn previously by Alison, the Patent Review Board of SIPO (PRB), issued a decision upholding the validity of Aspen's issued patent as amended in the proceedings. Alison has appealed the PRB's decision to the Beijing IP court. On July 25, 2020, the Beijing IP court dismissed Alison's appeal and upheld the validity of Aspen's patent and we received this decision on September 15, 2020. Nano has also filed a request seeking invalidation of a product patent at SIPO. After the oral hearing at PRB, Nano withdrew its invalidation request. On September 23, 2019, Alison filed yet another request to invalidate the same patent, whose validity was previously confirmed by PRB. On January 23, 2020 PRB denied Alison's latest invalidation request.

In April 2016, we also filed a patent infringement suit at the District Court in Mannheim, Germany (Mannheim court), against Nano, Alison and two European resellers asserting their infringement of one of our German patents. We subsequently asserted infringement of another three patents against Nano, Alison and a European reseller of Alison's products at the Mannheim court. We have since settled with one European reseller in exchange for a commitment not to procure infringing products and cooperation with our case.

- In January 2018, the court issued a series of judgments by acknowledgement (German, "Anerkenntnisurteil") finding the second reseller, Hiltex, liable for infringement and also issued injunctions against Hiltex. The judgments resulted from a settlement agreement in which Hiltex agreed not to resell the infringing products in Europe where at least one of the asserted patents are active.
- On March 8, 2019, the Mannheim court issued two separate judgments in cases against Nano and Alison, respectively. The Mannheim court determined that both Nano and Alison are infringing on Aspen's EP1638750 (750 Patent) in connection with their respective products. The court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing the infringing products. The court found the defendants liable to us for damages since September 22, 2012. The court

also ordered the defendants to provide information on the scope of the acts of infringement committed since August 22, 2012, and a recall of infringing products. The court ordered Nano and Alison to bear the costs of the legal proceedings and reimburse statutory attorneys' costs and expenses to us, that exact amount of which is yet to be determined. Nano and Alison have appealed the judgments of the Mannheim court. Nano subsequently withdrew the appeal while Alison's appeal is currently pending.

- The Mannheim court issued two decisions on December 23, 2019 finding that Alison infringed the 577 Patent and the 950 Patent and also issued injunctions prohibiting Alison from continuing infringement in connection with any aerogel sheets. The December 2019 decisions against Alison have now become final and binding.

- The Mannheim court issued two decisions on July 31, 2020 finding that Nano infringed each of the 577 Patent and the 950 Patent. In addition to granting other remedies, the court also issued injunctions prohibiting the offer, putting on the market, using, importing or possessing any aerogel sheets. After the passing of deadline to file appeals, these decisions have now become final.

- Nano and Alison also initiated nullity actions in German Federal Patent Court in Munich against our asserted German patents. On September 25, 2018, the Federal Patent Court in Munich dismissed the challenge to the validity of 750 Patent which has subsequently become final. Nano and Alison also filed an opposition to one of the asserted patents at the EPO. In December 2018, the opposition division of EPO determined the patent, EP2813338 (338 Patent), was invalid on formality grounds and decided to revoke it, which determination is currently under appeal at the EPO Board of appeals.

- On March 19 and 20, 2019 the German Federal Patent Court in Munich (FPC) conducted oral proceedings and voided four claims in EP2415577 (577 Patent) and confirmed the validity of challenged claims in EP2422950 (950 Patent) within the scope of silica gels. These FPC judgments are now final and binding on the parties. Nano had filed another nullity action seeking to invalidate the remaining claims in the 577 Patent, which action Nano subsequently failed to pursue. On June 17, 2020, Nano also filed an opposition to a recently issued Aspen Patent EP3120983B1, titled "Continuous Sheet of Gel Materials and Continuous sheet of Aerogel".

- On January 28, 2021, a search order was executed and relevant evidence secured at the principal places of business of AMA S.p.A. and AMA Composites S.r.l. (collectively, AMA) in San Martino in Rio and Campogalliano, respectively, based on an ex-parte search order issued by the Court of Genoa, Italy at our request in connection with alleged infringement of the Italian part of our patents previously asserted successfully against Nano and Alison in Germany. The Court of Genoa subsequently held a hearing and confirmed the validity of the search order and its execution. While the search proceedings do not take a position on the infringement issues, we may use any evidence collected during the search proceedings to prove infringement. As a result, on May 3, 2021, we filed an infringement complaint, a writ of summons, as known in Italy, at the Court of Genoa alleging that AMA has infringed the Italian part of three European patents (same patents asserted in the German litigation) and a patent on composition of aerogel-based composites in connection with AMA's resale of aerogel products supplied by Chinese companies and sale of any products derived therefrom. We are seeking monetary damages and preliminary injunction of AMA's alleged infringing activities. We expect the Court of Genoa to assess our claims and AMA's defense through appointment of an expert after the submission of relevant writs and evidence. We issued a press release on May 6, 2021 describing the patent enforcement action of May 3, 2021 (Press Release). On June 7, 2021, AMA served us a copy of a request it previously filed with the Court of Genoa seeking an ex-parte preliminary injunction (PI) against us alleging the Press Release constituted anti-competitive conduct and that it infringed AMA's trademark rights. The service of the request followed the court's prior denial of the ex-parte order and an order requiring AMA to serve the request on us. The court subsequently conducted an oral hearing on June 15, 2021. On June 24, 2021, the court denied AMA's request for a PI, reasoning that our Press Release was factually accurate, was not misleading, distinguished facts from opinions and that it was neither anti-competitive nor did it infringe trademark rights of AMA. The Court also ordered AMA to pay certain of our legal fees. On July 5, 2021, AMA informed us that it has decided not to appeal the denial of June 24, 2021. We subsequently learned that AMA had also made a criminal complaint against our chief executive officer for defamation in connection with the Press Release. On December 31, 2021, the local prosecutor, after reviewing the underlying facts, rejected AMA's arguments and requested the judge overseeing the matter to dismiss the complaint against our chief executive officer. In response to our infringement complaint, AMA has also added as a counter-claim in connection with its claims regarding the Press Release, those same claims that it previously sought a preliminary injunction which was denied by the court. The patent infringement proceedings are ongoing.

Additionally, a reseller of Nano's products in Taiwan challenged the validity of one of our patents in Taiwan in 2018. After careful review of our written response, the Taiwanese patent office has determined the patent as valid and dismissed the challenge in December 2018. In 2018, LG Chem Ltd. challenged the validity of one of our patents in Korea at the IPTAB of the Korean Intellectual Property Office. After conducting an oral hearing, the IPTAB issued a decision on November 30, 2019 upholding claims related to aerogel sheets incorporating fibers. On January 14, 2021 the Korean Patent Court confirmed the validity of the claims related to aerogel sheets incorporating fibers.

Due to their nature, it is difficult to predict the outcome or the costs involved in any litigation or administrative proceedings, including any appeals process. Furthermore, the counter parties in these proceedings may have significant resources and interest to litigate and therefore, these litigation matters could be protracted and may ultimately involve significant legal expenses. In addition to the foregoing, we have been and may be from time to time a party to other legal proceedings that arise in the ordinary course of business and to other patent enforcement actions to assert our patent rights.

Item 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

Item 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market Information and Dividend Policy

Our common stock is trading on The New York Stock Exchange, or NYSE, under the symbol "ASPN." As of February 25, 2022, there were approximately 29 stockholders of record of our common stock.

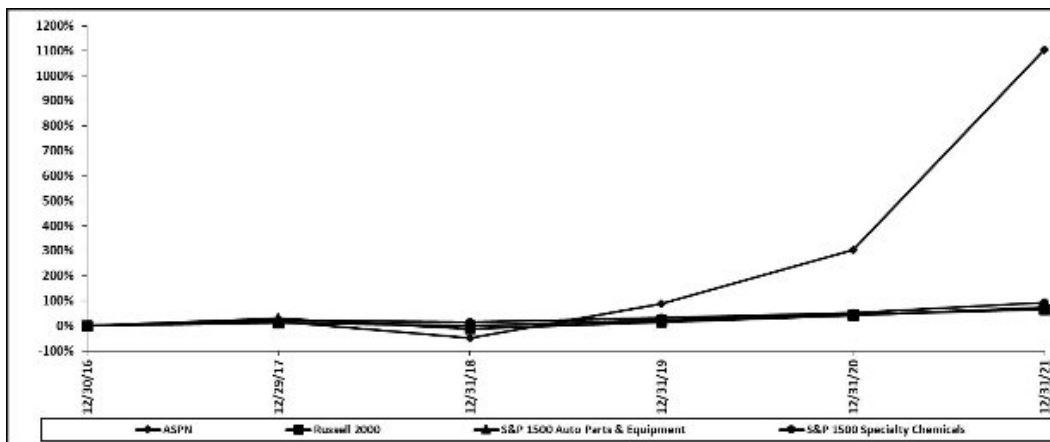
Dividends

We have not paid dividends to our stockholders since our inception and we do not plan to pay cash dividends in the foreseeable future. We currently intend to retain earnings, if any, to finance the development and expansion of our business.

Stock Performance Graph

This performance graph is not "soliciting material," is not deemed filed with the SEC and is not to be incorporated by reference in any filing by us under the Securities Act of 1933 or the Securities Exchange Act of 1934, as amended, whether made before or after the date hereof and irrespective of any general incorporation language in any such filing. The stock price performance shown on the graph is not necessarily indicative of future price performance.

Comparison of Cumulative Total Return



Unregistered Sales of Equity Securities and Use of Proceeds

- (a) *Unregistered Sales of Equity Securities.* Not applicable.
- (b) *Use of Proceeds from Initial Public Offering of Common Stock.* Not applicable.
- (c) *Purchases of Equity Securities By the Issuer and Affiliated Purchasers.* We did not repurchase any of our equity securities during the year ended December 31, 2021.

Item 6. [RESERVED]

Item 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion of our financial condition and results of operations should be read in conjunction with the "Selected Financial Data" and our consolidated financial statements and the related notes thereto included in this Annual Report on Form 10-K. In addition to historical information, some of the information contained in the following discussion and analysis or set forth elsewhere in this report, including information with respect to our plans and strategy for our business, includes forward-looking information that involves risks, uncertainties and assumptions. You should read the Risk Factors set forth in Item 1A of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis. Our actual results and the timing of events could differ materially from those anticipated by these forward looking statements.

Investors and others should note that we routinely use the Investors section of our website to announce material information to investors and the marketplace. While not all of the information that we post on the Investors section of our website is of a material nature, some information could be deemed to be material. Accordingly, we encourage investors, the media, and others interested in us to review the information that we share on the Investors section of our website, <https://www.aerogel.com/>.

Overview

We design, develop and manufacture innovative, high-performance aerogel insulation used primarily in the energy infrastructure and sustainable building materials markets. We believe our aerogel blankets deliver the best thermal performance of any widely used insulation product available on the market today and provide a combination of performance attributes unmatched by traditional insulation materials. Our end-user customers select our products where thermal performance is critical and to save money, improve resource efficiency, enhance sustainability, preserve operating assets and protect workers. Our insulation is used by oil producers and the owners and operators of refineries, petrochemical plants, liquefied natural gas facilities, power generating assets and other energy infrastructure. Our PyroGel® and Cryogel® product lines have undergone rigorous technical validation by industry leading end-users and achieved significant market adoption. Our Spaceloft® building materials are increasingly used by building owners to improve the energy efficiency and to enhance fire protection in buildings ranging from historic brownstones to modern high rises.

We are also actively developing a number of promising aerogel products and technologies for the electric vehicle market. We have developed and are commercializing our proprietary line of PyroThin® aerogel thermal barriers for use in battery packs in electric vehicles. Our PyroThin product is an ultra-thin, lightweight and flexible thermal barrier designed with other functional layers to impede the propagation of thermal runaway across multiple lithium-ion battery system architectures. Our thermal barrier technology offers a unique combination of thermal management, mechanical performance and fire protection properties that enable electric vehicle manufacturers to achieve critical battery performance and safety goals. In addition, we are seeking to leverage our patented carbon aerogel technology to develop industry-leading battery materials for use in lithium-ion battery cells. These battery materials have the potential to increase the energy density of the battery cells, thus enabling an increase in the driving range of electric vehicles.

The commercial potential for our PyroThin thermal barriers and our carbon aerogel battery materials in the electric vehicle market is significant. Accordingly, we are hiring additional personnel, incurring additional operating expenses, incurring significant capital expenditures to expand aerogel manufacturing capacity, establishing an automated thermal barrier fabrication operation, enhancing research and development resources and expanding our battery material research facilities, among other items.

We also derive product revenue from a number of other end markets. Customers in these markets use our products for applications as diverse as military and commercial aircraft, trains, buses, appliances, apparel, footwear and outdoor gear. As we continue to enhance our aerogel technology platform, we believe we will have additional opportunities to address high value applications in the global insulation market, the electric vehicle market and in a number of new, high-value markets, including hydrogen energy, filtration, water purification, and gas sorption.

We generate product revenue through the sale of our line of aerogel blankets and thermal barriers. We market and sell our products primarily through a sales force based in North America, Europe and Asia. The efforts of our sales force are supported by a small number of sales consultants with extensive knowledge of a particular market or region. Our sales force is responsible for establishing and maintaining customer and partner relationships, delivering highly technical information and ensuring high-quality customer service.

Our salespeople work directly with end-user customers and engineering firms to promote the qualification, specification and acceptance of our aerogel and thermal barrier products. We also rely on an existing and well-established channel of qualified insulation distributors and contractors in more than 50 countries around the world to ensure rapid delivery of our aerogel products and strong end-user support.

We also perform research services under contracts with various agencies of the U.S. government, including the Department of Defense and the Department of Energy, and other institutions. We have decided to cease efforts to secure additional funded research contracts and to wind down our existing contract research activities.

We manufacture our products using our proprietary technology at our facility in East Providence, Rhode Island. We have operated the East Providence facility since 2008 and have increased our capacity in phases to approximately \$250.0 million in annual revenue. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in Bulloch County, Georgia. We expect to build the second plant in two phases at an estimated cost of \$575.0 million for the first phase and \$125.0 million for the second phase. We currently expect the first phase of the plant will increase our annual revenue capacity by approximately \$650.0 million and the second phase by approximately \$700.0 million. We expect to have the first phase of the second plant operational late in the second -half of 2023. In addition, we are planning to construct a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico, in order to keep pace with the significant potential demand for our PyroThin thermal barriers.

We have entered into production contracts with a major U.S. automotive original equipment manufacturer (OEM) to supply fabricated, multi-part thermal barriers for use in the battery system of its next-generation electric vehicles. Pursuant to the contracts, we are obligated to supply the barriers at fixed annual prices and at volumes to be specified by the customer up to a daily maximum quantity through the term of the agreements, which expire at various times from 2026 through 2034. While the customer has agreed to purchase its requirement for the barriers from us at locations to be designated from time to time, it has no obligation to purchase any minimum quantity of barriers under the contracts. In addition, the customer may terminate the contracts any time and for any or no reason. All other terms of the contracts are generally consistent with the customer's standard purchase terms, including quality and warranty provisions customary in the automotive industry.

We have been engaged since 2016 in a strategic partnership with BASF to develop and commercialize products for the sustainable building materials and other markets. Pursuant to the partnership, we agreed to sell certain products exclusively to BASF at annual volumes specified by BASF, subject to certain volume limits, through December 31, 2027. Pursuant to the partnership, through the year ended December 31, 2019, BASF also made two prepayments of \$5.0 million each to us. BASF had the right to request that 25.3% of any amounts we invoiced to BASF for Spaceloft A2 be credited against the prepayment balances. BASF also had the right to request that we repay any uncredited amount of the first prepayment following a six-week notice period on or after January 1, 2022 and the second prepayment on or after January 1, 2023.

As of December 31, 2021, we had received \$10.0 million in prepayments from BASF and applied approximately \$0.3 million of credits against amounts we had invoiced to BASF. During 2021, Aspen and BASF jointly announced that BASF would discontinue further marketing and sale of Spaceloft A2 as of November 15, 2021. After that date, BASF customers have had the right to purchase Spaceloft A2 directly from us. On December 15, 2021, we terminated the supply arrangement with BASF. As part of the termination, Aspen and BASF agreed that any uncredited prepayment balances would remain outstanding and subject to repayment upon BASF's request following the requisite six-week notice periods after January 1, 2022 and January 1, 2023, respectively. On January 31, 2022, BASF requested that an outstanding prepayment balance of \$4.6 million be repaid and we made the requested repayment on February 15, 2022.

On November 5, 2020, we entered into a sales agreement for an at-the-market ("ATM") offering program with B. Riley Securities as our sales agent. During the year ended December 31, 2021, we sold 929,981 shares of our common stock through the ATM offering program and received net proceeds of \$19.4 million.

On February 3, 2021, we entered into a supply agreement with Silbond Corporation for the purchase of certain silanes products. Pursuant to the agreement, we agreed to purchase, and Silbond agreed to supply, all of our requirements for the specified silanes at our East Providence facility through the term of the agreement on September 30, 2023, unless either party terminates the agreement earlier pursuant to its terms.

On June 29, 2021, we sold 3,462,124 shares to an affiliate of Koch, in a private placement of our common stock and received net proceeds of \$73.5 million after deducting fees and offering expenses of \$1.5 million.

On February 15, 2022, we entered into a securities purchase agreement with an affiliate of Koch to sell 1,791,986 shares for aggregate gross proceeds of \$50.0 million. The closing of the sale of 1,791,986 shares is subject to customary closing conditions, including the expiration or termination of the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976. On

February 18, 2022, we sold and issued to an affiliate of Koch \$100.0 million in aggregate principal amount of our Convertible Senior PIK Toggle Notes due 2027, or the Notes. The Notes bear interest at the Secured Overnight Financing Rate, or SOFR, plus 5.50% per annum if interest is paid in cash, or the Cash Interest, or, if interest is paid in kind (through an increase in the principal amount of the outstanding Notes or through the issuance of additional Notes), at SOFR plus 6.50% per annum, or PIK Interest. Under the terms of the investment, SOFR has a floor of 1% and a cap of 3%. We can elect to make any interest payment through Cash Interest, PIK Interest or any combination thereof. Interest on the Notes is payable semi-annually in arrears on June 30 and December 30, commencing on June 30, 2022. It is expected that the Notes will mature on February 18, 2027, subject to earlier conversion, redemption or repurchase.

On March 12, 2021, we entered into an Amended and Restated Loan and Security Agreement (Loan Agreement) with Silicon Valley Bank to extend the maturity date of the revolving credit facility to April 28, 2022. Pursuant to the Loan Agreement, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum, plus a margin. The rates applicable to borrowings vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. The credit facility has also been amended to establish minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, each as defined in the Loan Agreement. On September 29, 2021, and subsequently on December 27, 2021, we entered into amendments to the Loan Agreement to revise certain financial covenants, among other things.

On May 1, 2020, our wholly owned subsidiary, Aspen Aerogels Rhode Island, LLC, executed a note for an unsecured loan of \$3.7 million (PPP Loan) pursuant to the Paycheck Protection Program established by the CARES Act, as amended, and administered by the U.S. Small Business Administration (SBA). On August 24, 2021, the SBA remitted \$3.7 million in principal and less than \$0.1 million in accrued interest after approving the Borrower's application for forgiveness of the PPP Loan under the provisions of the CARES Act. Accordingly, we recorded a total gain on the extinguishment of debt of \$3.7 million during the year ended December 31, 2021.

In response to the COVID-19 pandemic, we have implemented and are following safe practices recommended by public health authorities and other government entities. We continue to focus on the safety and health of our employees, customers and vendors. In addition, we have implemented various precautionary measures, including remote work arrangements, restricted business travel and procedures for social distancing, face coverings and safe hygiene. We continue to monitor public health guidance as it evolves and plan to adapt our practices as appropriate. Refer to the section below entitled "Item 1A. Risk Factors" for more information concerning risks to our business associated with COVID-19.

Our revenue for the year ended December 31, 2021 was \$121.6 million, which represented an increase of \$21.3 million, or 21%, from the year ended December 31, 2020. Net loss for the year ended December 31, 2021 was \$37.1 million and net loss per share was \$1.22. Net loss for the year ended December 31, 2020, was \$21.8 million and net loss per share was \$0.83.

Key Metrics and Non-GAAP Financial Measures

We regularly review a number of metrics, including the following key metrics, to evaluate our business, measure our performance, identify trends affecting our business, formulate financial projections and make strategic decisions.

Square Foot Operating Metric

We price our product and measure our product shipments in square feet. We estimate our annual capacity was 55 million square feet of aerogel blankets at December 31, 2021. We believe the square foot operating metric allows us and our investors to measure our manufacturing capacity and product shipments on a uniform and consistent basis. The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

	<u>Year Ended December 31,</u>		
	<u>2021</u>	<u>2020</u>	<u>2019</u>
	(Square feet in thousands)		
Product shipments in square feet	34,977	28,635	40,720

Adjusted EBITDA

We use Adjusted EBITDA, a non-GAAP financial measure, as a means to assess our operating performance. We define Adjusted EBITDA as net income (loss) before interest expense, taxes, depreciation, amortization, stock-based compensation expense and other items, from time to time, which we do not believe are indicative of our core operating performance, which in 2021 included a gain on the extinguishment of debt. Adjusted EBITDA is a supplemental measure of our performance that is not presented in accordance with U.S. GAAP. Adjusted EBITDA should not be considered as an alternative to net income (loss) or any other measure of financial performance calculated and presented in accordance with U.S. GAAP. In addition, our definition and presentation of Adjusted EBITDA may not be comparable to similarly titled measures presented by other companies.

We use Adjusted EBITDA:

- as a measure of operating performance because it does not include the impact of items that we do not consider indicative of our core operating performance;
- for planning purposes, including the preparation of our annual operating budget;
- to allocate resources to enhance the financial performance of our business; and
- as a performance measure used under our bonus plan.

We also believe that the presentation of Adjusted EBITDA provides useful information to investors with respect to our results of operations and in assessing the performance and value of our business. Various measures of EBITDA are widely used by investors to measure a company's operating performance without regard to items that can vary substantially from company to company depending upon financing and accounting methods, book values of assets, capital structures and the methods by which assets were acquired.

Although measures similar to Adjusted EBITDA are frequently used by investors and securities analysts in their evaluation of companies, we understand that Adjusted EBITDA has limitations as an analytical tool, and you should not consider it in isolation or as a substitute for net income (loss), income (loss) from operations, net cash provided by (used in) operating activities or an analysis of our results of operations as reported under U.S. GAAP. Some of these limitations are:

- Adjusted EBITDA does not reflect our historical cash expenditures or future requirements for capital expenditures or other contractual commitments;
- Adjusted EBITDA does not reflect changes in, or cash requirements for, our working capital needs;
- Adjusted EBITDA does not reflect stock-based compensation expense;
- Adjusted EBITDA does not reflect our income tax expense or cash requirements to pay our income taxes;
- Adjusted EBITDA does not reflect our interest expense, or the cash requirements necessary to service interest or principal payments on our debt;
- although depreciation, amortization and impairment charges are non-cash charges, the assets being depreciated, amortized or impaired will often have to be replaced in the future, and Adjusted EBITDA does not reflect any cash requirements for these replacements; and
- other companies in our industry may calculate EBITDA or Adjusted EBITDA differently than we do, limiting their usefulness as a comparative measure.

Because of these limitations, our Adjusted EBITDA should not be considered as a measure of discretionary cash available to us to reinvest in the growth of our business or as a measure of cash available for us to meet our obligations.

To properly and prudently evaluate our business, we encourage you to review the U.S. GAAP financial statements included elsewhere in this Annual Report on Form 10-K, and not to rely on any single financial measure to evaluate our business.

The following table presents a reconciliation of net loss, the most directly comparable U.S. GAAP measure, to Adjusted EBITDA for the years presented:

	Year Ended December 31,		
	2021	2020	2019
	(\$ in thousands)		
Net loss	\$ (37,094)	\$ (21,809)	\$ (14,565)
Depreciation and amortization	9,440	10,198	10,213
Stock-based compensation (1)	5,176	5,004	3,771
Gain on the extinguishment of debt	(3,734)	—	—
Interest expense, net	229	240	406
Adjusted EBITDA	<u>\$ (25,983)</u>	<u>\$ (6,367)</u>	<u>\$ (175)</u>

- (1) Represents non-cash stock-based compensation related to vesting and modifications of stock option grants, vesting of restricted stock units and vesting and modification of restricted common stock.

The following table presents a reconciliation of net loss, the most directly comparable U.S. GAAP measure, to Adjusted EBITDA for the quarters presented:

	Three Months Ended				Three Months Ended			
	2021				2020			
	March 31	June 30	Sept. 30	Dec. 31	March 31	June 30	Sept. 30	Dec. 31
	(\$ in thousands)							
Net loss	\$ (6,250)	\$ (6,669)	\$ (7,822)	\$ (16,353)	\$ (3,169)	\$ (5,698)	\$ (6,753)	\$ (6,189)
Depreciation and amortization	2,638	2,104	2,114	2,584	2,563	2,562	2,545	2,528
Stock-based compensation (1)	976	1,070	1,554	1,576	992	1,007	991	2,014
Gain on the extinguishment of debt	—	—	(3,734)	—	—	—	—	—
Interest expense, net	75	55	58	41	83	50	49	58
Adjusted EBITDA	<u>\$ (2,561)</u>	<u>\$ (3,440)</u>	<u>\$ (7,830)</u>	<u>\$ (12,152)</u>	<u>\$ 469</u>	<u>\$ (2,079)</u>	<u>\$ (3,168)</u>	<u>\$ (1,589)</u>

- (1) Represents non-cash stock-based compensation related to vesting and modifications of stock option grants, vesting of restricted stock units and vesting and modification of restricted common stock.

Our financial performance, including such measures as net income (loss), earnings per share and Adjusted EBITDA, are affected by a number of factors including volume and mix of aerogel products sold, average selling prices, our material costs and manufacturing expenses, the costs associated with capacity expansions and start-up of additional production capacity, and the amount and timing of operating expenses. Accordingly, we expect that our net income (loss), earnings per share and Adjusted EBITDA will vary from period to period.

During 2021, we experienced strong volume growth in our energy infrastructure business, particularly in North America, due to the beginning stages of a post-COVID recovery, initial revenues in the electric vehicle market, and continued market share gains in the sustainable building materials market. As a result, we experienced total revenue growth of 21% during the year. We significantly increased staffing and spending levels in support of growing demand for our thermal barrier business and our carbon aerogel battery material opportunity in coming years. We also increased staffing and spending to expand and defend our IP portfolio, and to enhance our general and administrative functions to manage the anticipated strong growth in our business. As a result, we experienced an increase in net loss and a decrease in Adjusted EBITDA during 2021 versus 2020.

We expect to maintain strong revenue growth during 2022 driven by a continued post-COVID recovery in the energy infrastructure market, accelerating demand in the electric vehicle market and continued market share gains in the sustainable building materials market. Our expectation to maintain strong revenue growth is based, in part, on our OEM customers' production volume forecasts and targets as well as our expectation to successfully scale our manufacturing capabilities and address any potential supply chain issues to meet this expected demand. We are also planning a significant increase in staffing and spending levels in support of our electric vehicle market opportunities, including expenses associated with the start-up and operation of an automated fabrication facility in Monterrey, Mexico, during the year. As a result, we expect to experience an increase in net loss and a decrease in Adjusted EBITDA during 2022.

We also expect to incur significant capital expenditures and growing expenses during 2022, related to our planned second aerogel manufacturing facility to be located in Bulloch County, Georgia. We are planning to invest approximately \$700.0 million in

two phases in the construction of the second facility. We expect to have the first phase of the second plant operational late in the second-half of 2023.

At full capacity, we estimate the Georgia facility alone can produce thermal barriers for 4.4 million electric vehicles per year and support more than \$1.35 billion in annual revenue. In the aggregate, we project our East Providence and Georgia plants will provide the capacity to support more than \$1.6 billion in annual revenue with potential gross margins of 35%, EBITDA margins of 25% and free cash flow sufficient to fund future capacity expansions, including a third aerogel plant.

Revenue

We recognize product revenue from the sale of our line of aerogel products and research services revenue from the provision of services under contracts with various agencies of the U.S. government and other institutions. Product and research services revenue is recognized upon the satisfaction of contractual performance obligations.

We record deferred revenue for product sales when (i) we have delivered products but other revenue recognition criteria have not been satisfied or (ii) payments have been received in advance of the completion of required performance obligations.

We have decided to cease efforts to secure additional research contracts and to wind down existing contract research activities.

The following table sets forth the total revenue for the periods presented:

	Year Ended December 31,		
	2021	2020	2019
	(\$ in thousands)		
Revenue:			
Product	\$ 121,112	\$ 99,834	\$ 136,934
Research services	510	439	2,441
Total revenue	<u>\$ 121,622</u>	<u>\$ 100,273</u>	<u>\$ 139,375</u>

Product revenue accounted for greater than 99% of total revenue for both the years ended December 31, 2021 and 2020, and 98% for the year ended December 31, 2019. We experienced a 21% increase in total revenue during 2021 driven by the increase in square feet shipped in our energy infrastructure business, particularly in North America, initial revenues in the electric vehicle market, and continued market share gains in the sustainable building materials market. Our product revenue increase was partially curtailed by COVID-related staffing and raw material shortages during the year, particularly in the fourth quarter.

We project revenue growth during 2022 due to a continued post-COVID recovery in the energy infrastructure market, accelerating demand in the electric vehicle market and continued market share gains in the sustainable building materials market. Our projected revenue growth may be constrained by a shortage of unskilled labor associated with the COVID-19 pandemic.

A substantial majority of our revenue is generated from a limited number of direct customers, including distributors, contractors, fabricators, partners and end-user customers. Our ten largest customers accounted for approximately 68% of our total revenue during the year ended December 31, 2021, and we expect that most of our revenue will continue to come from a relatively small number of customers for the foreseeable future.

In 2021, sales to Distribution International, Inc. represented 28% of our total revenue. In 2020, sales to Distribution International, Inc. and SPCC Joint Venture represented 21% and 15% of our total revenue, respectively. In 2019, sales to Distribution International, Inc. and SPCC Joint Venture represented 20% and 13% of our total revenue, respectively. For each of the noted periods, there were no other customers that represented 10% or more of our total revenues.

We conduct business across the globe and a substantial portion of our revenue is generated outside of the United States. Total revenue from outside of the United States, based on shipment destination, amounted to \$54.8 million, or 45% of our total revenue, \$55.5 million, or 55% of our total revenue, and \$81.0 million, or 58% of our total revenue, in the years ended December 31, 2021, 2020 and 2019, respectively.

Cost of Revenue

Cost of product revenue consists primarily of materials and manufacturing expense. Cost of product revenue is recorded when the related product revenue is recognized.

Material is our most significant component of cost of product revenue and includes fibrous batting, silica materials and additives. Material costs as a percentage of product revenue were 48%, 44% and 48% for the years ended December 31, 2021, 2020 and 2019, respectively. Material costs as a percentage of product revenue vary from product to product due to differences in average selling prices, material requirements, product thicknesses, and manufacturing yields. In addition, we provide warranties for our products and record the estimated cost within cost of revenue in the period that the related revenue is recorded or when we become aware that a potential warranty claim is probable and can be reasonably estimated. As a result of these factors, material costs as a percentage of product revenue will vary from period to period due to changes in the mix of aerogel products sold, the costs of our raw materials or the estimated cost of warranties. In addition, global supply chain disturbances, increased reliance on foreign materials procurement, industrial gas supply constraints, increases in the cost of our raw materials, and other factors may significantly impact our material costs and have a material impact on our operations. We expect that material costs will increase in absolute dollars during 2022 due to projected growth in product shipments, but decrease as a percentage of revenue due to projected increases in average selling prices, improved manufacturing, and fabrication yields and a favorable mix of products sold.

Manufacturing expense is also a significant component of cost of revenue. Manufacturing expense includes labor, utilities, maintenance expense, and depreciation on manufacturing assets. Manufacturing expense also includes stock-based compensation of manufacturing employees and shipping costs. Manufacturing expense as a percentage of product revenue was 44%, 42% and 33% for the years ended December 31, 2021, 2020 and 2019, respectively. We expect that manufacturing expense will increase in absolute dollars and as a percentage of revenue during 2022 due to increased staffing and spending levels in support of our thermal barrier business, including the start-up and operation of an automated fabrication facility in Monterrey, Mexico and the initial staffing and operational requirements of our planned second aerogel manufacturing facility in Bulloch County, Georgia.

During 2022, we expect that cost of product revenue will increase in absolute dollars due to projected volume growth and a planned increase in staffing and spending levels, but decrease as a percentage of product revenue due to projected increases in average selling prices, improved manufacturing and fabrication yields and a favorable mix of products sold.

Cost of research services revenue consists of direct labor costs of research personnel engaged in the contract research, third-party consulting and subcontractor expense, and associated direct material costs. This cost of revenue also includes overhead expenses associated with project resources, development tools and supplies. In 2022, we expect that cost of research services revenue will continue to decline as we wind down our existing contract research activities.

Gross Profit

Our gross profit as a percentage of revenue is affected by a number of factors, including the volume of aerogel products produced and sold, the mix of aerogel products sold, average selling prices, our material and manufacturing costs, realized capacity utilization and the costs associated with expansions and start-up of production capacity. Accordingly, we expect our gross profit to vary significantly in absolute dollars and as a percentage of revenue from period to period. Gross profit as a percentage of total revenue was 8%, 15%, and 19% for the years ended December 31, 2021, 2020 and 2019, respectively.

During 2022, we expect gross profit to increase in both absolute dollars and as a percentage of total revenue due to the combination of a projected increase in total revenue combined with projected reduction in material costs as a percentage of total revenue, offset, in part, by a projected increase in manufacturing expense as a percentage of revenue.

In the longer term, we expect gross profit to improve in absolute dollars and as a percentage of revenue due to expected increases in total revenue, production volumes and manufacturing productivity. In addition, we expect the gross profit improvement derived from the increases in revenue, volume and productivity will be supported by the continued implementation of lower cost product formulations and realization of material purchasing efficiencies.

Operating Expenses

Operating expenses consist of research and development, sales and marketing, and general and administrative expenses. Operating expenses include personnel costs, legal fees, professional fees, service fees, insurance premiums, travel expense, facilities related costs and other costs, expenses and fees. The largest component of our operating expenses is personnel costs, consisting of salaries, benefits, incentive compensation and stock-based compensation. In any particular period, the timing and extent of personnel additions or reductions, legal activities, including patent enforcement actions, marketing programs, research efforts and a range of similar activities or actions could materially affect our operating expenses, both in absolute dollars and as a percentage of revenue.

During 2022, we expect to continue to hire additional personnel and incur additional operating expenses to support the anticipated multi-year growth in our PyroThin thermal barrier business. As a result, we expect that operating expenses will increase in

both absolute dollars and as a percentage of revenue during the year. In the longer term, we expect that operating expenses will increase in absolute dollars, but decrease as a percentage of revenue.

Research and Development Expenses

Research and development expenses consist primarily of expenses for personnel engaged in the development of next generation aerogel compositions, form factors and manufacturing technologies. These expenses also include testing services, prototype expenses, consulting services, trial formulations for new products, equipment depreciation, facilities costs and related overhead. We expense research and development costs as incurred. We expect to continue to devote substantial resources to the development of new aerogel technologies, including our carbon aerogel battery materials. We believe that these investments are necessary to maintain and improve our competitive position. We also expect to continue to invest in research and engineering personnel and the infrastructure required in support of their efforts. While we expect our research and development expenses will increase in absolute dollars but decrease as a percentage of revenue in the longer term, in 2022 we expect these expenses will increase in both absolute dollars and as a percentage of revenue.

Sales and Marketing Expenses

Sales and marketing expenses consist primarily of personnel costs, incentive compensation, marketing programs, travel and related costs, consulting expenses and facilities related costs. We expect that sales and marketing expenses will increase in absolute dollars and as a percentage of revenue during 2022 principally due to an increase in compensation associated with the addition of personnel in support of our PyroThin thermal barrier business. In the longer term, we expect that sales and marketing expenses will increase in absolute dollars but decrease as a percentage of revenue.

General and Administrative Expenses

General and administrative expenses consist primarily of personnel costs, legal expenses, consulting and professional services, audit and tax consulting costs, and expenses for our executive, finance, legal, human resources and information technology organizations. General and administrative expenses have increased as we have incurred additional costs related to operating as a publicly-traded company, which include costs of compliance with securities, corporate governance, and related laws and regulations, investor relations expenses, increased insurance premiums, including director and officer insurance, and increased audit and legal fees. In addition, we expect our general and administrative expenses to increase as we add general and administrative personnel to support the anticipated growth of our business. We also expect that the patent enforcement actions, described in more detail under “Legal Proceedings” in Part I, Item 3 of this Annual Report on Form 10-K, if protracted, could result in significant legal expense over the medium to long-term. While we expect that our general and administrative expenses will increase in absolute dollars but decrease as a percentage of revenue in the longer term, in 2022 we expect such expenses will increase in both absolute dollars and as a percentage of revenue.

Gain on Extinguishment of Debt

On May 1, 2020, our wholly-owned subsidiary, Aspen Aerogels Rhode Island, LLC, or the Borrower, executed a note for an unsecured PPP loan of \$3.7 million pursuant to the CARES Act. On August 24, 2021, the SBA remitted \$3.7 million in principal and accrued interest to the noteholder after approving the Borrower’s application for forgiveness of the PPP Loan. Accordingly, we recorded a total gain on the extinguishment of debt of \$3.7 million during the year ended December 31, 2021

Interest Expense, Net

For the years ended December 31, 2021, 2020, and 2019, interest expense, net consisted primarily of fees and interest expense related to our revolving credit facility.

Provision for Income Taxes

We have incurred net losses since inception and have not recorded benefit provisions for U.S. federal income taxes or state income taxes since the tax benefits of our net losses have been offset by valuation allowances due to the uncertainty associated with the utilization of net operating loss carryforwards.

At December 31, 2021, we had \$296.1 million of net operating losses available to offset future federal income tax, if any, of which \$194.6 million expire on various dates through December 31, 2037. Net operating losses of \$101.5 million generated from 2018 through 2021 have an unlimited carryforward.

Results of Operations

The following tables set forth our results of operations for the periods presented:

	Year Ended December 31,		
	2021	2020	2019
	(\$ in thousands)		
Revenue:			
Product	\$ 121,112	\$ 99,834	\$ 136,934
Research services	510	439	2,441
Total revenue	121,622	100,273	139,375
Cost of revenue:			
Product	111,552	85,545	111,759
Research services	133	134	1,332
Gross profit	9,937	14,594	26,284
Operating expenses:			
Research and development	11,441	8,729	8,407
Sales and marketing	16,581	11,753	15,557
General and administrative	22,514	15,681	16,479
Total operating expenses	50,536	36,163	40,443
Loss from operations	(40,599)	(21,569)	(14,159)
Interest expense, net	(229)	(240)	(406)
Gain on extinguishment of debt	3,734	—	—
Total other income (expense)	3,505	(240)	(406)
Net loss	\$ (37,094)	\$ (21,809)	\$ (14,565)

Year ended December 31, 2021 compared to year ended December 31, 2020

The following tables set forth our results of operations for the periods presented:

	Year Ended December 31,				Year Ended December 31,	
	2021	2020	\$ Change	% Change	2021	2020
	(\$ in thousands)				(Percentage of total revenue)	
Revenue:						
Product	\$ 121,112	\$ 99,834	\$ 21,278	21%	100%	100%
Research services	510	439	71	16%	0%	0%
Total revenue	121,622	100,273	21,349	21%	100%	100%
Cost of revenue:						
Product	111,552	85,545	26,007	30%	92%	85%
Research services	133	134	(1)	(1)%	0%	0%
Gross profit	9,937	14,594	(4,657)	(32)%	8%	15%
Operating expenses:						
Research and development	11,441	8,729	2,712	31%	9%	9%
Sales and marketing	16,581	11,753	4,828	41%	14%	12%
General and administrative	22,514	15,681	6,833	44%	19%	16%
Total operating expenses	50,536	36,163	14,373	40%	42%	36%
Loss from operations	(40,599)	(21,569)	(19,030)	88%	(33)%	(22)%
Interest expense, net	(229)	(240)	11	(5)%	(0)%	(0)%
Gain on extinguishment of debt	3,734	—	3,734	100%	3%	—%
Total other income (expense)	3,505	(240)	3,745	1,560%	3%	(0)%
Net loss	\$ (37,094)	\$ (21,809)	\$ (15,285)	70%	(30)%	(22)%

Revenue

	Year Ended December 31,				Change	
	2021		2020		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
(\$ in thousands)						
Revenue:						
Product	\$ 121,112	100%	\$ 99,834	100%	\$ 21,278	21%
Research services	510	0%	439	0%	71	16%
Total revenue	<u>\$ 121,622</u>	100%	<u>\$ 100,273</u>	100%	<u>\$ 21,349</u>	21%

The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

Product shipments in square feet (in thousands)	Year Ended December 31,		Change	
	2021	2020	Amount	Percentage
		34,977	28,635	6,342

Total revenue increased \$21.3 million, or 21%, to \$121.6 million in 2021 from \$100.3 million in 2020. The increase in total revenue was the result of increases in both product revenue and research services revenue.

Product revenue increased by \$21.3 million, or 21%, to \$121.1 million in 2021 from \$99.8 million in 2020. This increase was driven by the increase in square feet shipped in our energy infrastructure business, particularly in North America, due to the beginning stages of a post-COVID recovery, initial revenues in the electric vehicle market, and continued market share gains in the sustainable building materials market.

Product revenue for the year ended December 31, 2021, included \$34.1 million in sales to Distribution International, Inc. Product revenue for the year ended December 31, 2020, included \$20.7 million in sales to Distribution International, Inc. and \$15.3 million in sales to SPCC Joint Venture. The average selling price per square foot of our products decreased by \$0.03, or 1%, to \$3.46 per square foot for the year ended December 31, 2021, from \$3.49 per square foot for the year ended December 31, 2020. This decrease in average selling price principally reflected the impact of a change in the mix of products sold. This decrease in average selling price had the effect of decreasing product revenue by approximately \$0.9 million for the year ended December 31, 2021.

In volume terms, product shipments increased by 6.4 million square feet, or 22%, to 35.0 million square feet of aerogel products for the year ended December 31, 2021, as compared to 28.6 million square feet in the year ended December 31, 2020. The increase in product volume had the effect of increasing product revenue by approximately \$22.1 million for the year ended December 31, 2021.

Research services revenue increased by \$0.1 million, or 16%, to \$0.5 million in 2021 from \$0.4 million in 2020. We have decided to cease efforts to secure additional research contracts and to wind down existing contract research activities.

Product revenue as a percentage of total revenue was greater than 99% of total revenue in 2021 and in 2020. Research services revenue was less than 1% of total revenue in 2021 and in 2020. We expect that product revenue will compose virtually all of our total revenue in the long-term.

We project revenue growth during 2022 due to a continued post-COVID recovery in the energy infrastructure market, accelerating demand in the electric vehicle market and continued market share gains in the sustainable building materials market.

Cost of Revenue

	Year Ended December 31,						Change	
	2021		2020				Amount	Percentage
	Amount	Percentage of Related Revenue	Percentage of Total Revenue	Amount	Percentage of Related Revenue	Percentage of Total Revenue		
(\$ in thousands)								
Cost of revenue:								
Product	\$ 111,552	92%	92%	\$ 85,545	86%	85%	\$ 26,007	30%
Research services	133	26%	0%	134	31%	0%	(1)	(1)%
Total cost of revenue	<u>\$ 111,685</u>	92%	92%	<u>\$ 85,679</u>	85%	85%	<u>\$ 26,006</u>	30%

Total cost of revenue increased \$26.0 million, or 30%, to \$111.7 million in 2021 from \$85.7 million in 2020. The increase in total cost of revenue was the result of an increase in product cost of revenue.

Product cost of revenue increased \$26.1 million, or 30%, to \$111.6 million in 2021 from \$85.5 million in 2020. The \$26.1 million increase was the result of a \$14.5 million increase in material costs and an \$11.6 million increase in manufacturing expense. The increase in material costs was driven principally by the 6.4 million square feet, or 22%, increase in product shipments, an increase in manufacturing costs and an unfavorable mix of products sold. The increase in manufacturing expense was primarily driven by increases in compensation and related costs of \$8.0 million, operating supplies of \$2.1 million, maintenance costs of \$0.6 million, waste disposal costs of \$0.5 million, and operating costs of \$0.4 million.

Product cost of revenue as a percentage of product revenue increased to 92% in 2021 from 86% in 2020. This increase was the result of the increase in both material costs and manufacturing expense as a percentage of revenue during the year ended December 31, 2021.

During 2022, we expect that cost of product revenue will increase in absolute dollars due to projected volume growth and a planned increase in staffing and spending levels to meet our expected revenue growth, but decrease as a percentage of product revenue due to projected increases in average selling prices, improved manufacturing and fabrication yields and a favorable mix of products sold.

Gross Profit

	Year Ended December 31,				Change	
	2021		2020			
	Amount	Percentage of Revenue	Amount	Percentage of Revenue	Amount	Percentage
(\$ in thousands)						
Gross profit	\$ 9,937	8%	\$ 14,594	15%	\$ (4,657)	(32)%

Gross profit decreased \$4.7 million, or 32%, to \$9.9 million in 2021 from \$14.6 million in 2020. The decrease in gross profit was the result the \$26.0 million increase in total cost of revenue, partially offset by the \$21.3 million increase in total revenue. The increase in total cost of revenue was principally driven by the 6.4 million square feet, or 22%, increase in product shipments. The increase in total revenue was principally the result of the 6.4 million square feet, or 22%, increase in product shipments.

Gross profit as a percentage of total revenue decreased to 8% in 2021 from 15% in 2020. This decrease was principally the result of the \$11.6 million increase in manufacturing costs and the unfavorable mix of products sold.

During 2022, we expect gross profit to increase in both in absolute dollars and as a percentage of total revenue due principally to the projected increase in total revenue combined with a projected reduction in material costs as a percentage of total revenue, offset, in part, by a projected increase in manufacturing expense as a percentage of revenue.

Research and Development Expenses

	Year Ended December 31,				Change	
	2021		2020		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Research and development expenses	\$ 11,441	9%	\$ 8,729	9%	\$ 2,712	31%

Research and development expenses increased by \$2.7 million, or 31%, to \$11.4 million in 2021 from \$8.7 million in 2020. The \$2.7 million increase was the result of increases in compensation and related costs of \$1.6 million, professional fees of \$0.6 million and other research and development expenses of \$0.5 million.

Research and development expenses as a percentage of total revenue was 9% during the years ended December 31, 2021 and 2020.

We expect that our research and development expenses will increase in both absolute dollars and as a percentage of revenue during 2022 in line with our decision to increase resources dedicated to the development of new aerogel products and technologies, including our carbon aerogel battery materials.

In the long-term, we expect to continue to increase investment in research and development in our efforts to enhance and expand our aerogel technology platform. However, we expect that research and development expenses will decline as a percentage of total revenue in the long-term due to projected growth in product revenue.

Sales and Marketing Expenses

	Year Ended December 31,				Change	
	2021		2020		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Sales and marketing expenses	\$ 16,581	14%	\$ 11,753	12%	\$ 4,828	41%

Sales and marketing expenses increased by \$4.8 million, or 41%, to \$16.6 million in 2021 from \$11.8 million in 2020. The increase was the result of increases in compensation and related costs of \$4.6 million and other expenses of \$0.7 million, partially offset by a decrease in sales consultant expenditures of \$0.5 million.

Sales and marketing expenses as a percentage of total revenue increased to 14% in 2021 from 12% in 2020 primarily due to elevated levels of compensation associated with an increase in sales and marketing personnel.

We expect sales and marketing expenses to increase in both absolute dollars and as a percentage of revenue during 2022, due principally to planned increases in staffing in support of our PyroThin thermal barrier business and a planned increase in marketing expense during the year.

In the long-term, we expect that sales and marketing expenses will continue to increase in absolute dollars as we continue to increase sales personnel and marketing efforts in support of expected growth in demand for our products. However, we expect that sales and marketing expenses will decrease as a percentage of total revenue in the long-term due to projected growth in product revenue.

General and Administrative Expenses

	Year Ended December 31,				Change	
	2021		2020		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
General and administrative expenses	\$ 22,514	19%	\$ 15,681	16%	\$ 6,833	44%

General and administrative expenses increased by \$6.8 million, or 44%, to \$22.5 million in 2021 from \$15.7 million in 2020. The \$6.8 million increase was the result of increases in compensation and related costs of \$2.8 million, professional fees of \$2.4

million, and other general and administrative costs of \$2.2 million, partially offset by a decrease in the provision for bad debt of \$0.6 million.

General and administrative expenses as a percentage of total revenue increased to 19% in 2021 from 16% in 2020 primarily due to increased expenditures associated with the growth in our human resource, finance, information technology and general management organizations in preparation for the anticipated growth in our business.

We expect general and administrative expenses to increase in both absolute dollars and as a percentage of revenue during 2022.

We also expect to increase general and administrative personnel and expense levels in the long term to support the anticipated growth of our business and continued expansion of our manufacturing operations. We also expect that the patent enforcement actions, described in more detail under “Legal Proceedings” in part I, Item 3, of this Annual Report on Form 10-K, could result in significant additional legal expense over the medium-to-long term. However, in the longer term, we expect that general and administrative expenses will decrease as a percentage of revenue due to projected growth in product revenue.

Interest Expense, Net

	Year Ended December 31,				Change	
	2021		2020		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Interest expense, net	\$ (229)	(0)%	\$ (240)	(0)%	\$ 11	(5)%

Interest expense, net, consisting primarily of fees and interest expense associated with outstanding balances under our revolving credit agreement, was \$0.2 million in 2021 and 2020.

Year ended December 31, 2020 compared to year ended December 31, 2019

The following tables set forth our results of operations for the periods presented:

	Year Ended December 31,				Year Ended December 31,	
	2020	2019	\$ Change	% Change	2020	2019
	(\$ in thousands)				(Percentage of total revenue)	
Revenue:						
Product	\$ 99,834	\$ 136,934	\$ (37,100)	(27)%	100%	98%
Research services	439	2,441	(2,002)	(82)%	0%	2%
Total revenue	100,273	139,375	(39,102)	(28)%	100%	100%
Cost of revenue:						
Product	85,545	111,759	(26,214)	(23)%	85%	80%
Research services	134	1,332	(1,198)	(90)%	0%	1%
Gross profit	14,594	26,284	(11,690)	(44)%	15%	19%
Operating expenses:						
Research and development	8,729	8,407	322	4%	9%	6%
Sales and marketing	11,753	15,557	(3,804)	(24)%	12%	11%
General and administrative	15,681	16,479	(798)	(5)%	16%	12%
Total operating expenses	36,163	40,443	(4,280)	(11)%	36%	29%
Loss from operations	(21,569)	(14,159)	(7,410)	52%	(22)%	(10)%
Interest expense, net	(240)	(406)	166	(41)%	(0)%	(0)%
Total interest expense, net	(240)	(406)	166	(41)%	(0)%	(0)%
Net loss	\$ (21,809)	\$ (14,565)	\$ (7,244)	50%	(22)%	(10)%

Revenue

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
(\$ in thousands)						
Revenue:						
Product	\$ 99,834	100%	\$ 136,934	98%	\$ (37,100)	(27)%
Research services	439	0%	2,441	2%	(2,002)	(82)%
Total revenue	<u>\$ 100,273</u>	100%	<u>\$ 139,375</u>	100%	<u>\$ (39,102)</u>	(28)%

The following chart sets forth product shipments in square feet associated with recognized revenue, including revenue recognized over time utilizing the input method, for the periods presented:

	Year Ended December 31,		Change	
	2020	2019	Amount	Percentage
	Product shipments in square feet (in thousands)	28,635	40,720	(12,085)

Total revenue decreased \$39.1 million, or 28%, to \$100.3 million in 2020 from \$139.4 million in 2019. The decrease in total revenue was the result of decreases in both product revenue and research services revenue.

Product revenue decreased by \$37.1 million, or 27%, to \$99.8 million in 2020 from \$136.9 million in 2019. This decrease was principally the result of COVID-19 related decreases in both project and maintenance-based demand in the global energy infrastructure market, offset, in small part, by growth in the building materials market and the impact of our 2020 price increase.

Product revenue for the year ended December 31, 2020, included \$20.7 million in sales to Distribution International, Inc. and \$15.3 million in sales to SPCC Joint Venture. Product revenue for the year ended December 31, 2019, included \$27.3 million in sales to Distribution International, Inc. and \$18.0 million in sales to SPCC Joint Venture. The average selling price per square foot of our products increased by \$0.13, or 4%, to \$3.49 per square foot for the year ended December 31, 2020, from \$3.36 per square foot for the year ended December 31, 2019. The increase in average selling price principally reflected the impact of price increases enacted in 2020. This increase in average selling price had the effect of increasing product revenue by approximately \$3.6 million for the year ended December 31, 2020.

In volume terms, product shipments decreased by 12.1 million square feet, or 30%, to 28.6 million square feet of aerogel products for the year ended December 31, 2020, as compared to 40.7 million square feet in the year ended December 31, 2019. The decrease in product volume had the effect of decreasing product revenue by approximately \$40.7 million for the year ended December 31, 2020.

Research services revenue decreased by \$2.0 million, or 82%, to \$0.4 million in 2020 from \$2.4 million in 2019. The decrease was primarily due to our decision to wind down our contract research activities to focus our research and development resources on improving the profitability of our existing business and developing new products and next-generation technology with application in new, high value markets.

Product revenue as a percentage of total revenue was greater than 99% of total revenue in 2020 and 98% of total revenue in 2019. Research services revenue was less than 1% of total revenue in 2020 and 2% of total revenue in 2019.

Cost of Revenue

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Related Revenue	Amount	Percentage of Related Revenue		
(\$ in thousands)						
Cost of revenue:						
Product	\$ 85,545	86%	\$ 111,759	82%	\$ (26,214)	(23)%
Research services	134	31%	1,332	55%	(1,198)	(90)%
Total cost of revenue	<u>\$ 85,679</u>	85%	<u>\$ 113,091</u>	81%	<u>\$ (27,412)</u>	(24)%

Total cost of revenue decreased \$27.4 million, or 24%, to \$85.7 million in 2020 from \$113.1 million in 2019. The decrease in total cost of revenue was the result of decreases in both product cost of revenue and research services cost of revenue.

Product cost of revenue decreased \$26.2 million, or 23%, to \$85.5 million in 2020 from \$111.8 million in 2019. The \$26.2 million decrease was the result of a \$22.7 million decrease in material costs and a \$3.5 million decrease in manufacturing expense. The decrease in material costs was driven principally by the 12.1 million square feet, or 30%, decrease in product shipments and the impact of our bill of material cost reduction initiatives. The decrease in manufacturing expense was primarily driven by decreases in variable plant and operating costs of \$2.3 million and compensation and related costs of \$1.2 million.

Product cost of revenue as a percentage of product revenue increased to 86% in 2020 from 82% in 2019. This increase was the result of the high proportion of fixed manufacturing expenses in our East Providence manufacturing facility that remained essentially unchanged despite a 27% decrease in product revenue in 2020, offset, in part, by the impact of our 2020 price increases, bill of material sourcing efficiencies, and discretionary expense controls in response to the COVID-19 pandemic.

Research services cost of revenue decreased by \$1.2 million, or 90%, to \$0.1 million in 2020 from \$1.3 million in 2019. Cost of research service revenue as a percentage of research services revenue decreased to 31% in 2020 from 55% in 2019 due to our decision to wind down existing research activities.

Gross Profit

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Gross profit	\$ 14,594	15%	\$ 26,284	19%	\$ (11,690)	(44)%

Gross profit decreased \$11.7 million, or 44%, to \$14.6 million in 2020 from \$26.3 million in 2019. The decrease in gross profit was the result of the \$39.1 million decrease in total revenue, offset, in part, by the \$27.4 million decrease in total cost of revenue. The decrease in revenue was principally the result of COVID-19 related decreases in both project and maintenance-based demand in the global energy infrastructure market, offset, in small part, by growth in our building materials business and the impact of our 2020 price increase. The decrease in total cost of revenue was principally the result of the 12.1 million square feet, or 30%, decrease in product shipments.

Gross profit as a percentage of total revenue decreased to 15% in 2020 from 19% in 2019. This decrease was principally the result of the high proportion of fixed manufacturing expenses in our East Providence manufacturing facility that remained essentially unchanged despite the 27% decrease in product revenue in 2020.

Research and Development Expenses

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Research and development expenses	\$ 8,729	9%	\$ 8,407	6%	\$ 322	4%

Research and development expenses increased by \$0.3 million, or 4%, to \$8.7 million in 2020 from \$8.4 million in 2019. The \$0.3 million increase reflected our decision to focus research activities on the development of new products and next-generation technology with application in new, high value markets, including the electric vehicle market.

Research and development expenses as a percentage of total revenue increased to 9% during the year ended December 31, 2020, from 6% during the comparable period in 2019. The increase was the result of both the increase in research and development expenses and the decrease in total revenue.

Sales and Marketing Expenses

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Sales and marketing expenses	\$ 11,753	12%	\$ 15,557	11%	\$ (3,804)	(24)%

Sales and marketing expenses decreased by \$3.8 million, or 24%, to \$11.8 million in 2020 from \$15.6 million in 2019. The decrease was the result of decreases in compensation and related costs of \$1.7 million, travel and related costs of \$1.3 million, sales consultant costs of \$0.6 million, and other expenses of \$0.2 million.

Sales and marketing expenses as a percentage of total revenue increased to 12% in 2020 from 11% in 2019 primarily due to the decrease in overall revenue of 28%.

General and Administrative Expenses

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
General and administrative expenses	\$ 15,681	16%	\$ 16,479	12%	\$ (798)	(5)%

General and administrative expenses decreased by \$0.8 million, or 5%, to \$15.7 million in 2020 from \$16.5 million in 2019. The \$0.8 million decrease was the result of decreases in patent enforcement costs of \$0.6 million, professional and legal fees of \$0.3 million, compensation and related costs of \$0.3 million and other general administrative expenses of \$0.1 million, offset in part by an increase in the provision for bad debts of \$0.3 million and a \$0.2 million decrease in recoveries of bad debt in 2020 as compared to 2019.

General and administrative expenses as a percentage of total revenue increased to 16% in 2020 from 12% in 2019 primarily due to the 28% decrease in revenue in 2020.

Interest Expense, net

	Year Ended December 31,				Change	
	2020		2019		Amount	Percentage
	Amount	Percentage of Revenue	Amount	Percentage of Revenue		
	(\$ in thousands)					
Interest expense, net	\$ (240)	(0)%	\$ (406)	(0)%	\$ 166	(41)%

Interest expense, net, consisting primarily of fees and interest expense associated with outstanding balances under our revolving credit agreement, was \$0.2 million and \$0.4 million in 2020 and 2019, respectively.

Liquidity and Capital Resources

Overview

We have experienced significant losses and invested substantial resources since our inception to develop, commercialize and protect our aerogel technology and to build a manufacturing infrastructure capable of supplying aerogel products at the volumes and costs required by our customers. These investments have included research and development and other operating expenses, capital expenditures, and investment in working capital balances.

Our long-term financial projections anticipate revenue growth, increasing levels of gross profit, and improved cash flows from operations. To meet expected growth in demand for our aerogel products in the electric vehicle market, we are planning to expand our aerogel blanket capacity by constructing a second manufacturing plant in Bulloch County, Georgia. We expect to build the second plant in two phases at an estimated cost of \$575.0 million for the first phase and \$125.0 million for the second phase. We expect to

have the first phase of the second plant operational late in the second-half of 2023. In addition, we are planning to construct and commence operation of a state-of-the-art, automated thermal barrier fabrication operation in Monterrey, Mexico during 2022 in order to keep pace with the significant potential demand for our PyroThin thermal barriers.

We are also increasing our investment in the research and development of next-generation aerogel products and technologies. During 2022, we will continue to develop aerogel products and technologies for the electric vehicle market. We believe the commercial potential for our technology in the electric vehicle market is significant. To meet the anticipated revenue growth and take advantage of this market opportunity, we are adding personnel, incurring additional operating expenses, and planning to construct a carbon aerogel battery materials facility, among other items.

We took several actions during 2021 to increase the financial resources available to support current operating requirements and capital expenditures. During the year ended December 31, 2021, we sold an additional 929,981 shares of our common stock through the ATM offering program and received net proceeds of \$19.4 million. On June 29, 2021, we sold 3,462,124 shares to an affiliate of Koch in a private placement of our common stock and received net proceeds of \$73.5 million.

On February 15, 2022, we entered into a securities purchase agreement with an affiliate of Koch to sell 1,791,986 shares for aggregate gross proceeds of \$50.0 million, or the Common Stock PIPE. The closing of the Common Stock PIPE is subject to customary closing conditions, including the expiration or termination of the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976. On February 18, 2022, we sold and issued to an affiliate of Koch \$100.0 million in aggregate principal amount of Notes or the Convertible Note PIPE. The Notes bear interest at the rate of SOFR plus 5.50% per annum if interest is paid in cash, or, if interest is paid in kind (through an increase in the principal amount of the outstanding Notes or through the issuance of additional Notes), at SOFR plus 6.50% per annum. Under the terms of the investment, SOFR has a floor of 1% and a cap of 3%. We can elect to make any interest payment through Cash Interest, PIK Interest or any combination thereof. Interest on the Notes is payable semi-annually in arrears on June 30 and December 30, commencing on June 30, 2022. It is expected that the Notes will mature on February 18, 2027, subject to earlier conversion, redemption or repurchase.

We believe that our December 31, 2021 cash and cash equivalents balance of \$76.6 million, plus the existing and anticipated proceeds from the Convertible Note PIPE and the Common Stock PIPE, respectively, and funds available under our revolving credit facility will be sufficient to support current operating requirements, current research and development activities and the initial capital expenditures required to support the evolving commercial opportunities in the electric vehicle market and other strategic business opportunities.

However, we plan to supplement our cash balance and available credit with equity financings, debt financings, customer prepayments or technology licensing fees to provide the additional capital necessary to purchase the capital equipment, construct the new facilities and complete the aerogel capacity expansions required to support our evolving commercial opportunities and strategic business initiatives. We also intend to extend or replace our revolving credit facility with Silicon Valley Bank prior to its maturity.

Primary Sources of Liquidity

Our principal sources of liquidity are currently our cash and cash equivalents and our revolving credit facility with Silicon Valley Bank. Cash and cash equivalents consist primarily of cash, money market accounts, and sweep accounts on deposit with banks. As of December 31, 2021, we had \$76.6 million of cash and cash equivalents.

On November 5, 2020, we entered into a sales agreement for an at-the-market offering program (ATM) under which we could sell up to \$33,871,250 of our common stock through B. Riley Securities, Inc. We agreed to pay B. Riley a commission of 3.0% of the gross proceeds of shares sold under the agreement. During the year ended December 31, 2021, we sold 929,981 shares of our common stock through the ATM and received net proceeds of \$19.4 million.

On June 29, 2021, we sold 3,462,124 shares to an affiliate of Koch in a private placement of our common stock and received net proceeds of \$73.5 million after deducting fees and offering expenses of \$1.5 million.

On February 15, 2022, we entered into a securities purchase agreement with an affiliate of Koch to sell 1,791,986 shares for aggregate gross proceeds of \$50.0 million. The closing of the Common Stock PIPE is subject to customary closing conditions, including the expiration or termination of the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976. On February 18, 2022, we issued to an affiliate of Koch \$100.0 million in aggregate principal amount of Notes.

On May 1, 2020, our wholly owned subsidiary, Aspen Aerogels Rhode Island, LLC, (Borrower) executed a note for a loan of \$3.7 million pursuant to the Paycheck Protection Program under the CARES Act, as amended, and administered by the Small Business Administration (SBA). On August 24, 2021, the SBA remitted \$3.7 million in principal and less than \$0.1 million in accrued

interest to the noteholder after approving the Borrower's application for forgiveness of the loan under the provisions of the CARES Act. Accordingly, we recorded a total gain on the extinguishment of debt of \$3.7 million during the year ended December 31, 2021.

We have maintained our revolving credit facility, as amended from time to time, with Silicon Valley Bank since March 2011. On March 12, 2021, we amended and restated the revolving credit facility to extend the maturity date to April 28, 2022 and to establish certain minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants. On September 29, 2021, and subsequently on December 27, 2021, we entered into an amendment to the loan agreement to revise certain financial covenants, among other items. We intend to extend or replace the facility prior to its maturity.

Under our revolving credit facility, we may borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, as defined, subject to a minimum rate of 4.00% per annum, plus a margin. The rates applicable to borrowings vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility.

Under the revolving credit facility, we are required to comply with both non-financial and financial covenants, including minimum Adjusted EBITDA and Adjusted Quick Ratio covenants, as defined in the loan agreement. At December 31, 2021, we were in compliance with all such covenants. The amount available to us under the revolving credit facility at December 31, 2021 was \$12.6 million after giving effect to \$1.3 million in outstanding letters of credit.

At December 31, 2021, we had no outstanding borrowings under our revolving credit facility with Silicon Valley Bank, \$1.3 million of outstanding letters of credit secured by the revolving credit facility, and an obligation of \$9.7 million associated with prepayments received pursuant to our supply agreement with BASF. In January 2022, BASF requested that an outstanding prepayment balance of \$4.6 million be repaid and we made the requested repayment on February 15, 2022.

See "Risk Factors - Risks Related to Our Business and Strategy - We will require significant additional capital to pursue our growth strategy, but we may not be able to obtain additional financing on acceptable terms or at all" in this Annual Report on Form 10-K for the year ended December 31, 2021.

Analysis of Cash Flow

The following table summarizes our cash flows for the periods indicated:

	Year Ended December 31,		
	2021	2020	2019
	(\$ in thousands)		
Net cash provided by (used in):			
Operating activities	\$ (18,628)	\$ (9,924)	\$ (1,054)
Investing activities	(13,778)	(3,416)	(2,112)
Financing activities	92,474	26,203	3,472
Net increase in cash	60,068	12,863	306
Cash, beginning of period	16,496	3,633	3,327
Cash and cash equivalents, end of period	<u>\$ 76,564</u>	<u>\$ 16,496</u>	<u>\$ 3,633</u>

Operating Activities

During 2021, we used \$18.6 million in net cash in operating activities, as compared to the use of \$9.9 million in net cash during 2020, an increase in the use of cash of \$8.7 million. This increase in the use of cash was the result of the increase in net loss adjusted for non-cash items of \$19.4 million, and a decrease in cash provided by changes in working capital of \$10.8 million.

During 2020, we used \$9.9 million in net cash in operating activities, as compared to the use of \$1.1 million in net cash during 2019, an increase in the use of cash of \$8.8 million. This increase in the use of cash was the result of the increase in net loss adjusted for non-cash items of \$5.7 million, and a decrease in cash provided by changes in working capital of \$3.1 million.

Investing Activities

Net cash used in investing activities is for capital expenditures for machinery and equipment principally to improve the throughput, efficiency and capacity of our East Providence facility and engineering designs for the planned aerogel manufacturing

facility in Bulloch County, Georgia. Net cash used in investing activities for 2021 and 2020 totaled \$13.8 million and \$3.4 million, respectively.

Financing Activities

Net cash provided by financing activities in 2021 totaled \$92.5 million and consisted of \$19.4 million of net proceeds from our ATM, net proceeds from the private placement of common stock of \$73.5 million, and proceeds from employee stock option exercises of \$2.3 million, offset, in part, by \$2.7 million for payments for employee tax withholdings associated with the vesting of restricted stock units.

Net cash provided by financing activities in 2020 totaled \$26.2 million and consisted of \$19.4 million in borrowings under our revolving credit facility, \$14.8 million in net proceeds from an underwritten public offering of our common stock, \$9.5 million in net proceeds from our ATM, \$3.7 million in net proceeds from the issuance of long term debt and \$2.6 million in proceeds from employee stock option exercises, offset, in part, by \$22.6 million of repayments under our revolving credit facility and \$1.2 million for payments for employee tax withholdings associated with the vesting of restricted stock units.

Capital Spending and Future Capital Requirements

We have made capital expenditures primarily to develop and expand our manufacturing capacity. Our capital expenditures totaled \$13.8 million in 2021, \$3.4 million in 2020 and \$2.1 million in 2019. As of December 31, 2021, we had capital commitments of approximately \$16.9 million, which included commitments for which we have entered into contracts as well as commitments authorized by our Board of Directors and relate to the enhancement of our existing production lines in our East Providence facility and the planned aerogel manufacturing facility in Bulloch County, Georgia. These commitments consist primarily of costs for equipment and construction.

We expect to build a second manufacturing plant in Bulloch County, Georgia, in two phases at an estimated cost of \$575.0 million for the first phase and \$125.0 million for the second phase. We currently expect that the first phase of the plant will increase our annual revenue capacity by approximately \$650.0 million and the second phase by approximately \$700.0 million.

We intend to fund capital expenditures related to the expansion of capacity of our existing manufacturing facility with our existing cash balance, available credit and anticipated cash flows from operations. We plan to fund the capital expenditures required to establish an automated thermal barrier fabrication operation, build a carbon aerogel battery materials facility, and to construct a new aerogel blanket manufacturing facility with additional equity financings, debt financings, customer prepayments, technology licensing fees or credit facilities.

Off-Balance Sheet Arrangements

Since inception, we have not engaged in any off-balance sheet activities that have or are reasonably likely to have a material current or future effect on our financial condition, changes in financial condition, revenues or expenses, results of operations, liquidity, capital expenditures, or capital resources.

Contractual Obligations and Commitments

Operating Leases

We lease office space for our corporate offices in Northborough, Massachusetts, which expires in 2031. We also lease additional facilities in East Providence, Rhode Island; Marlborough, Massachusetts; and Pawtucket, Rhode Island for research, administrative, fabrication, and warehousing purposes under leases expiring between March 31, 2024 and October 1, 2031. See "Item 2 — Properties." We also lease vehicles and equipment under non-cancelable operating leases that expire at various dates.

On December 22, 2021 we entered into a modified lease with G&I IX Forbes Whitney LLC, to lease approximately 51,650 square feet of space located at 30 Forbes Road, Northborough, Massachusetts 01532, the location of our current headquarters. The lease superseded a lease between us and Forbes Whitney LLC's predecessor-in-interest. The term of the lease began retroactively on September 1, 2021 and ends on December 31, 2031. The annual base rent associated with the lease was approximately \$459,000 during 2021 and has and will increase by approximately 3% annually through August 31, 2027. Beginning September 1, 2027, the base rent for the Leased Property would be reset to \$11.75 per square foot, increasing by 3% annually for the remaining term of the

lease. The lease also provides for our payment of our pro rata share of real estate taxes and certain other expenses. Upon the expiration of the lease term, we will have the right to extend the lease for an additional five years.

Thermal Barrier Contract

We are party to production contracts with a major U.S. automotive original equipment manufacturer, or OEM, to supply fabricated, multi-part thermal barriers, or Barriers, for use in the battery system of its next-generation electric vehicles, or Contracts. Pursuant to the Contracts, we are obligated to supply Barriers at fixed annual prices and at volumes to be specified by the OEM up to a daily maximum quantity through the respective terms of the agreements, which expire at various times from 2026 through 2034. While the OEM has agreed to purchase its requirement for Barriers for locations to be designated from time to time by the OEM, it has no obligation to purchase any minimum quantity of Barriers under the Contracts. In addition, the OEM may terminate the Contracts any time and for any or no reason. All other terms of the Contracts are generally consistent with the OEM's standard purchase terms, including quality and warranty provisions customary in the automotive industry.

Supply Agreement

We were party to a supply agreement, as amended, with BASF Polyurethanes GmbH (BASF), or the Supply Agreement, and a joint development agreement with BASF SE, or the JDA. Pursuant to the Supply Agreement, the Company agreed to sell exclusively to BASF certain of our products at annual volumes specified by BASF, subject to certain volume limits, through December 31, 2027.

Through the year ended December 31, 2019, BASF made two prepayments each in the amount of \$5.0 million to us. BASF had the right to request that 25.3% of any amounts invoiced by us to BASF for Spaceloft A2 were to be credited against the outstanding balance of the prepayments. BASF also had the right to request that we repay any uncredited amount of the first prepayment to BASF following a six-week notice period on or after January 1, 2022 and the second prepayment on or after January 1, 2023.

As of December 31, 2021, we had received \$10.0 million in prepayments from BASF and applied approximately \$0.3 million of credits against amounts invoiced to BASF for Spaceloft A2.

During 2021, we jointly announced that BASF would discontinue further marketing and sale of Spaceloft A2 as of November 15, 2021. After that date, BASF customers have had the right to purchase Spaceloft A2 directly from the Company.

On December 15, 2021, we terminated the supply arrangement with BASF. As part of the termination, we agreed that any uncredited prepayment balances would remain outstanding and subject to repayment upon BASF's request following the requisite six-week notice periods after January 1, 2022 and January 1, 2023, respectively.

Revolving Credit Facility

In March 2011, we entered into a revolving credit facility with Silicon Valley Bank. This facility had been amended at various dates through December 2020. On March 12, 2021, we amended and restated our revolving credit facility with Silicon Valley Bank to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels with respect to the minimum Adjusted EBITDA and minimum Adjusted Quick Ratio covenants, as defined. On September 29, 2021 and subsequently on December 27, 2021, we entered into an amendment to the Loan Agreement to revise certain financial covenants, among other things. Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum, plus a margin. Prime rate-based rates vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line of credit facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. We intend to extend or replace the facility prior to its maturity.

At December 31, 2021, the amount available to us under the revolving credit facility was \$12.6 million after giving effect to \$1.3 million in letters of credit outstanding under the facility.

On February 18, 2022, we sold and issued to an affiliate of Koch \$100.0 million in aggregate principal amount of Notes. The Notes bear interest at the rate of SOFR plus 5.50% per annum if interest is paid in cash, or, if interest is paid in kind (through an increase in the principal amount of the outstanding Notes or through the issuance of additional Notes), at SOFR plus 6.50% per annum. Under the terms of the investment, SOFR has a floor of 1% and a cap of 3%. We can elect to make any interest payment through Cash Interest, PIK Interest or any combination thereof. Interest on the Notes is payable semi-annually in arrears on June 30

and December 30, commencing on June 30, 2022. It is expected that the Notes will mature on February 18, 2027, subject to earlier conversion, redemption or repurchase.

The Notes are convertible at the option of the holder at any time until the business day prior to the maturity date, including in connection with a redemption by us. The Notes are convertible into shares of common stock based on an initial conversion rate of 28.623257 shares of our common stock per \$1,000 principal amount of the Notes (which is equal to an initial conversion price of \$34.936625 per share, or the Conversion Price), in each case subject to customary anti-dilution and other adjustments (as described in the Indenture, which governs the Notes). If the closing price per share of our common stock on the New York Stock Exchange is at least 130% of the Conversion Price for 20 consecutive trading days, we may elect to convert the principal and accrued interest owing under the Notes, plus a make-whole amount equal to the sum of the present values of the remaining interest payments that would have otherwise been payable from the date of such conversion, redemption or repurchase, as applicable, through maturity, or the Make-Whole Amount, into our common stock at the Conversion Price.

The Notes are redeemable by us at any time and from time to time in the event that the volume weighted average price of our common stock for the 10 trading days immediately preceding the date on which we provide the redemption notice has been at least 130% of the Conversion Price then in effect, at a redemption price of 100% of the principal amount of such Notes, plus accrued and unpaid interest to, but excluding the redemption date, plus the Make-Whole Amount.

Recently Issued Accounting Standards

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board (FASB) or other standard setting bodies. Recently issued standards typically do not require adoption until a future effective date. Prior to their effective date, the Company evaluates the pronouncements to determine the potential effects of adoption to its consolidated financial statements.

Standards Implemented Since December 31, 2020

The Company has not implemented any accounting standards that had a material impact on its consolidated financial statements during the year ended December 31, 2021.

Standards to be Implemented

The Company believes that the impact of recently issued accounting standards that are not yet effective will not have a material impact on its consolidated financial statements.

Critical Accounting Policies and Estimates

Our financial statements are prepared in accordance with accounting principles generally accepted in the United States of America. The preparation of our financial statements and related disclosures requires us to make estimates, assumptions and judgments that affect the reported amount of assets, liabilities, revenue, costs and expenses and related disclosures. We believe that the estimates, assumptions and judgments involved in these accounting policies have the greatest potential impact on our financial statements; and therefore, we consider these to be our critical accounting policies. Accordingly, we evaluate our estimates and assumptions on an ongoing basis. Our actual results may differ from these estimates under different assumptions and conditions. See note 2 to our consolidated financial statements included elsewhere in this Annual Report on Form 10-K for information about these critical accounting policies, as well as a description of our other significant accounting policies.

Revenue Recognition

We recognize product revenue from the sale of our line of aerogel products and research services revenue from the provision of services under contracts with various agencies of the U.S. government and other institutions. Product and research services revenue is recognized upon the satisfaction of contractual performance obligations. In general, our customary shipping terms are FOB shipping point. Products are typically delivered without significant post-sale obligations to customers other than standard warranty obligations for product defects. We provide warranties for our products and record the estimated cost within cost of sales in the period that the revenue is recorded. Our standard warranty period extends one to two years from the date of shipment, depending on the type of product purchased. Our warranties provide that our products will be free from defects in material and workmanship, and will, under normal use, conform to the specifications for the product.

We recorded warranty expense of less than \$0.1 million during the year ended December 31, 2021. We did not record any warranty expense during the years ended December 31, 2020 and 2019. As of December 31, 2021, we had satisfied all outstanding warranty claims.

Research services revenue is derived from the execution of contracts awarded by the U.S. government, other government agencies and other institutions. Our research service arrangements require us to perform research to investigate new forms and applications of aerogel technology. We record revenue earned on research services contracts using the percentage-of-completion method in two ways: (1) for firm-fixed-price contracts, we accrue that portion of the total contract price that is allocable, on the basis of our estimates of costs incurred to date to total contract cost; (2) for cost-plus-fixed-fee contracts, we record revenue that is equal to total payroll cost incurred times a stated factor plus reimbursable expenses, to a stated upper limit. The primary cost in these arrangements is the labor effort expended in completing the research. Typically, the only deliverable, other than labor hours expended, is reporting research results to the customer or delivery of research grade aerogel products. Because the input measure of labor hours expended is also reflective of the output measure, it is a reliable means to measure the extent of progress towards completion. Contract costs and rates used to allocate overhead to contracts are subject to audit by the respective contracting government agency. Revisions in cost estimates and fees during the course of the contract are reflected in the accounting period in which the facts that require the revisions become known. In 2019, we decided to wind down our existing contract research activities. This decision reflected our desire to focus our research and development resources on initiatives to improve the profitability of our existing business and on efforts to develop new products and next-generation technology with application in new, high value markets.

Stock-based Compensation

We maintain an equity incentive plan pursuant to which our board of directors may grant qualified and nonqualified stock options, restricted stock, restricted stock units and other stock-based awards to board members, officers, key employees and others who provide or have provided service to us.

We measure the costs associated with stock-based awards based on their estimated fair value at date of grant. We recognize the cost of stock-based awards as service, performance or market conditions are met. Future expense amounts for any particular quarterly or annual period could be affected by changes in our assumptions or changes in market conditions.

Stock Options

We use the Black-Scholes option-pricing model to estimate the fair value of stock option awards. The determination of the estimated fair value of stock option awards is based on a number of complex and subjective assumptions. These assumptions include the determination of the estimated fair value of the underlying security, the expected volatility of the underlying security, a risk-free interest rate, the expected term of the option, and the forfeiture rate for the award class. The following assumptions were used to estimate the fair value of the option awards:

	Year Ended December 31,		
	2021	2020	2019
Weighted-average assumptions:			
Expected term (in years)	5.96	5.96	5.81
Expected volatility	59.80%	52.27%	49.90%
Risk free rate	0.86%	1.08%	2.44%
Expected dividend yield	—%	—%	—%

- The expected term represents the period that our stock-based awards are expected to be outstanding and is determined using the simplified method described in ASC Topic 718, *Compensation — Stock Compensation*, for all grants. We believe this is a better representation of the estimated life than our actual limited historical exercise behavior.
- For the year ended December 31, 2021, we used our historical volatility as a basis to estimate expected volatility in the valuation of stock options. For the years ended December 31, 2020 and 2019, the expected volatility is primarily based on the weighted-average volatility of up to 17 companies within various industries that we believe are similar to our own.
- The risk-free interest rate is based on U.S. Treasury zero-coupon issues with a remaining term equal to the expected life assumed at the date of grant.
- We use an expected dividend yield of zero, since we do not intend to pay cash dividends on our common stock in the foreseeable future, nor have we paid dividends on our common stock in the past.

For stock options that contained a market condition we use a Monte-Carlo Simulation model to estimate the grant date fair value of awards expected to vest. We based the simulation model on the Black Scholes option-pricing model and a number of other complex assumptions including (i) whether the vesting condition would be satisfied within the time-vesting periods, and (ii) the date the common stock price target would be achieved per the terms of the agreement. On December 10, 2020, we modified the vesting conditions of NSOs to purchase 116,279 shares of common stock held by our CEO to extend the time period to achieve the common stock price target. We accounted for the extension of the time period as a modification and recognized \$1.1 million of incremental stock compensation expense during the year ended December 31, 2020.

For the restricted stock award issued to our Chief Executive Officer during the year ended December 31, 2015 that contains a performance condition, we assess the probability that the performance condition will be satisfied. On August 2, 2017, we modified the performance target with respect to 78,125 shares of these awards. As of December 31, 2020, the performance condition was not achieved and the award expired by its terms.

For the restricted stock awards issued to our Chief Executive Officer during the year ended December 31, 2021 that will vest subject to achievement of certain volume weighted average common stock price targets over a three-to-five year period, we used a Monte-Carlo simulation model to estimate the grant date fair value with respect to 461,616 shares of restricted common stock. The award had an aggregate date fair value of \$6.5 million.

During 2020, we estimated the fair value of the modified NSOs to purchase 116,279 of common stock held by our Chief Executive Officer by use of the Black-Scholes option-pricing model assuming an expected term of 2.5 years, an expected volatility of 67.23%, a risk-free rate of 0.17% and an expected dividend yield of zero.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Market risk represents the risk of loss that may impact our financial position due to adverse changes in financial market prices and rates. Our market risk exposure results primarily from fluctuations in interest rates as well as from inflation. In the normal course of business, we are exposed to market risks, including changes in interest rates which affect our line of credit under our revolving credit facility as well as cash flows. We may also face additional exchange rate risk in the future as we expand our business internationally.

Interest Rate Risk

We are exposed to changes in interest rates in the normal course of our business. At December 31, 2021, we had unrestricted cash and cash equivalents of \$76.6 million. These amounts were held for working capital and capital expansion purposes and were invested primarily in deposit accounts, money market accounts, and high-quality debt securities issued by the U.S. government via cash sweep accounts at a major financial institution in North America. Due to the short-term nature of these investments, we believe that our exposure to changes in the fair value of our cash as a result of changes in interest rates is not material.

As of December 31, 2021, we had no outstanding amounts drawn on our revolving credit facility. At December 31, 2021, we had \$1.3 million of outstanding letters of credit supported by the revolving credit facility.

Under our revolving credit facility, we are permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum, plus a margin. Our borrowing rate varies from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, we are required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility. The maturity date of our revolving credit facility is April 28, 2022. We intend to extend or replace the facility prior to its maturity.

At December 31, 2021, the amount available to us under the revolving credit facility was \$12.6 million after giving effect to the \$1.3 million of letters of credit outstanding under the facility.

Inflation Risk

Although we expect that our operating results will be influenced by general economic conditions, we do not believe that inflation has had a material effect on our results of operations during the periods presented in this report. However, our business may be affected by inflation in the future.

Foreign Currency Exchange Risk

We are subject to inherent risks attributed to operating in a global economy. Virtually all of our revenue, receivables, purchases and debts are denominated in U.S. dollars.

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

Aspen Aerogels, Inc.:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of Aspen Aerogels, Inc. and subsidiaries (the Company) as of December 31, 2021 and 2020, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2021, and the related notes and financial statement schedule II (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 31, 2021, based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2021, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2021 based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the consolidated financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of a critical audit matter does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Net realizable value of certain inventories

As discussed in Note 2 to the consolidated financial statements, inventories are stated at the lower of cost and net realizable value. As of December 31, 2021, the Company held inventories of \$12.0 million. The excess, obsolete or damaged goods provision recorded for inventories is equal to the difference between the cost of inventory and the estimated net realizable value, which is based upon assumptions about future demand, selling prices, and market conditions.

We identified the evaluation of the estimated net realizable value of certain inventories as a critical audit matter. A high degree of auditor judgment was required to evaluate the Company's assumption of future demand through future consumption, including whether past consumption is indicative of future consumption and the related effect on the net realizable value of certain inventories.

The following are the primary procedures we performed to address this critical audit matter. We evaluated the design and tested the operating effectiveness of certain internal controls related to the Company's inventory process. This included a control related to the Company's process to estimate future consumption. We assessed the Company's assumption related to future consumption and its correlation to past consumption by inquiring of relevant Company personnel regarding the impact of relevant changes to the overall business environment, including key customers and product lines. We compared the actual quantities of inventory on hand to actual consumption during the current year and subsequent to year-end to evaluate whether the historic and subsequent period consumption supported the Company's assumption related to future consumption. We recalculated the Company's estimate of the inventory provision based on the actual quantities of inventory on hand compared to the estimate of future consumption.

/s/ KPMG LLP

We have served as the Company's auditor since 2002.

Hartford, Connecticut
February 28, 2022

ASPEN AEROGELS, INC.
Consolidated Balance Sheets

	December 31,	
	2021	2020
(In thousands, except share and per share data)		
Assets		
Current assets:		
Cash and cash equivalents	\$ 76,564	\$ 16,496
Accounts receivable, net of allowances of \$150 and \$442	20,426	15,698
Inventories	11,987	13,099
Prepaid expenses and other current assets	3,173	1,830
Total current assets	112,150	47,123
Property, plant and equipment, net	55,778	46,739
Operating lease right-of-use assets	13,531	3,478
Other long-term assets	1,495	84
Total assets	<u>\$ 182,954</u>	<u>\$ 97,424</u>
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	\$ 17,440	\$ 5,351
Accrued expenses	10,819	3,884
Current portion of long-term debt	—	1,609
Deferred revenue	1,321	2,037
Operating lease liabilities	2,247	1,046
Current portion of prepayment liability	4,728	—
Total current liabilities	36,555	13,927
Prepayment liability, long-term	5,000	9,555
Long-term debt	—	2,059
Operating lease liabilities long-term	12,991	3,597
Other long-term liabilities	—	434
Total liabilities	<u>54,546</u>	<u>29,572</u>
Commitments and contingencies (Note 11)		
Stockholders' equity:		
Preferred stock, \$0.00001 par value; 5,000,000 shares authorized, no shares issued or outstanding at December 31, 2021 and 2020	—	—
Common stock, \$0.00001 par value; 125,000,000 shares authorized, 33,218,115 and 27,821,685 shares issued and outstanding at December 31, 2021 and December 31, 2020, respectively	—	—
Additional paid-in capital	673,461	575,811
Accumulated deficit	(545,053)	(507,959)
Total stockholders' equity	128,408	67,852
Total liabilities and stockholders' equity	<u>\$ 182,954</u>	<u>\$ 97,424</u>

See accompanying notes to consolidated financial statements.

ASPEN AEROGELS, INC.
Consolidated Statements of Operations

	Year Ended December 31,		
	2021	2020	2019
	(In thousands, except share and per share data)		
Revenue:			
Product	\$ 121,112	\$ 99,834	\$ 136,934
Research services	510	439	2,441
Total revenue	<u>121,622</u>	<u>100,273</u>	<u>139,375</u>
Cost of revenue:			
Product	111,552	85,545	111,759
Research services	133	134	1,332
Gross profit	<u>9,937</u>	<u>14,594</u>	<u>26,284</u>
Operating expenses:			
Research and development	11,441	8,729	8,407
Sales and marketing	16,581	11,753	15,557
General and administrative	22,514	15,681	16,479
Total operating expenses	<u>50,536</u>	<u>36,163</u>	<u>40,443</u>
Loss from operations	(40,599)	(21,569)	(14,159)
Interest expense, net	(229)	(240)	(406)
Gain on extinguishment of debt	3,734	—	—
Total other income (expense)	<u>3,505</u>	<u>(240)</u>	<u>(406)</u>
Net loss	<u>\$ (37,094)</u>	<u>\$ (21,809)</u>	<u>\$ (14,565)</u>
Net loss per share:			
Basic and diluted	<u>\$ (1.22)</u>	<u>\$ (0.83)</u>	<u>\$ (0.60)</u>
Weighted-average common shares outstanding:			
Basic and diluted	<u>30,433,154</u>	<u>26,377,652</u>	<u>24,099,438</u>

See accompanying notes to consolidated financial statements.

ASPEN AEROGELS, INC.

Consolidated Statements of Stockholders' Equity
(In thousands, except share and per share data)

	Preferred Stock \$0.00001 Par Value		Common Stock \$0.00001 Par Value		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Value	Shares	Value			
Balance at December 31, 2018	—	\$ —	23,973,517	\$ —	\$ 541,839	\$ (471,585)	\$ 70,254
Net loss	—	—	—	—	—	(14,565)	(14,565)
Stock compensation expense	—	—	—	—	3,771	—	3,771
Issuance of restricted stock	—	—	50,328	—	—	—	—
Vesting of restricted stock units	—	—	278,659	—	(470)	—	(470)
Balance at December 31, 2019	—	\$ —	24,302,504	\$ —	\$ 545,140	\$ (486,150)	\$ 58,990
Net loss	—	—	—	—	—	(21,809)	(21,809)
Stock compensation expense	—	—	—	—	5,004	—	5,004
Issuance of restricted stock	—	—	45,066	—	—	—	—
Vesting of restricted stock units	—	—	344,158	—	(1,219)	—	(1,219)
Proceeds from employee stock option exercises	—	—	460,600	—	2,661	—	2,661
Proceeds from underwritten public offering, net of underwriting discounts and commissions of \$1,093 and issuance costs of \$285	—	—	1,955,000	—	14,751	—	14,751
Proceeds from at-the-market offering, net of commissions and fees of \$299 and issuance costs of \$199	—	—	714,357	—	9,474	—	9,474
Balance at December 31, 2020	—	\$ —	27,821,685	\$ —	\$ 575,811	\$ (507,959)	\$ 67,852
Net loss	—	—	—	—	—	(37,094)	(37,094)
Stock compensation expense	—	—	—	—	5,176	—	5,176
Issuance of restricted stock	—	—	476,550	—	—	—	—
Vesting of restricted stock units	—	—	254,513	—	(2,713)	—	(2,713)
Proceeds from employee stock option exercises	—	—	351,387	—	2,301	—	2,301
Proceeds from at-the-market offering, net of commissions and fees of \$601 and issuance costs of \$43	—	—	929,981	—	19,377	—	19,377
Forfeiture of performance-based restricted stock	—	—	(78,125)	—	—	—	—
Proceeds from private placement of common stock, net of fees and issuance costs of \$1,491	—	—	3,462,124	—	73,509	—	73,509
Balance at December 31, 2021	—	\$ —	33,218,115	\$ —	\$ 673,461	\$ (545,053)	\$ 128,408

See accompanying notes to consolidated financial statements.

ASPEN AEROGELS, INC.

Consolidated Statements of Cash Flows

	Year Ended December 31,		
	2021	2020	2019
	(In thousands)		
Cash flows from operating activities:			
Net loss	\$ (37,094)	\$ (21,809)	\$ (14,565)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation	9,440	10,198	10,213
Gain on extinguishment of debt	(3,734)	—	—
Amortization of debt issuance costs	18	9	—
Provision for bad debt	(85)	325	—
Stock compensation expense	5,176	5,004	3,771
Reduction in the carrying amount of operating lease right-of-use assets	1,618	971	947
Changes in operating assets and liabilities:			
Accounts receivable	(4,643)	16,231	(6,689)
Inventories	1,112	(4,331)	(1,450)
Prepaid expenses and other assets	(2,324)	(716)	(84)
Accounts payable	7,379	(7,149)	141
Accrued expenses	6,983	(4,173)	4,344
Deferred revenue	(543)	(3,814)	3,392
Operating lease liabilities	(1,497)	(1,104)	(1,018)
Other liabilities	(434)	434	(56)
Net cash used in operating activities	(18,628)	(9,924)	(1,054)
Cash flows from investing activities:			
Capital expenditures	(13,778)	(3,416)	(2,112)
Net cash used in investing activities	(13,778)	(3,416)	(2,112)
Cash flows from financing activities:			
Proceeds from underwritten public offering, net of underwriting discounts and commissions of \$1,093	—	15,036	—
Issuance costs from underwritten public offering	—	(285)	—
Proceeds from issuance of long-term debt	—	3,686	—
Issuance costs from long-term debt	—	(27)	—
Prepayment proceeds under customer supply agreement	—	—	5,000
Proceeds from employee stock option exercises	2,301	2,661	—
Payments made for employee restricted stock tax withholdings	(2,713)	(1,219)	(470)
Proceeds from at-the-market offering net of commissions and fees of \$601 and \$299	19,420	9,673	—
Issuance costs from at-the-market offering	(43)	(199)	—
Repayments of borrowings under line of credit, net	—	(3,123)	(1,058)
Proceeds from private placement of common stock	75,000	—	—
Fees and issuance costs from private placement of common stock	(1,491)	—	—
Net cash provided by financing activities	92,474	26,203	3,472
Net increase in cash	60,068	12,863	306
Cash and cash equivalents at beginning of period	16,496	3,633	3,327
Cash and cash equivalents at end of period	\$ 76,564	\$ 16,496	\$ 3,633
Supplemental disclosures of cash flow information:			
Interest paid	\$ 236	\$ 216	\$ 440
Income taxes paid	\$ —	\$ —	\$ —
Supplemental disclosures of non-cash activities:			
Initial recognition of operating lease liabilities related to right-of-use assets	\$ —	\$ —	\$ 5,995
Right-of-use assets obtained in exchange for new operating lease liabilities	\$ 12,092	\$ 417	\$ 353
Changes in accrued capital expenditures	\$ 4,701	\$ (96)	\$ 63

See accompanying notes to consolidated financial statements.

ASPEN AEROGELS, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

(1) Description of Business

Nature of Business

Aspen Aerogels, Inc. (the Company) is an aerogel technology company that designs, develops and manufactures innovative, high-performance aerogel insulation used primarily in the energy infrastructure and sustainable building materials markets. In addition, the Company has introduced a line of aerogel thermal barriers for use in battery packs in the electric vehicle market. The Company is also developing applications for its aerogel technology in the battery materials and a number of other high-potential markets.

The Company has also conducted research related to aerogel technology supported by funding from several agencies of the U.S. government and other institutions in the form of research contracts. The Company has decided to cease efforts to secure additional funded research contracts and to wind down existing contract research activities.

The Company maintains its corporate offices in Northborough, Massachusetts. The Company has three wholly owned subsidiaries: Aspen Aerogels Rhode Island, LLC, Aspen Aerogels Germany, GmbH and Aspen Aerogels Georgia, LLC.

On June 18, 2014, the Company completed the initial public offering (IPO) of its common stock.

Liquidity

During the year ended December 31, 2021, the Company incurred a net loss of \$37.1 million and used \$18.6 million of cash in operations, used \$13.8 million of cash for capital expenditures, received net proceeds of \$19.4 million through an at-the-market (ATM) offering of the Company's common stock and received net proceeds of \$73.5 million through a private placement of the Company's common stock. The Company had cash and cash equivalents of \$76.6 million, a \$4.7 million current prepayment liability (see note 11), and no outstanding borrowings under its revolving line of credit as of December 31, 2021 (see note 7). After giving effect to the \$1.3 million of outstanding letters of credit, the amount available to the Company at December 31, 2021, under the revolving line of credit was \$12.6 million. The revolving line of credit matures on April 28, 2022.

On May 1, 2020, Aspen Aerogels Rhode Island, LLC received a loan in the amount of \$3.7 million pursuant to the Paycheck Protection Program established by the CARES Act and administered by the Small Business Administration (SBA). On August 24, 2021, the SBA remitted \$3.7 million in principal and less than \$0.1 million in accrued interest to the noteholder after approving the Borrower's application for forgiveness of the loan under the provisions of the CARES Act. Accordingly, the Company recorded a total gain on the extinguishment of debt of \$3.7 million during the year ended December 31, 2021.

The Company is increasing investment in the research and development of next-generation aerogel products and manufacturing process technologies. In addition, the Company has developed a number of promising aerogel products and technologies for the electric vehicle market. The Company believes that the commercial potential for the Company's products and technology in the electric vehicle market is significant. Accordingly, the Company is hiring additional personnel, incurring additional operating expenses, and incurring significant capital expenditures to expand silica aerogel manufacturing capacity, build an automated thermal barrier fabrication operation, enhance research and development laboratory facilities and equipment, and construct a battery materials facility, among other efforts.

The Company expects its existing cash balance and the amount anticipated to be available under the existing revolving line of credit will be sufficient to support current operating requirements, current research and development activities and the initial capital expenditures required to support the evolving commercial opportunity in the electric vehicle market and other strategic business initiatives. However, the Company plans to supplement its cash balance and available credit with equity financings, debt financings, customer prepayments, or technology licensing fees to provide the additional capital necessary to purchase the capital equipment, construct the new facilities, establish the operations and complete the aerogel capacity expansions required to support these evolving commercial opportunities and strategic business initiatives.

(2) Summary of Basis of Presentation and Significant Accounting Policies

Principles of Consolidation

The accompanying consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles (U.S. GAAP), include the accounts of the Company and its wholly owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Use of Estimates

The preparation of the consolidated financial statements requires the Company to make a number of estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. Significant items subject to such estimates and assumptions include allowances for doubtful accounts, sales returns and allowances, product warranty costs, inventory valuation, the carrying amount of property and equipment, right-of-use assets, lease liabilities, stock-based compensation, and deferred income taxes. The Company evaluates its estimates and assumptions on an on-going basis using historical experience and other factors, including current economic conditions, which are believed to be reasonable under the circumstances. Management adjusts such estimates and assumptions when facts and circumstances warrant. Illiquid credit markets, volatile equity markets, and declines in business investment can increase the uncertainty inherent in such estimates and assumptions. As future events and their effects cannot be determined with precision, actual results could differ significantly from these estimates. Changes in these estimates resulting from continuing changes in the economic environment will be reflected in the financial statements in future periods.

Cash and Cash Equivalents

Cash equivalents include short-term, highly liquid instruments, which consist of money market accounts and high-quality debt securities issued by the U.S. government via cash sweep accounts. All cash and cash equivalents are maintained with major financial institutions in North America. Deposits with these financial institutions may exceed the amount of insurance provided on such deposits; however, these deposits typically may be redeemed upon demand and, therefore, bear minimal risk.

Concentration of Credit Risk

Financial instruments, which potentially expose the Company to concentrations of credit risk, consist principally of accounts receivable. The Company's customers are primarily insulation distributors, insulation contractors, insulation fabricators and select energy and automotive end-users located throughout the world. The Company performs ongoing credit evaluations of its customers' financial condition and generally requires no collateral to secure accounts receivable. The Company maintains an allowance for doubtful accounts based on its assessment of the collectability of accounts receivable. The Company reviews the allowance for doubtful accounts quarterly. During the year ended December 31, 2021, the Company did not record any charges for uncollectible accounts receivable. During the year ended December 31, 2020, the Company recorded a charge for estimated customer uncollectible accounts receivable of \$0.3 million. During the year ended December 31, 2019, the Company did not record any charges for uncollectible accounts receivable. Allowance for doubtful accounts was \$0.1 million and \$0.3 million at December 31, 2021 and 2020, respectively. The Company does not have any off-balance-sheet credit exposure related to its customers.

For the year ended December 31, 2021, one customer represented 28% of total revenue. For the year ended December 31, 2020, two customers represented 21% and 15% of total revenue, respectively. For the year ended December 31, 2019, two customers represented 20% and 13% of total revenue, respectively.

At December 31, 2021, the Company had two customers which accounted for 27% and 17% of accounts receivable, respectively. At December 31, 2020, the Company had one customer which accounted for 26% of accounts receivable.

Inventories

Inventory consists of finished products and raw materials. Inventories are carried at lower of cost, determined using the first-in, first-out (FIFO) method, and net realizable value. Cost includes materials, labor and manufacturing overhead. Manufacturing overhead is allocated to the costs of conversion based on normal capacity of the Company's production facility. Abnormal freight, handling costs and material waste is expensed in the period it occurs.

The Company periodically reviews its inventories and makes provisions as necessary for estimated excess, obsolete or damaged goods to ensure values approximate the lower of cost and net realizable value. The amount of any such provision is equal to the difference between the cost of inventory and the estimated net realizable value based upon assumptions about future demand, selling prices and market conditions.

Property, Plant and Equipment, Net

Property, plant and equipment are stated at cost. Expenditures for maintenance and repairs are charged to expense as incurred. Expenditures for major betterments are capitalized as additions to property, plant and equipment.

Depreciation on plant and equipment is calculated on the straight-line method over the estimated useful lives of the assets. Assets related to leasehold improvements are amortized on a straight-line basis over the shorter of the lease term or estimated useful life of the asset.

Assets utilized in the Company's operations that are taken out of service with no future use are charged to cost of revenue or operating expenses, depending on the department in which the asset was utilized. Impairments of construction in progress are charged to operating expenses upon the determination of no future use.

Other Assets

Other assets primarily include long-term deposits.

Impairment of Long-Lived Assets

Long-lived assets are reviewed for impairment when events or changes in circumstances indicate that the carrying amount of an asset or asset group may not be recoverable. Recognition and measurement of a potential impairment is performed on assets grouped with other assets and liabilities at the lowest level where identifiable cash flows are largely independent of the cash flows of other assets and liabilities. Recoverability of assets to be held and used is measured by a comparison of the carrying amount of an asset or asset group to future undiscounted net cash flows expected to be generated by the asset or asset group. If the carrying amount of an asset or asset group exceeds its estimated undiscounted future cash flows, an impairment charge is recognized for the amount by which the carrying amount of the asset or asset group exceeds the fair value of the asset or asset group. Fair value is determined through various valuation techniques including discounted cash flow models, quoted market values and third-party independent appraisals, as considered necessary.

Leases

On January 1, 2019, the Company adopted Accounting Standards Update (ASU) 2016-02, Leases (Topic 842).

Revenue Recognition

The Company recognizes revenue in accordance with Accounting Standards Codification 606, Revenue from Contracts with Customers (ASC 606). See note 3 for further details.

Warranty

The Company provides warranties for its products and records the estimated cost within cost of revenue in the period that the related revenue is recorded. The Company's standard warranty period extends to one year from the date of shipment. This standard warranty provides that the Company's products will be free from defects in material and workmanship, and will, under normal use, conform to the specifications for the product.

The Company's products may be utilized in systems that involve new technical demands and new configurations. Accordingly, the Company regularly reviews and assesses whether warranty reserves should be recorded in the period the related revenue is recorded. For an initial shipment of product for use in a system with new technical demands or new configurations and where the Company is unsure of meeting the customer's specifications, the Company will defer the recognition of product revenue and related costs until written customer acceptance is obtained.

The Company recorded warranty expense of less than \$0.1 million during the year ended December 31, 2021. The Company did not record any warranty expense during the years ended December 31, 2020 and 2019, respectively.

Shipping and Handling Costs

Shipping and handling costs are classified as a component of cost of revenue. Customer payments of shipping and handling costs are recorded as product revenue.

Stock-based Compensation

The Company grants share-based awards to its employees and non-employee directors. All share-based awards granted, including grants of stock options, restricted stock and restricted stock units (RSUs), are recognized in the statement of operations based on their fair value as of the date of grant. Expense is recognized on a straight-line basis over the requisite service period for all awards with service conditions. For performance-based awards, the grant date fair value is recognized as expense when the condition is probable of being achieved, and then on a graded basis over the requisite service period. The Company uses the Black-Scholes option-pricing model to determine the fair value of service-based option awards. The Black-Scholes model requires the use of a number of complex and subjective assumptions including fair value of the underlying security, the expected volatility of the underlying security, a risk-free interest rate and the expected term of the option.

The fair value of restricted stock and RSUs is determined using the closing price of the Company's common stock on the date of grant. All shares of restricted stock are not transferable until vested. Restricted stock is typically issued to non-employee directors and typically vests over a one-year period from the date of issuance. RSUs are issued to employees and typically vest over a three-year period from the date of issuance. The fair value of restricted stock and RSUs upon which vesting is solely service-based is expensed ratably over the vesting period. If the service condition for shares of restricted stock is not met for any reason, the shares of unvested restricted stock will be forfeited and returned to the Company.

For stock options that contain a market condition, the Company uses the Monte-Carlo simulation option-pricing model to determine the fair value of the awards. In addition to the input assumptions used in the Black-Scholes model, the Monte-Carlo simulation option-pricing model factors the probability that the specific market condition may or may not be satisfied into the valuation. Stock-based compensation expense for awards with a market condition is recognized on a straight-line basis over the requisite service period for each such award.

For the restricted stock awards issued to the Company's chief executive officer during the year ended December 31, 2021 that will vest subject to achievement of certain volume weighted average common stock price targets over a three-to-five year period, the Company used a Monte-Carlo simulation model to estimate the grant date fair value with respect to 461,616 shares of restricted common stock. The award had an aggregate date fair value of \$6.5 million.

Pursuant to the "evergreen" provisions of the 2014 Employee, Director and Consultant Equity Incentive Plan, the number of shares of common stock authorized for issuance under the plan automatically increased by 556,433 shares to 8,531,413 shares effective January 1, 2021.

Research and Development

Costs incurred in the Company's research and development activities include compensation and related costs, services provided by third-party contractors, materials and supplies and are classified as research and development expenses as incurred. Research and development costs directly associated with research services revenue are classified as research services in cost of revenue.

Earnings per Share

The Company calculates net loss per common share based on the weighted-average number of common shares outstanding during each period. Potential common stock equivalents are determined using the treasury stock method. The weighted-average number of common shares included in the computation of diluted net income (loss) gives effect to all potentially dilutive common equivalent shares, including outstanding stock options and RSUs. Common equivalent shares are excluded from the computation of diluted net loss per share if their effect is antidilutive.

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. The Company accounts for uncertain tax positions using a recognition threshold and measurement attribute for the financial statement recognition and measurement of a tax position taken or expected to be taken in a tax return. Differences between tax positions taken in a tax return and amounts recognized in the financial statements are recorded as adjustments to income taxes payable or receivable, or adjustments to deferred taxes, or both. Changes in recognition or measurement are reflected in the period in which the change in judgment occurs. The Company recognizes penalties and interest related to uncertain tax positions, if any, as a component of income tax expense.

Segments

Operating segments are identified as components of an enterprise about which separate, discrete financial information is available for evaluation by the chief operating decision maker in making decisions on how to allocate resources and assess performance. The Company's chief operating decision maker is the Chief Executive Officer. The Company's chief operating decision maker reviews consolidated operating results to make decisions about allocating resources and assessing performance for the entire Company. The Company presently views its operations and manages its business as one operating segment.

Information about the Company's total revenues, based on shipment destination or services location, is presented in the following table:

	Year Ended December 31,		
	2021	2020	2019
	(In thousands)		
Revenue:			
U.S.	\$ 66,837	\$ 44,842	\$ 58,328
International	54,785	55,431	81,047
Total revenue	<u>\$ 121,622</u>	<u>\$ 100,273</u>	<u>\$ 139,375</u>

Recently Issued Accounting Standards

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board or other standard setting bodies. Recently issued standards typically do not require adoption until a future effective date. Prior to their effective date, the Company evaluates the pronouncements to determine the potential effects of adoption to its consolidated financial statements.

Standards Implemented Since December 31, 2020

The Company has not implemented any accounting standards that had a material impact on its consolidated financial statements during the year ended December 31, 2021.

Standards to be Implemented After December 31, 2021

The Company believes that the impact of recently issued accounting standards that are not yet effective will not have a material impact on its consolidated financial statements.

(3) Revenue from Contracts with Customers

Revenue Recognition

Revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements within the scope of ASC 606, the Company performs the following five steps: (i) identification of the contract with a customer; (ii) identification of the performance obligations in the contract; (iii) determination of the transaction price; (iv) allocation of the transaction price to the separate performance obligations in the contract; and (v) recognition of the revenue associated with performance obligations as they are satisfied. The Company applies the five-step model to contracts when it is probable that the Company will collect the consideration it is entitled to in exchange for the goods or services it transfers to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, the Company assesses the goods or services promised within each contract and determines those that are performance obligations and assesses whether each promised good or service is distinct. If the contract contains a single performance obligation, the entire transaction price is allocated to the single performance obligation. Contracts that contain multiple performance obligations require an allocation of the transaction price based on the estimated relative standalone-selling prices of the promised products or services underlying each performance obligation. The Company determines standalone-selling prices based on the price at which the performance obligation is sold separately. If the standalone-selling price is not observable through past transactions, the Company estimates the standalone-selling price considering available information such as market conditions and internally approved pricing guidelines related to the performance obligations. The Company then recognizes as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

When determining the transaction price of a contract, an adjustment is made if payment from a customer occurs either significantly before or significantly after performance, resulting in a significant financing component. Applying the practical expedient in paragraph ASC 606-10-32-18, the Company does not assess whether a significant financing component exists if the period between when the Company performs its obligations under the contract and when the customer pays is one year or less. The Company did not have any contracts outstanding at both December 31, 2020 and December 31, 2019 and did not enter into any contracts during each of the years ended December 31, 2021 and 2020 that contained a significant financing component.

The Company records deferred revenue for product sales when (i) the Company has delivered products but other revenue recognition criteria have not been satisfied or (ii) payments have been received in advance of the completion of required performance obligations.

Shipping and Handling Costs

Shipping and handling costs associated with outbound freight after control over a product has transferred to a customer are accounted for as fulfillment costs and are included in the cost of product revenue. The associated amount of revenue recognized includes the consideration to which the Company expects to be entitled to receive in exchange for incurring these shipping and handling costs.

Product Revenue

The Company generally enters into contracts containing one type of performance obligation. The Company recognizes product revenue when the performance obligation is satisfied, which is generally upon delivery according to contractual shipping terms within customer purchase orders.

The Company also enters into rebate agreements with certain customers. These agreements may be considered an additional performance obligation of the Company or variable consideration within a contract. Rebates are recorded as a reduction of revenue in the period the related product revenue is recognized. A corresponding liability is recorded as a component of deferred revenue on the consolidated balance sheets. These arrangements are primarily based on the customer attaining contractually specified sales volumes.

The Company estimates the amount of its product sales that may be returned by its customers and records this estimate as a reduction of revenue in the period the related product revenue is recognized. The Company currently estimates product return liabilities using historical rates of return, current quarter credit sales, and specific items of exposure on a contract-by-contract basis. Sales return reserves were approximately \$0.1 million at both December 31, 2021 and December 31, 2020. The Company recognized less than \$0.1 in warranty expense related to the sale of EV thermal barriers during the year ended December 31, 2021.

Subsea Projects

The Company manufactures and sells subsea products that are designed for pipe-in-pipe applications in offshore oil production and are typically customized to meet customer specifications. Subsea products typically have no alternative use and contain an enforceable right to payment. Customer invoicing terms for subsea products are typically based on certain milestones within the production and delivery schedule. Under the provisions of ASC 606, the Company recognizes revenue at a point in time when transfer of control of the products is passed to the customer, or over time utilizing the input method. The timing of revenue recognition is assessed on a contract-by-contract basis. During the years ended December 31, 2021, 2020, and 2019 the Company recognized revenue of \$4.7 million, \$9.7 million, and \$17.0 million respectively, in connection with subsea projects.

Thermal Barriers

The Company supplies fabricated, multi-part thermal barriers for use in battery packs in the electric vehicle market. These thermal barriers are customized to meet customer specifications. Thermal barrier products typically have no alternative use and may contain an enforceable right to payment. Under the provisions of ASC 606, the Company may recognize revenue at a point in time when transfer of the control of the products is passed to the customer, or over time utilizing the input method. The timing of revenue recognition is assessed on a contract-by-contract basis. During the year ended December 31, 2021, the Company recognized revenue of \$6.7 million in connection with thermal barrier contracts.

Research Services

The Company performs research services under contracts with various government agencies and other institutions. These contracts generally have one type of performance obligation associated with the provision of research services including certain licenses to any resulting intellectual property. The Company records revenue using the percentage-of-completion method in two ways: (1) for firm-fixed-price contracts, the Company accrues that portion of the total contract price that is allocable on the basis of the Company's estimates of costs incurred to date to total contract costs; and (2) for cost-plus-fixed-fee contracts, the Company records revenue that is equal to total payroll cost incurred times a stated factor plus reimbursable expenses, to a stated upper limit. The primary cost under the Company's research service contracts is the labor expended in completing the research. Typically, the only deliverable, other than the labor hours expended, is reporting research results to the customer or delivery of research grade aerogel products. Because the input measure of labor hours expended is also reflective of the output measure, it is a reliable means to measure the extent of progress toward completion. Revisions in cost estimates and fees during the course of the contract are reflected in the accounting period in which the facts that require the revisions become known. Contract costs and rates used to allocate overhead to contracts are subject to audit by the respective contracting government agency. Adjustments to revenue as a result of audit are recorded within the period they become known. To date, adjustments to revenue as a result of contracting agency audits have been insignificant.

Disaggregation of Revenue

In the following tables, revenue is disaggregated by primary geographical region and source of revenue:

	December 31, 2021		
	U.S.	International	Total
	(In thousands)		
Geographical region			
Asia	\$ —	\$ 19,383	\$ 19,383
Canada	—	2,985	2,985
Europe	—	27,924	27,924
Latin America	—	4,493	4,493
U.S.	66,837	—	66,837
Total revenue	<u>\$ 66,837</u>	<u>\$ 54,785</u>	<u>\$ 121,622</u>
Source of revenue			
Product revenue	\$ 59,789	\$ 49,960	\$ 109,749
Subsea projects	—	4,699	4,699
EV thermal barrier	6,538	126	6,664
Research services	510	—	510
Total revenue	<u>\$ 66,837</u>	<u>\$ 54,785</u>	<u>\$ 121,622</u>

	December 31, 2020		
	U.S.	International	Total
	(In thousands)		
Geographical region			
Asia	\$ —	\$ 38,403	\$ 38,403
Canada	—	986	986
Europe	—	13,881	13,881
Latin America	—	2,161	2,161
U.S.	44,842	—	44,842
Total revenue	<u>\$ 44,842</u>	<u>\$ 55,431</u>	<u>\$ 100,273</u>

Source of revenue			
Product revenue	\$ 42,416	\$ 47,678	\$ 90,094
Subsea projects	1,987	7,753	9,740
Research services	439	—	439
Total revenue	<u>\$ 44,842</u>	<u>\$ 55,431</u>	<u>\$ 100,273</u>

	December 31, 2019		
	U.S.	International	Total
	(In thousands)		
Geographical region			
Asia	\$ —	\$ 44,485	\$ 44,485
Canada	—	9,064	9,064
Europe	—	24,081	24,081
Latin America	—	3,417	3,417
U.S.	58,328	—	58,328
Total revenue	<u>\$ 58,328</u>	<u>\$ 81,047</u>	<u>\$ 139,375</u>

Source of revenue			
Product revenue	\$ 52,050	\$ 67,856	\$ 119,906
Subsea projects	3,837	13,191	17,028
Research services	2,441	—	2,441
Total revenue	<u>\$ 58,328</u>	<u>\$ 81,047</u>	<u>\$ 139,375</u>

Contract Balances

The following table presents changes in the Company's contract assets and contract liabilities during the year ended December 31, 2021:

	Balance at December 31, 2020	Additions	Deductions	Balance at December 31, 2021
	(In thousands)			
Contract assets				
Subsea projects	\$ 1,370	\$ 4,521	\$ (4,443)	\$ 1,448
Product revenue	—	362	(127)	235
Research services	67	510	(429)	148
Total contract assets	<u>\$ 1,437</u>	<u>\$ 5,393</u>	<u>\$ (4,999)</u>	<u>\$ 1,831</u>
Contract liabilities				
Deferred revenue				
Product revenue	\$ 1,859	\$ 3,686	\$ (4,224)	\$ 1,321
Subsea projects	178	2,168	(2,346)	—
Prepayment liability	9,555	173	—	9,728
Total contract liabilities	<u>\$ 11,592</u>	<u>\$ 6,027</u>	<u>\$ (6,570)</u>	<u>\$ 11,049</u>

During the year ended December 31, 2021, the Company recognized \$1.7 million of revenue that was included in deferred revenue at December 31, 2020.

A contract asset is recorded when the Company satisfies a performance obligation by transferring a promised good or service and has earned the right to consideration from its customer. These assets may represent a conditional or unconditional right to consideration and are included within accounts receivable on the consolidated balance sheets.

A contract liability is recorded when consideration is received, or such consideration is unconditionally due, from a customer prior to transferring goods or services under the terms of the contract. Contract liabilities are recognized as revenue after control of the products or services is transferred to the customer and all revenue recognition criteria have been met.

(4) Inventories

Inventories consist of the following:

	<u>December 31,</u>	
	<u>2021</u>	<u>2020</u>
	(In thousands)	
Raw material	\$ 7,312	\$ 4,068
Finished goods	4,675	9,031
Total	<u>\$ 11,987</u>	<u>\$ 13,099</u>

(5) Property, Plant and Equipment, Net

Property, plant and equipment consist of the following:

	<u>December 31,</u>		<u>Useful life</u>
	<u>2021</u>	<u>2020</u>	
	(In thousands)		
Construction in progress	\$ 13,456	\$ 1,906	—
Buildings	24,016	24,016	30 years
Machinery and equipment	130,529	124,807	3 — 10 years
Computer equipment and software	9,457	8,850	3 years
Total	177,458	159,579	
Accumulated depreciation and amortization	(121,680)	(112,840)	
Property, plant and equipment, net	<u>\$ 55,778</u>	<u>\$ 46,739</u>	

Depreciation expense was \$9.4 million, \$10.2 million and \$10.2 million for the years ended December 31, 2021, 2020 and 2019, respectively.

Construction in progress totaled \$13.5 million and \$1.9 million at December 31, 2021 and 2020, respectively. The balance at December 31, 2021 included engineering designs and other pre-construction costs totaling \$6.1 million for a planned aerogel manufacturing facility in Bulloch County, Georgia.

(6) Accrued Expenses

Accrued expenses consist of the following:

	<u>December 31,</u>	
	<u>2021</u>	<u>2020</u>
	(In thousands)	
Employee compensation	\$ 8,991	\$ 2,587
Other accrued expenses	1,828	1,297
Total	<u>\$ 10,819</u>	<u>\$ 3,884</u>

(7) Revolving Line of Credit

The Company is party to an Amended and Restated Loan and Security Agreement with Silicon Valley Bank (Loan Agreement). On March 12, 2021, the Loan Agreement was amended and restated to extend the maturity date of the revolving credit facility to April 28, 2022 and to establish certain minimum Adjusted EBITDA levels and minimum Adjusted Quick Ratio covenants, each as defined in the Loan Agreement. On September 29, 2021, and subsequently on December 27, 2021, the Company entered into amendments to the Loan Agreement to revise certain financial covenants, among other items. On December 27, 2021, the Company entered into an amendment to the Loan Agreement to revise certain financial covenants, among other items.

Under the revolving credit facility, the Company is permitted to borrow a maximum of \$20.0 million, subject to continued covenant compliance and borrowing base requirements. The interest rate applicable to borrowings under the revolving credit facility is based on the prime rate, subject to a minimum rate of 4.00% per annum, plus a margin. The rates applicable to borrowings vary from prime rate plus 0.75% per annum to prime rate plus 2.00% per annum. In addition, the Company is required to pay a monthly unused revolving line facility fee of 0.50% per annum of the average unused portion of the revolving credit facility.

Under the Loan Agreement, the Company is required to comply with both non-financial and financial covenants, including a minimum Adjusted EBITDA covenant and a minimum Adjusted Quick Ratio covenant. As of December 31, 2021, the Company was in compliance with all such covenants. Obligations under the Loan Agreement are secured by a security interest in all assets of the Company, including those at the East Providence facility, except for certain exclusions. The Company intends to extend or replace the facility prior to its maturity.

As of December 31, 2021 and 2020, the Company had no amounts drawn from the revolving credit facility.

The Company has provided letters of credit to secure obligations under certain commercial contracts and other obligations. The Company had outstanding letters of credit backed by the revolving credit facility of \$1.3 million at December 31, 2021, and \$1.4 million at December 31, 2020, which reduce the funds otherwise available to the Company under the facility.

At December 31, 2021, the amount available to the Company under the revolving credit facility was \$12.6 million after giving effect to the \$1.3 million of outstanding letters of credit.

(8) Debt

On May 1, 2020, Aspen Aerogels Rhode Island, LLC (the Borrower) executed a promissory note in favor of Northeast Bank to receive an unsecured loan in the principal amount of \$3.7 million (the PPP Loan) pursuant to the Paycheck Protection Program established by the CARES Act, as amended by the Paycheck Protection Program Flexibility Act, and administered by the Small Business Administration (SBA). The PPP Loan was subsequently sold by Northeast Bank to The Loan Source, Inc. (PPP Investor), a secondary market investor.

On August 24, 2021, the SBA remitted \$3.7 million in principal and less than \$0.1 million in accrued interest to the PPP Investor after approving the Borrower's application for forgiveness of the PPP Loan under the provisions of the CARES Act. Accordingly, the Company recorded a total gain on the extinguishment of debt of \$3.7 million.

As of December 31, 2021, the Company had no required principal or interest payments remaining related to the PPP Loan.

As of December 31, 2020, long-term debt consisted of the following:

	December 31,
	2020
	(In thousands)
Long-term debt, principal	\$ 3,686
Current portion of long-term debt	(1,609)
Debt issuance costs, net of accumulated amortization	(18)
Long-term debt	<u>\$ 2,059</u>

(9) Interest Expense, net

For the years ended December 31, 2021, 2020, and 2019, interest expense, net was \$0.2 million, \$0.2 million, and \$0.4 million, respectively, and consisted primarily of fees and interest expense related to the Company's revolving credit facility with Silicon Valley Bank.

(10) Leases

The Company leases office, laboratory, warehouse and fabrication space in Massachusetts and Rhode Island under operating leases. Under these agreements, the Company is obligated to pay annual rent, real estate taxes, and certain other operating expenses. The Company also leases equipment under operating leases. The Company's operating leases expire at various dates through 2031.

The Company determines if an arrangement is a lease at inception. Right-of-use (ROU) assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent the Company's payment obligations under the lease. Operating lease ROU assets and liabilities are recognized based on the present value of lease payments over the lease term. To measure its lease liabilities, the Company uses its incremental borrowing rate or the rate implicit in the lease, if available. The Company calculates its incremental borrowing rate using a synthetic credit rating analysis based on Moody's Building Materials Industry Rating Methodology. ROU assets also include any direct costs and prepaid lease payments but exclude any lease incentives received. The Company's lease terms may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise that option. Lease expense for lease payments is recognized on a straight-line basis over the lease term.

The Company elected the short-term lease recognition exemption for all leases that qualify. For leases that qualify for this exemption, the Company does not recognize ROU assets or lease liabilities. For lease agreements with lease and non-lease components, the Company accounts for each component separately. However, in the case of equipment leases, the Company accounts for lease and non-lease components as a single component.

Maturities of operating lease liabilities at December 31, 2021 are as follows:

Year	Operating Leases (In thousands)
2022	\$ 3,076
2023	2,630
2024	2,038
2025	1,803
2026	1,634
Thereafter	8,333
Total lease payments	19,514
Less imputed interest	(4,276)
Total lease liabilities	\$ 15,238

The Company incurred operating lease costs of \$2.2 million and \$1.4 million during the years ended December 31, 2021 and 2020, respectively. Cash payments related to operating lease liabilities were \$2.1 million and \$1.5 million during the years ended December 31, 2021 and 2020, respectively. At December 31, 2021, the weighted average remaining lease term for operating leases was 8.4 years. At December 31, 2021, the weighted average discount rate for operating leases was 5.9%.

As of December 31, 2021, the Company has additional operating equipment leases that will commence during 2022 with total lease payments of \$0.1 million and a weighted average lease term of 4.0 years.

(11) Commitments and Contingencies

Cloud Computing Agreement

The Company is party to a cloud computing agreement that is a service contract for enterprise resource planning software. The agreement has a three-year term beginning on January 15, 2021. During the year ended December 31, 2021, the Company capitalized \$1.0 million of costs related to implementation of the software that will begin to amortize during 2022. The capitalized implementation costs are classified on the consolidated balance sheets as follows:

	December 31, 2021	
	(In thousands)	
Cloud computing costs included in other current assets	\$	389
Cloud computing costs included in other assets		637
Total capitalized cloud computing costs	\$	<u>1,027</u>

Thermal Barrier Contract

The Company is party to production contracts with a major U.S. automotive original equipment manufacturer (OEM) to supply fabricated, multi-part thermal barriers (Barriers) for use in the battery system of its next-generation electric vehicles (Contracts). Pursuant to the Contracts, the Company is obligated to supply Barriers at fixed annual prices and at volumes to be specified by the OEM up to a daily maximum quantity through the respective terms of the agreements, which expire at various times from 2026 through 2034. While the OEM has agreed to purchase its requirement for Barriers from the Company for locations to be designated from time to time by the OEM, it has no obligation to purchase any minimum quantity of Barriers under the Contracts. In addition, the OEM may terminate the Contracts any time and for any or no reason. All other terms of the Contracts are generally consistent with the OEM's standard purchase terms, including quality and warranty provisions that are customary in the automotive industry.

BASF Supply Agreement

The Company is party to a supply agreement, as amended, with BASF Polyurethanes GmbH (BASF) (the Supply Agreement) and a joint development agreement with BASF SE (the JDA). Pursuant to the Supply Agreement, the Company agreed to sell exclusively to BASF certain of the Company's products at annual volumes specified by BASF, subject to certain volume limits, through December 31, 2027.

Through the year ended December 31, 2019, BASF made two prepayments each in the amount of \$5.0 million to the Company. BASF had the right to request that 25.3% of any amounts invoiced by the Company to BASF for Spaceloft A2 were to be credited against the outstanding balance of the prepayments. BASF also had the right to request that the Company repay any uncredited amount of the first prepayment to BASF following a six-week notice period on or after January 1, 2022 and the second prepayment on or after January 1, 2023.

As of December 31, 2021, the Company had received \$10.0 million in prepayments from BASF and applied approximately \$0.3 million of credits against amounts invoiced to BASF for Spaceloft A2.

During 2021, the Company and BASF jointly announced that BASF would discontinue further marketing and sale of Spaceloft A2 as of November 15, 2021. After that date, BASF customers have had the right to purchase Spaceloft A2 directly from the Company.

On December 15, 2021, the Company terminated the supply arrangement and JDA with BASF and BASF SE, respectively. As part of the termination, the Company and BASF agreed that any uncredited prepayment balances would remain outstanding and subject to repayment upon BASF's request following the requisite six-week notice periods after January 1, 2022 and January 1, 2023, respectively.

Prepayment liabilities as of December 31, 2021 and December 31, 2020 were as follows:

	December 31, 2021		December 31, 2020	
	(In thousands)			
Prepayment liability	\$	9,728	\$	9,845
Current portion of prepayment liability		(4,728)		—
Prepayment liability included within deferred revenue		—		(290)
Prepayment liability, long-term	\$	<u>5,000</u>	\$	<u>9,555</u>

Letters of Credit

The Company has provided certain customers with letters of credit securing obligations under commercial contracts. The Company had letters of credit outstanding of \$1.3 million and \$1.4 million at December 31, 2021 and 2020, respectively. These letters of credit are secured by the Company's revolving credit facility (see note 7).

Operating Leases

During 2016, the Company entered into an agreement to extend its lease of approximately 51,650 square feet of office space in Northborough, Massachusetts. The lease commenced on January 1, 2017 and will expire on December 31, 2031. The annual base rent associated with the lease was \$459,000 during 2021 and is increasing by approximately 3% annually for the term of the lease. The lease also requires the payment by the Company of its pro rata share of real estate taxes and certain other expenses. Prior to the expiration of the lease, the Company will have the right to extend the lease for an additional term of five years.

Under the terms of the lease extension, the landlord provided the Company with an allowance of \$1.2 million to be utilized for improvements to the leased premises. These amounts were considered a lease incentive and were excluded from the Company's ROU assets upon its adoption of ASU 2016-02 on January 1, 2019 (see note 10). At December 31, 2021 and 2020, the Company had capitalized \$1.2 million in associated leasehold improvement costs.

The Company also leases facilities and equipment under operating leases expiring at various dates through 2031. Under these agreements, the Company is obligated to pay annual rent, real estate taxes, and certain operating expenses. See note 10 for further information on future minimum lease payments under operating leases at December 31, 2021.

The Company incurred rent expense under all operating leases of approximately \$2.2 million, \$1.4 million and \$1.5 million in the years ended December 31, 2021, 2020 and 2019, respectively.

Federal, State and Local Environmental Regulations

The Company is subject to federal, state and local laws and regulations relating to the environment. These laws generally provide for control of pollutants released into the environment and require responsible parties to undertake remediation. Penalties may be imposed for noncompliance.

During the year ended 2020, the Company was in technical discussions with the U.S. Environmental Protection Agency (EPA) in connection with the EPA's notice of potential violation and opportunity to confer that the Company received regarding the applicability of certain Resource Conservation and Recovery Act (RCRA) provisions to certain aspects of its manufacturing unit operations. The EPA notice was in connection with the EPA's RCRA Compliance Evaluation Inspection of the Company's East Providence, Rhode Island manufacturing facility in May 2019. Subsequent to these initial discussions, the Company received notice from the EPA that there were no violations with respect to its manufacturing unit operations.

Litigation

The Company is, from time to time, a party to litigation that arises in the normal course of its business operations. See Part I, Item 3 ("Legal Proceedings") of this Annual Report on Form 10-K for a description of certain of the Company's current legal proceedings. The Company is not presently a party to any litigation for which it believes a loss is probable requiring an amount to be accrued or a possible loss contingency requiring disclosure.

(12) Stockholders' Equity

At December 31, 2021 and 2020, the Company was authorized to issue 130,000,000 shares of stock, of which 125,000,000 shares were designated as common stock and 5,000,000 shares were designated as preferred stock.

(13) Employee Benefit Plan

The Company sponsors the Aspen Aerogels, Inc. 401(k) Plan. Under the terms of the plan, the Company's employees may contribute a percentage of their pretax earnings. During the year ended December 31, 2021, the Company provided matching contributions of \$0.3 million. During the years ended December 31, 2020 and December 31, 2019, the Company provided matching contributions of \$0.2 million.

(14) Employee Stock Ownership Plans

Effective June 12, 2014, the Company adopted the 2014 Employee, Director and Consultant Equity Incentive Plan (the 2014 Equity Plan). Under the 2014 Equity Plan, the Company may grant incentive stock options (ISOs), non-qualified stock options (NSOs), restricted stock, restricted stock units (RSUs) and other stock-based awards. Stock options under the plan are to be granted with an exercise price not less than the fair market value of the Company's common stock at the date of grant. Equity awards granted to employees generally vest over a service period of three to four years. Restricted stock and stock options granted to nonemployee directors generally vest over a one-year service period.

During 2021, the Company granted 72,531 RSUs with a grant date fair value of \$2.0 million and NSOs to purchase 220,177 shares of common stock with a grant date fair value of \$3.2 million to employees under the 2014 Equity Plan. The RSUs and NSOs granted to employees will generally vest over a three-year period.

During the year ended December 31, 2021, the Company also granted 14,934 shares of restricted common stock with a grant date fair value of \$0.3 million and NSOs to purchase 18,528 shares of common stock with a grant date fair value of \$0.2 million to its non-employee directors under the 2014 Equity Plan. The restricted common stock and NSOs granted to non-employee directors will vest upon the earlier of the date that is the one-year anniversary of the grant or the day prior to the Company's annual meeting of stockholders to be held in 2022.

On June 29, 2021, the Company also awarded 461,616 shares of restricted common stock to its chief executive officer. The shares will vest subject to the achievement of certain volume weighted average common stock price targets, over a three-to-five year period. The award had an aggregate grant date fair value of \$6.5 million.

On December 10, 2020, the Company modified the vesting conditions of NSOs to purchase 116,279 of common stock held by its chief executive officer (the CEO Options) to extend the time period to achieve the common stock price target. The Company accounted for the extension of the time period for the achievement of the common stock price target vesting condition of the NSOs as a modification and recognized \$1.1 million of incremental stock compensation expense during the year ended December 31, 2020.

Stock-based compensation is included in cost of sales or operating expenses, as applicable, and consists of the following:

	Year Ended December 31,		
	2021	2020	2019
	(In thousands)		
Cost of product revenue	\$ 510	\$ 598	\$ 573
Research and development expenses	750	652	506
Sales and marketing expenses	822	704	629
General and administrative expenses	3,094	3,050	2,063
Total stock-based compensation	<u>\$ 5,176</u>	<u>\$ 5,004</u>	<u>\$ 3,771</u>

At December 31, 2021, 3,917,401 shares of common stock were reserved for issuance upon the exercise or vesting of outstanding stock-based awards granted under the 2014 Equity Plan and 2001 Equity Incentive Plan, as amended (the 2001 Equity Plan). Any cancellations or forfeitures of the options outstanding under the 2001 Equity Plan will result in the shares reserved for issuance upon exercise or such options becoming available for grant under the 2014 Equity Plan. At December 31, 2021, the Company has either reserved in connection with statutory tax withholdings or issued a total of 3,914,596 shares under the 2014 Equity Plan. At December 31, 2021, there were 699,416 shares available for future grant under the 2014 Equity Plan.

Stock Options Valuation and Amortization Method

The fair value of each stock option is estimated as of the date of grant using the Black-Scholes option-pricing model. Key inputs into this formula included expected term, expected volatility, expected dividend yield and the risk-free rate. Each assumption is set forth and discussed below.

The Company used a Monte-Carlo Simulation model to estimate the original grant date fair value of the CEO Options as well as the subsequent modifications. The simulation model was based on the Black-Scholes option-pricing model and a number of complex assumptions including (i) whether the vesting condition is satisfied within the time-vesting periods, and (ii) the date the common stock price target is met per the terms of the agreement.

For stock options with a service condition, the fair value is amortized on a straight-line basis over the requisite service period of the options, which is generally a three-year vesting period from the date of grant.

Expected Term

The expected term represents the period that the Company's stock-based awards are expected to be outstanding. The Company does not have sufficient historical exercise data to provide a reasonable basis upon which to estimate the expected term. Accordingly, the Company uses the simplified method to calculate the expected term for options granted.

Expected Volatility

In 2021, the Company used its historical volatility as a basis to estimate expected volatility in the valuation of stock options. In 2020 and 2019, due to the Company's limited historical data, the Company used an estimated volatility based on the historical volatility of comparable companies with publicly available share prices. The 2020 and 2019 expected volatility was primarily based on the weighted average volatility of up to 17 companies with business, financial and market attributes that the Company believes are similar to its own.

Expected Dividend

The Company uses an expected dividend yield of zero. The Company does not intend to pay cash dividends on its common stock in the foreseeable future, nor has it paid dividends on its common stock in the past.

Risk-free Interest Rate

The Company uses a risk-free interest rate based on U.S. Treasury zero-coupon issues with a remaining term equal to the expected life assumed at the date of grant.

Estimated Forfeitures

The Company records the impact of forfeitures of service-based awards under the provisions of ASU 2016-09 at the time an award is forfeited.

Assumptions Utilized

The following information relates to the fair value of the option awards estimated by use of the Black-Scholes option-pricing model:

	Year Ended December 31,		
	2021	2020	2019
Weighted average assumptions:			
Expected term (in years)	5.96	5.96	5.81
Expected volatility	59.80%	52.27%	49.90%
Risk free rate	0.86%	1.08%	2.44%
Expected dividend yield	0.00%	0.00%	0.00%
Weighted average fair value:			
Grant-date fair value of options granted	\$ 14.28	\$ 4.15	\$ 1.90
Grant-date fair value of options vested	\$ 2.91	\$ 2.44	\$ 2.24
Aggregate intrinsic value of options exercised	\$ 12,675,489	\$ 1,987,654	\$ —

Outstanding Options

The following table summarizes information about stock options outstanding:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share	Weighted Average Exercise Price Per Share	Weighted Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value
(\$ in thousands, except share and per share data)					
Options outstanding at December 31, 2020	3,704,444	\$ 5.33	\$ 8.28	6.48	\$ 36,830,172
Granted	238,705	\$ 14.28	\$ 26.04		
Forfeited	(24,379)	\$ 14.22	\$ 18.84		
Expired	(176)	\$ 7,336.64	\$ 14,768.41		
Exercised	(351,387)	\$ 3.25	\$ 6.55		\$ 12,675,489
Options outstanding at December 31, 2021	3,567,207	\$ 6.07	\$ 9.45	5.78	\$ 146,520,052
Exercisable at December 31, 2021	2,726,409	\$ 5.94	\$ 8.56	5.78	\$ 114,897,811
Expected to vest at December 31, 2021	840,798	\$ 6.47	\$ 12.29	1.92	\$ 31,622,241

As of December 31, 2021, total unrecognized compensation cost related to non-vested service-based options granted under the 2014 Equity Plan was \$3.6 million. The unrecognized compensation cost for the service-based options is expected to be recognized over a weighted average period of 1.92 years.

Restricted Stock Awards and Restricted Stock Units

The Company values restricted stock awards and RSUs based on the closing price of our shares on the date of grant. RSUs have time-based vesting conditions and typically vest over three or four years. During the year ended December 31, 2021, the Company granted RSUs to one executive which will vest over one year. Restricted stock awards issued to nonemployee directors generally vest in full one year from the date of grant. During the year ended December 31, 2021, the Company also awarded 461,616 shares of restricted common stock to its chief executive officer. The shares will vest subject to the achievement of certain volume weighted average common stock price targets, over a three-to-five year period.

During the year ended December 31, 2021, the Company also awarded 461,616 shares of restricted common stock to its chief executive officer. The shares will vest subject to the achievement of certain volume weighted average common stock price targets, over a three-to-five year period. The Company valued the shares using a Monte-Carlo simulation model to estimate the grant date fair value utilizing an expected volatility of 59.3% and a risk free rate of 0.89%.

The following table provides detail of grants, vesting, and forfeitures of RSUs during 2021:

	Restricted Stock Units	Weighted Average Grant Date Fair Value
Balance at December 31, 2020	675,572	\$ 4.88
Granted	72,531	27.91
Vested	(375,306)	4.62
Forfeited	(22,602)	7.45
Balance at December 31, 2021	350,195	\$ 9.75

Restricted stock awards granted during 2021 are considered issued and outstanding common stock and are excluded from the table above. As of December 31, 2021, there were 14,934 shares of restricted stock outstanding granted to nonemployee directors and 461,616 shares of restricted stock outstanding granted to the Company's chief executive officer.

The total intrinsic value of restricted stock and RSUs that vested in 2021 and 2020 was \$8.4 million and \$4.0 million, respectively. As of December 31, 2021, 287,004 of the total shares of restricted stock and RSUs outstanding will vest upon the fulfillment of service conditions.

As of December 31, 2021, total unrecognized compensation cost related to restricted stock awards issued to nonemployee directors of \$0.1 million, and RSUs of \$2.1 million is expected to be recognized over a weighted average period of 0.42 years and 1.89 years respectively.

As of December 31, 2021, total unrecognized compensation cost related to restricted stock awards issued to the Company's chief executive officer of \$5.5 million is expected to be recognized over a weighted average period of 2.89 years.

(15) CARES Act Payroll Tax Deferral

The Company elected to defer approximately \$0.9 million of its employer payroll tax obligation for the period from March 27, 2020 to December 31, 2020 pursuant to the provisions of the CARES Act. The Company was required to remit 50 percent of the deferred tax balance on or before December 31, 2021 and is required to remit the remaining 50 percent on or before December 31, 2022. As of December 31, 2021, the Company had remitted its initial repayment obligation.

Other long-term liabilities consist of the following:

	December 31, 2021	December 31, 2020
	(In thousands)	
Deferred employer payroll tax obligation	\$ 434	\$ 870
Current portion of deferred payroll tax obligation	(434)	(436)
Other long-term liabilities	\$ —	\$ 434

(16) Net Loss Per Share

The computation of basic and diluted net loss per share consists of the following:

	Year ended December 31,		
	2021	2020	2019
	(In thousands, except share and per share data)		
Numerator:			
Net loss	\$ (37,094)	\$ (21,809)	\$ (14,565)
Denominator:			
Weighted average shares outstanding, basic and diluted	30,433,154	26,377,652	24,099,438
Net loss per share, basic and diluted	\$ (1.22)	\$ (0.83)	\$ (0.60)

On June 29, 2021, the Company sold 3,462,124 shares to an affiliate of Koch Strategic Platforms, LLC in a private placement of its common stock and received net proceeds of \$73.5 million after deducting fees and offering expenses of \$1.5 million. During the year ended December 31, 2021, the Company also completed the sale of 929,981 shares at an average price of \$21.53 per share through its ATM offering.

Potentially dilutive common shares that were excluded from the computation of diluted net loss per share because they were anti-dilutive consist of the following:

	Year ended December 31,		
	2021	2020	2019
Common stock options	3,567,207	3,704,444	3,547,434
Restricted common stock units	350,195	675,572	1,083,000
Restricted common stock awards	14,934	123,191	128,453
Total	3,932,336	4,503,207	4,758,887

In the table above, anti-dilutive shares consist of those common stock equivalents that have (i) an exercise price above the average stock price for the period or (ii) related average unrecognized stock compensation expense sufficient to buy back the entire amount of shares. The Company excludes the shares issued in connection with restricted stock awards from the calculation of basic weighted average common shares outstanding until the restrictions lapse.

For each of the years ended December 31, 2021, 2020 and 2019, there was no dilutive impact of the common stock options, RSUs, and restricted stock awards.

(17) Income Taxes

The Company incurred net operating losses and recorded a full valuation allowance against net deferred assets for all periods presented. Accordingly, the Company has not recorded a provision for federal or state income taxes.

The reconciliation between the U.S. statutory income tax rate and the Company's effective rate consists of the following:

	Year Ended December 31,		
	2021	2020	2019
U.S. federal income tax statutory rate	21%	21%	21%
Permanent differences	10%	2%	(2)%
State tax, net of federal benefit	5%	4%	—%
Changes in valuation allowance for deferred tax assets	(35)%	(26)%	(18)%
Stock-based compensation	—%	(1)%	(1)%
Expiring net operating losses	(1)%	(1)%	—%
Other	—%	1%	—%
Effective tax rate	—	—	—

The tax effects of temporary differences between financial statement and tax accounting that gave rise to significant portions of the Company's deferred tax assets and deferred tax liabilities at December 31, 2021 and 2020 are presented below:

	December 31,	
	2021	2020
	(In thousands)	
Deferred tax assets:		
Net operating loss carryforwards	\$ 68,867	\$ 58,120
Stock-based compensation	5,539	5,345
Operating lease liabilities	3,869	1,179
Tax credit carryforwards	315	289
Reserves and accruals	1,904	687
Interest expense limitation	356	297
Total gross deferred tax assets	80,850	65,917
Deferred tax liabilities:		
Depreciation	(2,257)	(2,948)
Operating lease right-of-use assets	(3,436)	(883)
Total deferred tax liabilities	(5,693)	(3,831)
Total deferred tax assets and liabilities	75,157	62,086
Valuation allowance	(75,157)	(62,086)
Net deferred tax asset	\$ —	\$ —

The CARES Act made several changes to the Internal Revenue Code. The changes include, but are not limited to, increasing the limitation on the amount of deductible interest expense, allowing companies to carryback certain net operating losses and increasing the amount of net operating loss carryforwards that corporations can use to offset taxable income. The tax law changes in the CARES Act did not have a material impact on the Company's income tax provision.

The net change in the valuation allowance for the year ended December 31, 2021, was an increase of \$13.1 million. The Company has recorded a full valuation allowance against its deferred tax assets due to the uncertainty associated with the utilization of the net operating loss carryforwards and other future deductible items. In assessing the realizability of deferred tax assets, the Company considers all available evidence, historical and prospective, with greater weight given to historical evidence, in determining whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of the Company's deferred tax assets generally is dependent upon generation of future taxable income.

At December 31, 2021, the Company had \$296.1 million of net operating losses available to offset future federal income, if any, of which \$194.6 million expire on various dates through December 31, 2037. Net operating losses of \$101.5 million generated from 2018 through 2021 have an unlimited carryforward.

At December 31, 2021, the Company had \$115.2 million of apportioned net operating losses available to offset future state taxable income, if any, and which begin to expire at various dates between 2022 and 2041.

For each of the years ended December 31, 2021, 2020, and 2019, the Company did not have any material unrecognized tax benefits and thus no interest and penalties related to unrecognized tax benefits were recorded. In addition, the Company does not expect that the amount of unrecognized tax benefits will change significantly within the next twelve months.

The Company files a federal income tax return in the United States and income tax returns in various state and foreign jurisdictions. All tax years are open for examination by the taxing authorities for both federal and state purposes.

(18) Subsequent Events

The Company has evaluated subsequent events through February 28, 2022, the date of issuance of the consolidated financial statements for the year ended December 31, 2021.

On February 15, 2022, the Company entered into a note purchase agreement (Notes) with an affiliate of Koch Strategic Platforms (KSP), relating to the issuance and sale of \$100.0 million of the Company's convertible debt. The Notes will bear interest at the Secured Overnight Financing Rate (SOFR) plus 5.50% per annum if interest is paid in cash, or, if interest is paid in kind (through an increase in the principal amount of the outstanding Notes or through the issuance of additional Notes), at SOFR plus 6.50% per annum (PIK Interest). The Company can elect to make any interest payment through cash, PIK Interest or any combination thereof. Interest on the Notes is payable semi-annually in arrears on June 30 and December 30, commencing on June 30, 2022. It is expected that the Notes will mature on February 18, 2027, subject to earlier conversion, redemption or repurchase.

In addition, KSP has agreed to purchase 1,791,986 shares of the Company's common stock at a price of \$27.902 per share, resulting in gross proceeds to the Company of \$50 million. The private placement of shares is subject to the satisfaction of customary closing conditions, including the expiration or termination of the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976 review.

Schedule II
VALUATION AND QUALIFYING ACCOUNTS
(in thousands)

Description	Balance at Beginning of Year	Charges to Costs and Expenses (a)	Recoveries of Costs and Expenses (b)	Deductions to Allowances for Uncollectible Accounts (c)	Charges to (Deductions from) Other Accounts (d)	Balance at End of Year
Year Ended December 31, 2021:						
Allowances for uncollectible accounts and sales returns and allowances	\$ 442	(85)	(208)	—	—	\$ 150
Year Ended December 31, 2020:						
Allowances for uncollectible accounts and sales returns and allowances	\$ 144	325	—	—	(27)	\$ 442
Year Ended December 31, 2019:						
Allowances for uncollectible accounts and sales returns and allowances	\$ 2,877	—	(228)	(2,552)	47	\$ 144

- (a) Represents allowances for uncollectible accounts established through general and administrative expenses.
- (b) Represents recoveries of allowances for uncollectible accounts established through general and administrative expenses.
- (c) Represents actual write-offs of uncollectible accounts.
- (d) Represents net change in allowances for sales returns, recorded as contra-revenue.

Item 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

Not applicable.

Item 9A. CONTROLS AND PROCEDURES

(a) *Evaluation of Disclosure Controls and Procedures.* We maintain disclosure controls and procedures that are designed to ensure that information required to be disclosed in the reports that we file or submit under the Securities Exchange Act of 1934, as amended, or the Exchange Act, is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms and is accumulated and communicated to our management, including our principal executive officer and principal financial officer, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure.

As of December 31, 2021, our management, with the participation of our principal executive officer and principal financial officer, evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act). Our management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives, and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on such evaluation, our principal executive officer and principal financial officer have concluded, that, as of December 31, 2021, our disclosure controls and procedures were effective to ensure that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and is accumulated and communicated to our management, including our principal executive officer and principal financial officer, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure. In addition, our principal executive officer and principal financial officer have concluded that the impact of the COVID-19 pandemic did not impact our ability to maintain our internal controls over financial reporting and disclosure controls and procedures.

(b) *Management's Report on Internal Control over Financial Reporting.* The Company's management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act, as a process designed by, or under the supervision of, the Company's principal executive and principal financial officers and effected by the Company's board of directors, management and other personnel to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. The Company's internal control over financial reporting includes those policies and procedures that:

- pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the Company;
- provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and
- provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

The Company's management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2021. In making this assessment, management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in Internal Control-Integrated Framework (2013).

Based on our assessment, management believes that, as of December 31, 2021, the Company's internal control over financial reporting is effective based on those criteria.

Our independent registered public accounting firm has issued an audit report on our assessment of our internal control over financial reporting. This report appears further below in this Item 9A.

(c) *Changes in Internal Controls.* There were no changes in our internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15(d)-15(f) promulgated under the Exchange Act, identified in connection with the evaluation of such internal control that occurred during the fourth quarter of the last fiscal year that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. OTHER INFORMATION

As previously reported, upon the recommendation of our Compensation and Leadership Development Committee, or the Committee, our Board of Directors, or the Board, approved the target bonus amounts and goals under the bonus plan for fiscal year 2021 for Donald R. Young, our chief executive officer, on February 24, 2021. The Committee approved the target bonus amounts and goals under the bonus plan for fiscal year 2021 for John F. Fairbanks and Corby Whitaker on February 23, 2021. Each named executive officer's 2021 bonus award amount, calculated as a percentage of year-end base salary, was based on achieving and exceeding certain performance metrics. For 2021, these performance metrics were revenue and adjusted EBITDA. Calculation of the achievement of the adjusted EBITDA target was made in a manner that excluded the impact of any costs incurred in 2021 associated with intellectual property enforcement and certain other strategic activities, if so determined by our Board or Committee. For revenue and adjusted EBITDA, the 2021 performance metrics specified a threshold value that must be achieved before any bonus amount would be paid under that metric, a target value, or the Target, associated with a target bonus amount, and an incentive amount if the Target value is exceeded. In addition, a component of the bonus, expressed as a percentage of the target bonus amount, may be added to or deducted from otherwise earned bonus based upon the relative achievement, or lack thereof, of certain additional performance goals, as determined by our Board or Committee. The target bonus amounts for fiscal year 2021 for Messrs. Young, Fairbanks and Whitaker, expressed as a percentage of their year-end base salary, were 110%, 55% and 55%, respectively, payable in cash. The maximum bonus that can be earned is limited to 225% of the target bonus.

The bonuses varied depending on our percentage achievement of the Target set by the Committee. The Company did not fully achieve the Target required for a 100% target bonus payout. Based on the achievement formula, the executives were entitled to 70% of their target bonus. The Committee reserves the right to pay discretionary bonuses for fiscal year 2021 to account for unanticipated, unusual or extraordinary circumstances or performance.

On February 23, 2022, the Committee awarded bonus payments to the NEOs as called for under the previously approved compensation package as well an additional discretionary amount, such that each NEO received the same total bonus amount as he would have received had 100% of the Target been achieved. The Committee made this decision to award the additional discretionary amounts after thorough analysis and discussion of the Company's fiscal 2021 financial performance, the reasons why the Target was not achieved including but not limited to, the Company's decision, in consultation with the Board, to allocate resources strategically to the emerging electric vehicle business that is expected to benefit the Company's performance in the future, as well as COVID-19 related disruptions and supply chain disruptions, and a recognition of the level of performance throughout the year as well as retention considerations for the Company's workforce generally. In light of these circumstances and Committee's assessment of Company's opportunity that was created in the electric vehicle market, the Committee believed it was appropriate to pay the additional discretionary bonuses to reward and incentivize management. The Committee believed that doing so was also consistent with the Committee's policy of aligning the interests of the Company's employees with the interests of its stockholders. The Committee also approved the extension of the exercise period for stock options held by our retiring Chief Financial Officer (CFO), John F. Fairbanks, from 90 days to the later of (i) one year from his expected April 1, 2022 retirement as CFO and (ii) one year from the date of the end of his consulting period if he and the Company enter into a consulting agreement as is anticipated, but in any event no later than April 1, 2024.

The total bonus payments were as follows, which amounts include the additional discretionary amounts.

NEO	Discretionary Bonus Amount	Total Bonus Amount
Donald R. Young President and Chief Executive Officer	\$169,950	\$617,485
John F. Fairbanks Vice President, Chief Financial Officer and Treasurer	\$49,501	\$181,503
Corby Whitaker Senior Vice President, Sales and Marketing	\$66,000	\$242,000

Item 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The response to this item is incorporated by reference from the discussion responsive thereto under the captions “Management and Corporate Governance” and “Code of Business Conduct and Ethics” in the Company’s Proxy Statement for the 2022 Annual Meeting of Stockholders.

Item 11. EXECUTIVE COMPENSATION

The response to this item is incorporated by reference from the discussion responsive thereto under the caption “Executive Officer and Director Compensation,” “Compensation Discussion and Analysis,” “Management and Corporate Governance – Compensation Committee Interlocks and Insider Participation,” “Compensation Committee Report” and “Risks Related to Compensation Practices and Policies” in the Company’s Proxy Statement for the 2022 Annual Meeting of Stockholders.

Item 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The response to this item is incorporated by reference from the discussion responsive thereto under the captions “Security Ownership of Certain Beneficial Owners and Management” and “Equity Compensation Plan Information” in the Company’s Proxy Statement for the 2022 Annual Meeting of Stockholders.

Item 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The response to this item is incorporated by reference from the discussion responsive thereto under the captions “Certain Relationships and Related Person Transactions” and “Management and Corporate Governance” in the Company’s Proxy Statement for the 2022 Annual Meeting of Stockholders.

Item 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The response to this item is incorporated by reference from the discussion responsive thereto under the caption “Independent Registered Public Accounting Firm” in the Company’s Proxy Statement for the 2022 Annual Meeting of Stockholders.

PART IV

Item 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

Item 15(a). The following documents are filed as part of this Annual Report on Form 10-K:

Item 15(a)(1). The following consolidated financial statements of the Company are included in Part II, Item 8 of this Annual Report on Form 10-K:

Report of Independent Registered Public Accounting Firm
 Consolidated Balance Sheets as of December 31, 2021 and 2020
 Consolidated Statements of Operations for the Years Ended December 31, 2021, 2020, and 2019
 Consolidated Statements of Stockholders' Equity for the Years Ended December 31, 2021, 2020 and 2019
 Consolidated Statements of Cash Flows for the Years Ended December 31, 2021, 2020 and 2019
 Notes to Consolidated Financial Statements

Item 15(a)(2). The following financial statements schedule is included in Part II, Item 8:

Schedule II – Valuation and Qualifying Accounts

All other financial statement schedules have not been included because they are not applicable or the information is included in the financial statements or notes thereto.

Item 15(a)(3). Exhibits:

The following is a list of exhibits filed as part of this Annual Report on Form 10-K.

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
3.1	Restated Certificate of Incorporation of the Registrant, as filed with the Secretary of State of the State of Delaware on June 18, 2014.		Form 8-K (Exhibit 3.2)	6/19/14	001-36481
3.2	Restated Bylaws of Aspen Aerogels, Inc.		Form 8-K (Exhibit 3.3)	6/19/14	001-36481
4.1	Form of common stock certificate.		Amendment No. 1 to Form S-1 (Exhibit 4.1)	5/14/14	333-195523
4.2	Description of Securities.		Form 10-K (Exhibit 4.3)	3/6/20	001-36481
4.3	Form of Note (including Indenture incorporated by reference therein).		Form 8-K (Exhibit 4.1)	2/17/22	001-36481
10.1	2001 equity incentive plan, as amended. +		Form S-1 (Exhibit 10.1.1)	4/28/14	333-195523
10.2	Form of incentive stock option agreement granted under 2001 equity incentive plan, as amended. +		Form S-1 (Exhibit 10.1.2)	4/28/14	333-195523

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.3	Form of 2013 incentive stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.3)	4/28/14	333-195523
10.4	Form of 2013 performance-based incentive stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.4)	4/28/14	333-195523
10.5	Form of non-qualified stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.5)	4/28/14	333-195523
10.6	Form of 2013 non-qualified stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.6)	4/28/14	333-195523
10.7	Form of 2013 performance-based non-qualified stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.7)	4/28/14	333-195523
10.8	Form of 2013 independent director stock option agreement for options issued in exchange for the forfeiture of options granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.8)	4/28/14	333-195523
10.9	Form of 2013 performance-based independent director stock option agreement granted under 2001 equity incentive plan, as amended.+		Form S-1 (Exhibit 10.1.9)	4/28/14	333-195523
10.10	2014 employee, director and consultant equity incentive plan. +		Form S-8 (Exhibit 99.10)	8/13/14	333-198124
10.11	Form of stock option agreement granted under 2014 employee, director and consultant equity incentive plan.+		Amendment No. 1 to Form S-1 (Exhibit 10.2.2)	5/14/14	333-195523
10.12	Form of restricted stock unit agreement for executive officers under 2014 employee, director and consultant equity incentive plan. +		Form 10-Q (Exhibit 10.3)	11/7/14	001-36481
10.13	Form of restricted stock agreement for directors under 2014 employee, director and consultant equity incentive plan. +		Amendment No. 1 to Form S-1 (Exhibit 10.2.3)	5/14/14	333-195523
10.14	Multi-tenant industrial net lease, dated August 20, 2001, by and between the Registrant and Cabot II — MA1M03, LLC (as successor landlord to TMT290 Industrial Park, Inc.), as amended.		Form S-1 (Exhibit 10.3)	4/28/14	333-195523
10.14.1	First Amendment to Lease, dated December 22, 2021, by and between the Registrant and G&I IX Forbes Whitney, LLC.	X			
10.15.1	Second Amended and Restated Loan and Security Agreement dated March 12, 2021, by and between the Registrant and Silicon Valley Bank.		Form 10-K (Exhibit 10.15.13)	3/12/21	001-36481
10.15.2	First Amendment to the Second Amended and Restated Loan and Security Agreement, dated as of September 29, 2021, by and between the Registrant and Silicon Valley Bank.		Form 10-Q (Exhibit 10.1)	11/4/21	001-36481
10.15.3	Second Amendment to the Second Amended and Restated Loan and Security Agreement, dated as of December 27, 2021, by and between the Registrant and Silicon Valley Bank.	X			

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.16	Promissory Note, dated May 1, 2020 by and between Aspen Aerogels Rhode Island, LLC and Northeast Bank.		Form 10-Q (Exhibit 10.1)	5/4/20	001-36481
10.17	Executive Agreement, dated as of November 7, 2018, by and between the Registrant and Donald R. Young. +		Form 10-Q (Exhibit 10.2)	11/7/18	001-36481
10.17.1	Amendment to Executive Agreement, dated as of August 1, 2019, by and between the Registrant and Donald R. Young. +		Form 10-Q (Exhibit 10.1)	8/2/19	001-36481
10.17.2	Second Amendment to the Executive Agreement, dated as of January 1, 2020, by and between the Registrant and Donald R. Young. +		Form 10-K (Exhibit 10.16.2)	3/6/20	001-36481
10.17.3	Third Amendment to the Executive Agreement, dated as of June 29, 2021, by and between the Registrant and Donald R. Young. +		Form 10-Q (Exhibit 10.3)	8/4/21	001-36481
10.17.4	Executive Agreement, dated as of January 4, 2022, by and between the Registrant and Donald R. Young. +	X			

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.18	Form of executive agreement, dated as of December 21, 2018, by and between the Registrant and each of Messrs. Fairbanks and Whitaker. +		Form 8-K (Exhibit 10.1)	12/21/18	001-36481
10.18.1	Form of executive agreement, dated as of January 4, 2022, by and between the Registrant and each of Messrs. Fairbanks and Whitaker. +	X			
10.19	Bonus plan. +		Amendment No. 2 to Form S-1 (Exhibit 10.15)	5/22/14	333-195523
10.20	Form of participation letter of executive officers under bonus plan. +		Form 10-K (Exhibit 10.23)	3/2/17	001-36481
10.21	Non-Employee Director Compensation Policy. +	X			
10.22	Compensation Recoupment Policy.		Form 10-K (Exhibit 10.25)	3/8/19	001-36481
10.23	Cross license agreement dated as of April 1, 2006 by and between Cabot Corporation and the Registrant, as amended.*		Form S-1 (Exhibit 10.17)	4/28/14	333-195523
10.24	Form of indemnification agreement with directors and certain officers. +		Amendment No. 1 to Form S-1 (Exhibit 10.18)	5/14/14	333-195523
10.25	Inducement Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the City of Statesboro, Georgia and Bulloch County, Georgia.		Form 10-Q (Exhibit 10.1)	5/6/16	001-36481
10.26	PILOT Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the City of Statesboro, Georgia and Bulloch County, Georgia.		Form 10-Q (Exhibit 10.2)	5/6/16	001-36481
10.27	Performance and Accountability Agreement, dated February 15, 2016, by and between the Registrant and the Development Authority of Bulloch County, the Georgia Department of Community Affairs and the administering agency for the OneGeorgia Authority.		Form 10-Q (Exhibit 10.3)	5/6/16	001-36481
10.28	Supply Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.1)	8/5/16	001-36481
10.28.1	Amended and Restated Supply Agreement, dated February 16, 2018, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.2)	5/4/18	001-36481
10.28.2	First Addendum to the Amended and Restated Supply Agreement, dated January 14, 2019, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.1)	5/3/19	001-36481
10.29	Side Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.2)	8/5/16	001-36481
10.29.1	Amended and Restated Side Agreement, dated February 16, 2018, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.3)	5/4/18	001-36481
10.29.2	First Amendment to the Amended and Restated Supply Agreement, and Termination of the Side Agreement, dated December 15, 2021, by and between the Registrant and BASF SE.*	X			

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.30	Joint Development Agreement, dated June 21, 2016, by and between the Registrant and BASF SE.*		Form 10-Q (Exhibit 10.3)	8/5/16	001-36481

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
10.31	At Market Issuance Sales Agreement, dated November 5, 2020, by and between the Registrant and B. Riley Securities, Inc.		Form 10-Q (Exhibit 10.1)	11/5/20	001-36481
10.32	Supply Agreement, dated February 3, 2021, by and between the registrant and Silbond Corporation.*		Form 10-Q (Exhibit 10.1)	5/4/21	001-36481
10.33	Securities Purchase Agreement, dated June 29, 2021, by and between the Registrant and Spring Creek Capital, LLC.		Form 8-K (Exhibit 10.1)	6/30/21	001-36481
10.34	Performance-Based Restricted Stock Agreement, dated as of June 29, 2021, by and between the Registrant and Donald R. Young. †		Form 10-Q (Exhibit 10.3)	8/4/21	001-36481
10.35	Note Purchase Agreement, dated February 15, 2022, by and between the Registrant and Wood River Capital, LLC.		Form 8-K (Exhibit 10.1)	2/17/22	001-36481
10.36	Securities Purchase Agreement, dated February 15, 2022, by and between the Registrant and Wood River Capital, LLC.		Form 8-K (Exhibit 10.2)	2/17/22	001-36481
14.1	Code of business conduct and ethics.		Form 10-K (Exhibit 14.1)	3/6/20	001-36481
21.1	Subsidiaries of the Registrant.	X			
23.1	Consent of KPMG LLP.	X			
31.1	Certification of principal executive officer under Section 302(a) of the Sarbanes-Oxley Act of 2002.	X			
31.2	Certification of principal financial officer under Section 302(a) of the Sarbanes-Oxley Act of 2002.	X			
32	Certifications of the principal executive officer and the principal financial officer under Section 906 of the Sarbanes-Oxley Act of 2002.	X			
101.INS	XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.	X			
101.SCH	Inline XBRL Taxonomy Extension Schema Document.	X			
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document.	X			
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document.	X			
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document.	X			
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document.	X			
104	Cover Page Interactive Data File (embedded within the Inline XBRL document).	X			

+ Management contract or compensatory plan or arrangement.

* Confidential treatment has been granted with respect to certain portions of this Exhibit, which portions have been omitted and filed separately with the Securities and Exchange Commission as part of an application for confidential treatment pursuant to the Securities Act of 1933, as amended.

Item 16. FORM 10-K SUMMARY

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ASPEN AEROGELS, INC.

Date: February 28, 2022

By: /s/ Donald R. Young
Donald R. Young
President and Chief Executive Officer
(principal executive officer)

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated below and on the dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ Donald R. Young</u> Donald R. Young	President, Chief Executive Officer and Director (principal executive officer)	February 28, 2022
<u>/s/ John F. Fairbanks</u> John F. Fairbanks	Vice President, Chief Financial Officer and Treasurer (principal financial officer and principal accounting officer)	February 28, 2022
<u>/s/ William P. Noglows</u> William P. Noglows	Chairman of the Board	February 28, 2022
<u>/s/ Rebecca B. Blalock</u> Rebecca B. Blalock	Director and Chair of the Nominating and Governance Committee	February 28, 2022
<u>/s/ Robert M. Gervis</u> Robert M. Gervis	Director and Chair of the Compensation and Leadership Development Committee	February 28, 2022
<u>/s/ Steven R. Mitchell</u> Steven R. Mitchell	Director	February 28, 2022
<u>/s/ Mark L. Noetzel</u> Mark L. Noetzel	Director	February 28, 2022
<u>/s/ Richard F. Reilly</u> Richard F. Reilly	Director and Chair of the Audit Committee	February 28, 2022

FIRST AMENDMENT TO LEASE

This First Amendment to Lease (this "**Amendment**") is executed as of December 22, 2021 (the "**Effective Date**"), between G&I IX FORBES WHITNEY LLC, a Delaware limited liability company ("**Landlord**"), and ASPEN AEROGELS, INC., a Delaware corporation ("**Tenant**"). Capitalized terms used herein but not defined shall be given the meanings assigned to them in the Lease.

RECITALS:

Landlord and Tenant are currently parties to that certain Industrial Real Estate Lease dated June 29, 2016 (the "**Original Lease**" and, as amended from time to time, the "**Lease**") for approximately 51,650 rentable square feet (the "**Premises**") in the building located at 30 Forbes Road, Northborough, Massachusetts (the "**Building**"). The Lease Term is scheduled to expire on December 31, 2026. Landlord and Tenant desire to amend the Lease to, among other things, extend the Lease Term on the terms and conditions contained herein.

AGREEMENTS:

For valuable consideration, whose receipt and sufficiency are acknowledged, Landlord and Tenant agree as follows:

1. **Extension of Lease Term.** The Lease Term is hereby retroactively amended and extended for a period of one hundred twenty-four (124) months beginning on September 1, 2021 (the "**Renewal Effective Date**") such that it expires on December 31, 2031 (the "**Expiration Date**"), on the terms and conditions of the Lease, as modified hereby. The remainder of the Lease Term as set forth in the Original Lease shall be discarded.

2. **Base Rent.** Beginning on the Renewal Effective Date and continuing through the Expiration Date, Tenant shall pay Base Rent for the Premises as follows:

Time Period	Monthly Base Rent Rate Per Square Foot	Monthly Installments of Base Rent
09/01/21 – 08/31/22	\$8.89	\$38,264.04
09/01/22 – 08/31/23	\$9.16	\$39,411.96
09/01/23 – 08/31/24	\$9.43	\$40,594.32
09/01/24 – 08/31/25	\$9.71	\$41,812.15
09/01/25 – 08/31/26	\$10.01	\$43,066.52
09/01/26 – 08/31/27	\$10.31	\$44,358.51
09/01/27 – 08/31/28	\$11.75	\$50,573.96
09/01/28 – 08/31/29	\$12.10	\$52,091.18
09/01/29 – 08/31/30	\$12.47	\$53,653.91
09/01/30 – 08/31/31	\$12.84	\$55,263.53
09/01/31 – 12/31/31	\$13.22	\$56,921.44

3. **Additional Rent.** Tenant shall continue to pay all sums due and payable under the Lease, other than Base Rent, including without limitation Tenant's Pro Rata Share of Total Operating Costs and Utility Costs, in accordance with the terms of the Lease, as amended hereby.
4. **Acceptance of Premises.** Tenant accepts the Premises in their "AS-IS" condition and Landlord shall have no obligation to improve, repair, restore or refurbish the Premises except as otherwise specifically provided in the Lease and this Amendment. Tenant acknowledges that neither Landlord nor any agent of Landlord has made any representation or warranty, except as otherwise expressly provided in the Lease or this Amendment, with respect to the Premises or any other portion of the Property including, without limitation, any representation or warranty with respect to the suitability or fitness of the Premises or any other portion of the Property for the conduct of Tenant's business.
5. **Tenant Improvements.** Tenant shall perform tenant improvements in the Premises for which Landlord shall provide allowances to offset certain costs, all subject to and in accordance with **Exhibit A** hereto (the "**Work Letter**"). Additionally, and separate and apart from the work contemplated in the Work Letter, Tenant hereby acknowledges and agrees that, prior to the Effective Date, Landlord has, at Landlord's sole cost and expense, replaced the rear egress steps currently serving the Premises with new steps using Building-standard materials (the "**Landlord Work**"). Tenant's execution and delivery of this Amendment shall conclusively establish that Tenant has inspected the Landlord Work and accepted it in its current as-is condition and in full satisfaction of Landlord's obligation to perform said Landlord Work.
6. **Tenant's Insurance.**
- a. The reference to "\$300,000" in Section 7.01 of the Original Lease, regarding Tenant's "damage to rented premises" insurance coverage, is hereby deleted and replaced with "\$1,000,000".
- b. All of Tenant's insurance policies, except workers' compensation and employer's liability, shall include Landlord, Landlord's property manager and Landlord's mortgagee as additional insureds or loss payees as their interests may appear.
7. **Options.** All prior and unexercised options to renew or extend the Lease Term, rights of first refusal, rights of first offer, expansion rights or other similar rights are hereby deleted in their entirety and shall be of no further force or effect. The foregoing shall not be deemed to limit or impact in any way the new options set forth expressly in Sections 8 and 9 of this Amendment.
8. **Renewal Option.** Tenant shall have the option to renew the Lease and extend the Lease Term pursuant to and in accordance with **Exhibit B** attached hereto.
9. **Right of First Refusal.** Tenant shall have a right of first refusal pursuant to and in accordance with **Exhibit C** attached hereto.
10. **Limitation of Liability.** In addition to any other limitations of Landlord's liability as contained in the Lease, as amended to date, the liability of Landlord (and its partners, shareholders or members) to Tenant (or any person or entity claiming by, through or under Tenant) for any default by Landlord under the terms of the Lease or any matter relating to or arising out of the occupancy or use of the Premises and/or other areas of the Building shall be limited to Tenant's actual direct, but not consequential, damages therefor and shall be recoverable only from the interest of Landlord in the Building and Property (inclusive of rents, proceeds and awards), and Landlord (and its partners, shareholders or members) shall not be personally liable for any deficiency.
11. **Notices.** All notices and other communications given pursuant to the Lease shall be in writing and shall be (a) mailed by first class, United States mail, postage prepaid, certified, with return receipt requested, and addressed to the parties hereto at the address listed below, (b) hand delivered to the intended addressee, or (c) sent by nationally recognized overnight courier. Notice sent by certified mail, postage prepaid, shall be effective three business days after being deposited in the United States mail; all other notices shall be effective upon delivery to the address of the addressee (even if such addressee refuses delivery thereof). The parties hereto may change their
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addresses by giving notice thereof to the other in conformity with this provision. Landlord and Tenant hereby agree not to conduct the transactions or communications contemplated by the Lease, as amended hereby, by electronic means; nor shall the use of the phrase "in writing" or the word "written" be construed to include electronic communications. The addresses for notice set forth below shall supersede and replace any addresses for notice set forth in the Lease.

Landlord: c/o CBRE | Property Management
3 Burlington Woods Drive
Burlington, MA 01803
Attention: Property Manager

with a copy to c/o DRA Advisors LLC
575 Fifth Avenue (38th Floor)
New York, NY 10017
Attn: Asset Management

Tenant: Aspen Aerogels, Inc.
30 Forbes Road, Bldg. B
Northborough, MA 01532
Attn: Office of General Counsel

12. **Brokerage.** Landlord and Tenant each warrant to the other that it has not dealt with any broker or agent in connection with the negotiation or execution of this Amendment other than CBRE, representing Landlord, and Beacon St Realty Advisors, representing Tenant, whose commissions shall be paid by Landlord pursuant to separate written agreements. Tenant and Landlord shall each indemnify the other against all costs, expenses, attorneys' fees, and other liability for commissions or other compensation claimed by any other broker or agent claiming the same by, through, or under the indemnifying party.

13. **Prohibited Persons and Transactions.** Tenant represents and warrants to Landlord that Tenant is currently in compliance with and shall at all times during the Lease Term (including any extension thereof) remain in compliance with the regulations of the Office of Foreign Assets Control ("**OFAC**") of the Department of the Treasury (including those named on OFAC's Specially Designated Nationals and Blocked Persons List) and any statute, executive order (including the September 24, 2001, Executive Order Blocking Property and Prohibiting Transactions with Persons Who Commit, Threaten to Commit or Support Terrorism), or other governmental action relating thereto.

14. **Ratification.** Tenant hereby ratifies and confirms its obligations under the Lease, and represents and warrants to Landlord that it has no defenses thereto. Additionally, Tenant further confirms and ratifies that, as of the date hereof, (a) the Lease is and remains in good standing and in full force and effect, (b) Tenant has no claims, counterclaims, set-offs or defenses against Landlord arising out of the Lease or in any way relating thereto or arising out of any other transaction between Landlord and Tenant, and (c) except as expressly provided for in this Amendment, all tenant finish-work allowances provided to Tenant under the Lease or otherwise, if any, have been paid in full by Landlord to Tenant, and Landlord has no further obligations with respect thereto.

15. **WAIVER OF JURY TRIAL.** TO THE MAXIMUM EXTENT PERMITTED BY LAW, LANDLORD AND TENANT EACH WAIVE ANY RIGHT TO TRIAL BY JURY IN ANY LITIGATION OR TO HAVE A JURY PARTICIPATE IN RESOLVING ANY DISPUTE ARISING OUT OF OR WITH RESPECT TO THE LEASE OR ANY OTHER INSTRUMENT, DOCUMENT OR AGREEMENT EXECUTED OR DELIVERED IN CONNECTION HERewith OR THE TRANSACTIONS RELATED HERETO.

16. **Recordation of Lease.** Tenant shall not record the Lease or any memorandum of the Lease without the prior written consent of Landlord, which consent may be withheld or denied in the sole and absolute discretion of Landlord, and any recordation by Tenant shall be a material breach of the Lease. Tenant grants to

Landlord a power of attorney to execute and record a release releasing any such recorded instrument of record that was recorded without the prior written consent of Landlord.

17. **Headings.** The headings or captions of the paragraphs in this Amendment are for convenience only and shall not act and shall not be implied to act to limit or expand the construction and intent of the contents of the respective paragraph.

18. **Binding Effect; Governing Law.** Except as modified hereby, the Lease shall remain in full effect and this Amendment shall be binding upon Landlord and Tenant and their respective successors and assigns. If any inconsistency exists or arises between the terms of this Amendment and the terms of the Lease, the terms of this Amendment shall prevail. This Amendment shall be governed by the laws of the State in which the Premises are located.

19. **Counterparts.** This Amendment may be executed in multiple counterparts, each of which shall constitute an original, but all of which shall constitute one document. This Amendment may be executed by electronic signature, which shall be considered as an original signature for all purposes and shall have the same force and effect as an original signature. For these purposes, "electronic signature" shall mean electronically scanned and transmitted versions (e.g., via pdf file) of an original signature, signatures electronically inserted and verified by software such as Adobe Sign, or faxed versions of an original signature.

20. **Submission of Amendment Not Offer.** The submission by Landlord to Tenant of this Amendment for Tenant's consideration shall have no binding force or effect, and shall not confer any rights upon Tenant or impose any obligations upon Landlord irrespective of any reliance thereon by Tenant, change of position, partial performance, or any correspondence among either party or its authorized representatives. This Amendment is effective and binding on Landlord only upon the execution and delivery of this Amendment by Landlord and Tenant.

[remainder of page intentionally left blank]

This Amendment is executed on the respective dates set forth below, but for reference and effectiveness purposes this Amendment shall be dated as of the Effective Date. If the execution date is left blank, this Amendment shall be deemed executed as of the Effective Date.

LANDLORD: G&I IX FORBES WHITNEY LLC,
a Delaware limited liability company

By: /s/Valla Brown
Name: Valla Brown
Title: Vice President

Execution Date: Effective Date

TENANT: ASPEN AEROGELS, INC.,
a Delaware corporation

By: /s/John F. Fairbanks
Name: John F. Fairbanks
Title: VP, CFO & Treasurer

Execution Date: December 22, 2021

Exhibit A – Work Letter

1. **Acceptance of Premises.** Except for Landlord's obligation to perform the Landlord Work and to disburse the Construction Allowance as set forth in this **Exhibit A**, Tenant accepts the Premises in their "**AS-IS**" condition on the Effective Date.
 2. **Plans and Specifications.** Landlord and Tenant agree and confirm that the construction drawings prepared by Olson Lewis + Architects dated July 30, 2021, incorporated by reference for all purposes herein (the "**Working Drawings**"), constitute the final, mutually approved permit set of drawings accurately depicting the work to be performed in the Premises. Notwithstanding the content of the Working Drawings, one component of the Work (as hereinafter defined) shall include the replacement of the HVAC unit currently serving the Premises known as RTU9 (such replacement work being considered part of the "Work" but referred to herein specifically as the "**HVAC Work**").
 3. **Contractors; Performance of Work.** The Work shall be performed only by licensed contractors and subcontractors approved in writing by Landlord, which approval shall not be unreasonably withheld, conditioned or delayed. All contractors and subcontractors shall be required to procure and maintain insurance against such risks, in such amounts, and with such companies as Landlord may reasonably require. Certificates of such insurance must be received by Landlord before the Work is commenced. The Work shall be performed in a good and workmanlike manner free of defects, shall conform strictly with the Working Drawings.
 4. **Construction Contracts.** Tenant entered into a construction contract with PIDC Construction, LLC ("**PIDC**") for the work contemplated under this Exhibit, and Landlord hereby grants its consent for PIDC as the general contractor for the Work. Tenant shall provide a copy of its contract with PIDC to Landlord together with certificate of insurance evidencing PIDC's maintenance of a general commercial liability insurance of not less than a combined single limit of \$5,000,000, naming Landlord, Landlord's property management company, Landlord's asset management company, Landlord's Mortgagee, Tenant, and each of their respective Affiliates as additional insureds.
 5. **Change Orders.** Tenant may initiate changes in the Work. Any such change that would either (i) result in a change in the estimated Total Construction Costs of \$25,000.00 or more, or (ii) would adversely affect (in the reasonable discretion of Landlord) (1) the Building's structure or the Building's systems (including the Building's restrooms or mechanical rooms), (2) the exterior appearance of the Building, or (3) the appearance of the Building's common areas or elevator lobby areas, shall require Landlord's prior written consent, not to be unreasonably withheld, conditioned or delayed. Tenant shall, upon completion of the Work, furnish Landlord with an accurate architectural "as-built" plan of the Work as constructed, which plan shall be incorporated into this Exhibit by this reference for all purposes. If Tenant requests any changes to the Work described in the Working Drawings, then such increased costs and any additional design costs incurred in connection therewith as the result of any such change shall be added to the Total Construction Costs.
 6. **Excess Costs.** The entire cost of performing the Work (including design of and space planning for the Work and preparation of the Working Drawings and the final "as-built" plan of the Work, costs of construction labor and materials, electrical usage during construction, additional janitorial services, general tenant signage, related taxes and insurance costs, licenses, permits, certifications, surveys and other approvals required by Law, all of which costs are herein collectively called the "**Total Construction Costs**") in excess of the Construction Allowance (hereinafter defined) shall be paid by Tenant. For the avoidance of doubt, Landlord shall not charge any construction supervision or management fee.
 7. **Walk-Through; Punchlist.** When Tenant considers the Work in the Premises to be complete, Tenant will notify Landlord and, at a mutually agreeable time, Landlord's representative and Tenant's representative shall conduct a walk-through of the Premises for quality control and to ensure compliance with the Working Drawings and this Exhibit, including, if necessary, identifying any necessary touch-up work, repairs and minor completion items that are necessary for final completion of the Work.
 8. **Construction Allowance.** Landlord shall provide to Tenant a construction allowance not to exceed \$475,000.00 (the "**Construction Allowance**") to be applied toward the Total Construction Costs.
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\$100,000.00 out of the Construction Allowance shall be specifically earmarked to be applied toward the costs of the HVAC Work; in the event the HVAC Work costs less than \$100,000.00, the balance shall be utilized by Tenant towards the Total Construction Costs. No advance of the Construction Allowance shall be made until Tenant has paid to the contractor performing the Work (and provided reasonable evidence thereof to Landlord) the anticipated amount by which the projected Total Construction Costs exceed the Construction Allowance (e.g., if Tenant's contract with PIDC calls for a total cost of \$500,000.00, Tenant must pay to PIDC at least \$25,000.00 prior to making requests for disbursements from the Construction Allowance). Landlord shall pay to Tenant the Construction Allowance in multiple disbursements (but not more than once in any calendar month) following the receipt by Landlord of the following items: (a) a request for payment, (b) final or partial lien waivers, as the case may be, from all persons performing work or supplying or fabricating materials for the Work, fully executed, acknowledged and in recordable form, and (c) the Architect's certification that the Work for which reimbursement has been requested has been finally completed, including (with respect to the last application for payment only) any punch-list items, on the appropriate AIA form or another form approved by Landlord (collectively, a "**Completed Application for Payment**"). Landlord shall pay the amount requested in the applicable Completed Application for Payment to Tenant within 30 days following Tenant's submission of the Completed Application for Payment. If, however, the Completed Application for Payment is incomplete or incorrect, Landlord's payment of such request shall be deferred until 30 days following Landlord's receipt of the Completed Application for Payment. Notwithstanding anything to the contrary contained in this Exhibit, Landlord shall not be obligated to make any disbursement of the Construction Allowance during the pendency of any of the following: (A) Landlord has received written notice of any unpaid claims relating to any portion of the Work or materials in connection therewith, other than claims which will be paid in full from such disbursement, (B) there is an unbonded lien outstanding against the Building or the Premises or Tenant's interest therein by reason of work done, or claimed to have been done, or materials supplied or specifically fabricated, claimed to have been supplied or specifically fabricated, to or for Tenant or the Premises, (C) the conditions to the advance of the Construction Allowance are not satisfied, or (D) an Event of Default by Tenant exists. The Construction Allowance must be used (that is, the Work must be fully complete and the Construction Allowance disbursed) within eighteen (18) months following the Effective Date or shall be deemed forfeited with no further obligation by Landlord with respect thereto, time being of the essence with respect thereto.

Notwithstanding anything in this Exhibit to the contrary, in the event the Total Construction Costs exceed the Construction Allowance, subject to the limitations with respect to the costs of the HVAC Work set forth above, Landlord shall make available to Tenant, at Tenant's sole election, additional funds not to exceed \$1,500,000.00 ("**Additional Allowance**") to be applied toward the Total Construction Costs in the same manner and subject to the same procedures as set forth above. In the event that Tenant elects to utilize any Additional Allowance, any such amount so utilized shall be amortized over the extended Lease Term at eight percent (8%) annual interest, and Tenant shall pay to Landlord the amortized amount (including interest) in equal monthly amounts together with its rental payments under the Lease as amended by this Amendment.

9. **No "Owner-contractor" Relationship.** Landlord and Tenant acknowledge and agree that their relationship is and shall be solely that of "landlord-tenant" (thereby excluding a relationship of "owner-contractor," "owner-agent" or other similar relationships) and that Tenant is not authorized to act as Landlord's common law agent or construction agent in connection with any work performed in the Premises. Accordingly, all materialmen, contractors, artisans, mechanics, laborers and any other persons now or hereafter contracting with Tenant, any contractor or subcontractor of Tenant for the furnishing of any labor, services, materials, supplies or equipment with respect to any portion of the Premises, at any time from the date hereof until the end of the Lease Term, are hereby charged with notice that they look exclusively to Tenant to obtain payment for same. Nothing herein shall be deemed a consent by Landlord to any liens being placed upon the Premises, the Property or Landlord's interest therein due to any work performed by or for Tenant or deemed to give any contractor or subcontractor or materialman any right or interest in any funds held by Landlord to reimburse Tenant for any portion of the cost of such work. Tenant shall defend, indemnify and hold harmless Landlord and its agents and representatives from and against all claims, demands, causes of action, suits, judgments, damages and expenses (including reasonable attorneys' fees) in any way arising from or relating to the failure by Tenant to pay for any work performed, materials furnished, or obligations incurred by or at the request of Tenant. This indemnity provision shall survive termination or expiration of the Lease.

10. **No Restoration.** Notwithstanding anything in the Lease to the contrary, Tenant shall have no obligation to remove or restore any of the Work actually approved and funded by Landlord under this Exhibit. Nothing in this Section 8 shall be deemed as a waiver of or limitation on Landlord's right to require Tenant to restore other areas of the Premises and other, prior Tenant-made alterations, specifically including but without limitation the older, existing lab areas in the Premises, as permitted pursuant to the terms and conditions of the Lease.

11. **Construction Representatives.** Landlord's and Tenant's representatives for coordination of construction and approval of change orders will be as follows, provided that either party may change its representative upon written notice to the other:

Landlord's Representative:

c/o _____

Telephone: ____ - ____ - _____

Email: _____

Tenant's Representative:

c/o _____

Telephone: ____ - ____ - _____

Email: _____

Exhibit B – Renewal Option

Provided no Event of Default exists and Tenant is occupying the entire Premises at the time of such election, Tenant may renew the Lease for one (1) additional period of five (5) years, by delivering written notice of the exercise thereof to Landlord not earlier than twelve (12) months nor later than nine (9) months before the expiration of the Lease Term. The Base Rent payable for each month during such extended Lease Term shall be the greater of (a) the prevailing rental rate (the "**Prevailing Rental Rate**"), at the commencement of such extended Lease Term, for renewals of space in the Building of equivalent quality, size, utility and location, with all improvements, alterations and betterments to the Premises made by or on behalf of Tenant following the Effective Date (including all components of the Work as defined in the Work Letter), the length of the extended Lease Term, the "AS IS" nature of the renewal, and the credit standing of Tenant to be taken into account, and (b) the then current Base Rent rate. Within thirty (30) days after receipt of Tenant's notice to renew, Landlord shall deliver to Tenant written notice of the Prevailing Rental Rate and shall advise Tenant of the required adjustment to Base Rent, if any, and the other terms and conditions offered. Tenant shall, within ten (10) business days after receipt of Landlord's notice, notify Landlord in writing whether Tenant accepts or rejects Landlord's determination of the Prevailing Rental Rate. If Tenant timely notifies Landlord that Tenant accepts Landlord's determination of the Prevailing Rental Rate, then, on or before the commencement date of the extended Lease Term, Landlord and Tenant shall execute an amendment to the Lease extending the Lease Term on the same terms provided in the Lease, except as follows:

- (a) Base Rent shall be adjusted to the Prevailing Rental Rate (in the event the Prevailing Rental Rate is greater than the then current Base Rent rate);
- (b) Tenant shall have no further renewal option unless expressly granted by Landlord in writing; and
- (c) Landlord shall lease to Tenant the Premises in their then-current condition, and Landlord shall not provide to Tenant any allowances (e.g., moving allowance, construction allowance, and the like) or other tenant inducements except to the extent expressly agreed otherwise.

If Tenant rejects Landlord's determination of the Prevailing Rental Rate and timely notifies Landlord thereof, Tenant may, in its notice to Landlord, require that the determination of the Prevailing Rental Rate be made by brokers (and if Tenant makes such election, Tenant shall be deemed to have irrevocably renewed the Lease Term, subject only to the determination of the Prevailing Rental Rate as provided below). In such event, within ten (10) days thereafter, each party shall select a qualified commercial real estate broker with at least ten (10) years' experience in leasing property and buildings in the city or submarket in which the Premises are located. The two brokers shall give their opinion of prevailing rental rates within twenty (20) days after their retention. In no event, however, shall the Base Rent in the renewal term be less than the then current Base Rent rate per rentable square foot in effect hereunder. In the event the opinions of the two brokers differ and, after good faith efforts over the succeeding twenty (20)-day period, they cannot mutually agree, the brokers shall immediately and jointly appoint a third broker with the qualifications specified above. This third broker shall immediately (within five (5) business days) choose either the determination of Landlord's broker or Tenant's broker and such choice of this third broker shall be final and binding on Landlord and Tenant. Each party shall pay its own costs for its real estate broker. Following the determination of the Prevailing Rental Rate by the brokers, the parties shall equally share the costs of any third broker. The parties shall promptly execute an amendment as set forth above. If Tenant fails to timely notify Landlord in writing that Tenant accepts or rejects Landlord's determination of the Prevailing Rental Rate, time being of the essence with respect thereto, Tenant's shall be deemed to have rejected Landlord's determination.

Tenant's rights under this Exhibit shall terminate if (1) the Lease or Tenant's right to possession of the Premises is terminated, (2) Tenant assigns any of its interest in the Lease or sublets any portion of the Premises (other than a permitted transfer to an Affiliate as set forth in the Original Lease), or (3) Tenant fails to timely exercise its option under this Exhibit, time being of the essence with respect to Tenant's exercise thereof.

Exhibit C – Right of First Refusal

Subject to then-existing renewal or expansion options or other preferential rights of other tenants, and provided no Event of Default exists and Tenant is leasing and occupying the entire Premises at the time of such election, Tenant shall have a one-time right of first refusal (the “**Right of First Refusal**”) to lease available space in the Building (“**First Refusal Space**”), in accordance with and subject to each of the following terms and conditions:

(a)**Procedure for Offer.** During the Term, should Landlord receive an offer (an “**Offer**”) with respect to all or any portion of the First Refusal Space (provided said portion is available for lease and in a leasable configuration) from a bona fide third party prospect (the “**Prospect**”) which Landlord is willing to accept, Landlord shall notify Tenant (a “**First Refusal Notice**”). Pursuant to such First Refusal Notice, Landlord shall offer to lease to Tenant the applicable First Refusal Space on the terms and conditions of the Offer. As used in this Exhibit only, the term “available for lease” means that the First Refusal Space is neither: (i) subject to any rights of third parties existing as of the Effective Date, including, without limitation, previously granted rights of first notice, first refusal, expansion rights, extension rights, options to lease, or other previously granted rights, nor (ii) subject to renewal by occupants in the Building as of the Effective Date, regardless whether their leases contains an option to renew and regardless of whether any such option was actually exercised.

(b)**Procedure for Acceptance.** If Tenant wishes to exercise Tenant’s Right of First Refusal with respect to the space described in a First Refusal Notice, then within five (5) business days of delivery of such First Refusal Notice to Tenant, Tenant shall deliver notice to Landlord (a “**First Refusal Acceptance Notice**”) of Tenant’s exercise of the Right of First Refusal with respect to the First Refusal Space on the terms contained therein. If Tenant does not deliver a First Refusal Acceptance Notice within the five (5) business-day period, then Landlord shall be free to lease the space described in such First Refusal Notice to any third party. If the space described in the Offer includes space in addition to the First Refusal Space, Tenant shall exercise its Right of First Refusal with respect to the entire space set forth in the Offer or not at all.

(c)**Other Terms of Lease Apply.** Except for the specific terms applicable to the First Refusal Space, all other terms and conditions of the Lease shall apply to the First Refusal Space.

Amendment to Lease. Promptly after Tenant’s exercise of the Right of First Refusal, Landlord and Tenant shall enter into an amendment to the Lease to reflect the addition of the applicable First Refusal Space subject to the same basic terms of the Lease.

Personal. The Right of First Refusal as set forth in this Exhibit is personal to the original Tenant named herein and such option may only be exercised by such original Tenant (and not any assignee, sublessee or transferee of Tenant’s interest in this Lease).

**SECOND AMENDMENT
TO
SECOND AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT**

This Second Amendment to Second Amended and Restated Loan and Security Agreement (this “**Amendment**”) is entered into this 27th day of December, 2021 by and between **SILICON VALLEY BANK** (“**Bank**”) and **ASPEN AEROGELS, INC.**, a Delaware corporation (“**Borrower**”) whose address is 30 Forbes Road, Building B, Northborough, Massachusetts 01532.

RECITALS

- A.** Bank and Borrower have entered into that certain Second Amended and Restated Loan and Security Agreement dated as of March 12, 2021 and a First Amendment to Second Amended and Restated Loan and Security Agreement dated September 29, 2021 (as the same may from time to time be further amended, restated, amended and restated, modified and/or supplemented, the “**Loan Agreement**”).
- B.** Bank has extended credit to Borrower for the purposes permitted in the Loan Agreement.
- C.** Borrower has requested that Bank amend the Loan Agreement to make certain revisions to the Loan Agreement as more fully set forth herein.
- D.** Bank has agreed to so amend certain provisions of the Loan Agreement, but only to the extent, in accordance with the terms, subject to the conditions and in reliance upon the representations and warranties set forth below.

AGREEMENT

Now, **THEREFORE**, in consideration of the foregoing recitals and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and intending to be legally bound, the parties hereto agree as follows:

- 1. Definitions.** Capitalized terms used but not defined in this Amendment shall have the meanings given to them in the Loan Agreement.
- 2. Amendments to Loan Agreement.**

2.1 Section 6.9 (Financial Covenants). Clause (a) of Section 6.9 is deleted in its entirety and replaced with the following:

“(a) EBITDA. Borrower shall achieve, measured as of the end of each fiscal quarter during the following periods, EBITDA of at least (loss not worse than) the following for the following periods:

Period	Minimum EBITDA (maximum loss)
Trailing twelve (12) month period ending December 31, 2021	(\$25,000,000)

For the quarterly periods ending after December 31, 2021, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28,

2022 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply.”

2.2 Exhibit B (Compliance Certificate). The Compliance Certificate attached to the Loan Agreement as Exhibit B is amended in its entirety and replaced with the Compliance Certificate in the form of Exhibit B attached hereto.

3. Limitation of Amendments.

3.1 The amendments set forth in Section 2 above are effective for the purposes set forth herein and shall be limited precisely as written and shall not be deemed to (a) be a consent to any amendment, waiver or modification of any other term or condition of any Loan Document, or (b) otherwise prejudice any right or remedy which Bank may now have or may have in the future under or in connection with any Loan Document.

3.2 This Amendment shall be construed in connection with and as part of the Loan Documents and all terms, conditions, representations, warranties, covenants and agreements set forth in the Loan Documents, except as herein amended, are hereby ratified and confirmed and shall remain in full force and effect.

4. Consent. Bank hereby consents to Borrower’s maintainance of Inventory in a certain Malaysia free trade zone warehouse that is not subject to a bailee agreement in favor of Bank; provided that such consent is conditioned upon the value Borrower’s assets at such location not exceeding \$500,000 at any time. Borrower hereby acknowledges and agrees that except as specifically provided herein, nothing in this section or anywhere in this Amendment shall be deemed or otherwise construed as a consent or waiver by Bank of any of its rights and remedies pursuant to the Loan Documents, applicable law or otherwise. Bank’s consent is limited to such Malaysia free trade zone warehouse.

5. Representations and Warranties. To induce Bank to enter into this Amendment, Borrower hereby represents and warrants to Bank as follows:

5.1 Immediately after giving effect to this Amendment (a) the representations and warranties contained in the Loan Documents are true, accurate and complete in all material respects as of the date hereof (except to the extent such representations and warranties relate to an earlier date, in which case they are true and correct as of such date), and (b) no Event of Default has occurred and is continuing;

5.2 Borrower has the power and authority to execute and deliver this Amendment and to perform its obligations under the Loan Agreement, as amended by this Amendment;

5.3 The organizational documents of Borrower delivered to Bank on the Effective Date remain true, accurate and complete and have not been amended, supplemented or restated and are and continue to be in full force and effect;

5.4 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, have been duly authorized;

5.5 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not and will not contravene (a) any law or regulation binding on or affecting Borrower, (b) any contractual restriction with a Person binding on Borrower, (c) any order, judgment or decree of any court or other governmental or public body or authority, or subdivision thereof, binding on Borrower, or (d) the organizational documents of Borrower;

5.6 The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not require any order, consent, approval, license, authorization or validation of, or filing, recording or registration with, or exemption by any governmental or public body or authority, or subdivision thereof, binding on Borrower, except as already has been obtained or made; and

5.7 This Amendment has been duly executed and delivered by Borrower and is the binding obligation of Borrower, enforceable against Borrower in accordance with its terms, except as such enforceability may be limited by bankruptcy, insolvency, reorganization, liquidation, moratorium or other similar laws of general application and equitable principles relating to or affecting creditors' rights.

6. Ratification of Perfection Certificate. Borrower hereby ratifies, confirms and reaffirms, all and singular, the terms and disclosures contained in a certain Perfection Certificate dated as of March 12, 2021, and acknowledges, confirms and agrees that the disclosures and information Borrower provided to Bank in such Perfection Certificate as updated by Annex 1, have not changed, as of the date hereof.

7. No Defenses of Borrower. Borrower hereby acknowledges and agrees that Borrower has no offsets, defenses, claims, or counterclaims against Bank with respect to the Obligations, or otherwise, and that if Borrower now has, or ever did have, any offsets, defenses, claims, or counterclaims against Bank, whether known or unknown, at law or in equity, all of them are hereby expressly WAIVED and Borrower hereby RELEASES Bank from any liability thereunder.

8. Integration. This Amendment and the Loan Documents represent the entire agreement about this subject matter and supersede prior negotiations or agreements. All prior agreements, understandings, representations, warranties, and negotiations between the parties about the subject matter of this Amendment and the Loan Documents merge into this Amendment and the Loan Documents.

9. Counterparts. This Amendment may be executed in any number of counterparts and all of such counterparts taken together shall be deemed to constitute one and the same instrument.

10. Fees and Expenses. Borrower agrees to promptly pay Bank, upon receipt of an invoice, Bank's legal fees and expenses incurred in connection with this Amendment.

11. Effectiveness. As a condition precedent to the effectiveness of this Amendment and the Bank's obligation to make further Advances under the Revolving Line, the Bank shall have received the following documents prior to or concurrently with this Amendment, each in form and substance reasonably satisfactory to Bank:

11.1 this Amendment duly executed on behalf of Borrower;

11.2 long form good standing certificates of Borrower and Guarantor, certified by their respective jurisdictions of formation, dated as of a date no earlier than thirty (30) days prior to the date hereof;

11.3 the Acknowledgment of Amendment and Reaffirmation of Guaranty substantially in the form attached hereto as **Schedule 1**, duly executed and delivered by Guarantor; and

11.4 such other documents as Bank may reasonably request.

12. Post-Closing Requirement. NONE

[Signature page follows.]

IN WITNESS WHEREOF, the parties hereto have caused this Amendment to be duly executed and delivered as of the date first written above.

BANK

SILICON VALLEY BANK

By: /s/Jon Wolter

Name: Jon Wolter

Title: Managing Director

BORROWER

ASPEN AEROGELS, INC.

By: /s/ John F. Fairbanks

Name: John Fairbanks

Title: Chief Financial Officer

**ACKNOWLEDGMENT OF AMENDMENT
AND REAFFIRMATION OF GUARANTY AND SECURITY AGREEMENT**

Section 1. Guarantor hereby acknowledges and confirms that it has reviewed and approved the terms and conditions of the First Amendment to Second Amended and Restated Loan and Security Agreement dated as of the date hereof (“the **Amendment**”).

Section 2. Guarantor hereby consents to the Amendment and agrees that the Guaranty and Guarantor Security Agreement relating to the Obligations of Borrower under the Loan Agreement shall continue in full force and effect, shall be valid and enforceable and shall not be impaired or otherwise affected by the execution of the Amendment or any other document or instruction delivered in connection herewith.

Section 3. Guarantor represents and warrants that, after giving effect to the Amendment, all representations and warranties contained in the Guaranty are true, accurate and complete as if made the date hereof.

Dated as of December 27, 2021

[Signature Page Follows]

GUARANTOR:

ASPEN AEROGELS RHODE ISLAND, LLC

By: /s/John F. Fairbanks

Name: John Fairbanks

Title: Chief Financial Officer

EXHIBIT B

COMPLIANCE CERTIFICATE

TO: SILICON VALLEY BANK Date:
 FROM: ASPEN AEROGELS, INC.

The undersigned authorized officer of Aspen Aerogels, Inc. ("**Borrower**") certifies that under the terms and conditions of the Amended and Restated Loan and Security Agreement between Borrower and Bank (as amended and in effect, the "**Agreement**"), (1) Borrower is in complete compliance for the period ending _____ with all required covenants except as noted below, (2) there are no Events of Default, (3) all representations and warranties in the Agreement are true and correct in all material respects on this date except as noted below; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, (4) Borrower, and each of its Subsidiaries, has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and local taxes, assessments, deposits and contributions owed by Borrower except as otherwise permitted pursuant to the terms of Section 5.9 of the Agreement, and (5) no Liens have been levied or claims made against Borrower or any of its Subsidiaries, if any, relating to unpaid employee payroll or benefits of which Borrower has not previously provided written notification to Bank. Attached are the required documents supporting the certification. The undersigned certifies that these are prepared in accordance with GAAP consistently applied from one period to the next except as explained in an accompanying letter or footnotes. The undersigned acknowledges that no borrowings may be requested at any time or date of determination that Borrower is not in compliance with any of the terms of the Agreement, and that compliance is determined not just at the date this certificate is delivered. Capitalized terms used but not otherwise defined herein shall have the meanings given them in the Agreement.

e indicate compliance status by circling Yes/No under "Complies" column.

Reporting Covenant	Required	Complies
Monthly financial statements with Compliance Certificate	Monthly within 30 days	Yes No
Quarterly financial statements with Compliance Certificate	Quarterly within 45 days	Yes No
Annual financial statement (CPA Audited)	FYE within 150 days	Yes No
SEC 10-K and 8-K	Within 5 days after filing with SEC	Yes No
Accounts Payable and A/P Agings, and Deferred Revenue reports	Monthly within 20 days	Yes No
Inventory Base Reports	15 th and last Business Day of each month (monthly within 20 days when a Streamline Period is in effect) and with each request for a Credit Extension;	Yes No
Warrant covenants	FYE within 30 days	Yes No

Financial Covenant	Required	Actual	Complies
Maintain as indicated:			
Minimum EBITDA	*	\$	Yes No
Minimum Adjusted Quick Ratio	1.20 to 1.00	to 1.00	Yes No

*See Section 6.9

Performance Pricing		Applies
Adjusted Quick Ratio at least 1.50:1.00	Prime + 0.75% (Eligible Accounts) or Prime + 1.25% (Eligible Foreign Accounts);	Yes No
Adjusted Quick Ratio less than 1.50:1.00	Prime + 1.50% (Eligible Accounts); Prime + 2.00% (Eligible Foreign Accounts)	Yes No

The following financial covenant analyses and information set forth in Schedule 1 attached hereto are true and accurate as of the date of this Certificate.

The following are the exceptions with respect to the certification above: (If no exceptions exist, state "No exceptions to note.")

ASPEN AEROGELS, INC.

BANK USE ONLY

By:
Name:
Title:

Received by: _____
AUTHORIZED SIGNER
Date: _____
Verified: _____
AUTHORIZED SIGNER
Date: _____
Compliance Status: Yes No

Schedule 1 to Compliance Certificate

Financial Covenants of Borrower

In the event of a conflict between this Schedule and the Loan Agreement, the terms of the Loan Agreement shall govern.

I. **EBITDA** (Section 6.9(a))

Required: Borrower shall achieve, measured as of the end of each fiscal quarter during the following periods, EBITDA of at least (loss not worse than) the following for the following periods:

Period	Minimum EBITDA (maximum loss)
Trailing twelve (12) month period ending December 31, 2021	(\$25,000,000)

For the quarterly periods ending after December 31, 2021, the minimum EBITDA financial covenant thresholds shall be determined by Bank in its sole discretion on or before February 28, 2022 based on the Board-approved projections delivered to Bank pursuant to Section 6.2(f) hereof; provided further, that failure to timely deliver such Board-approved projections in accordance with Section 6.2(f) shall result in an immediate Event of Default for which no cure or grace period shall apply.

Actual:

- A. Net Income

- B. To the extent included in the determination of Net Income
 - 1. The provision for income taxes
 - 2. Depreciation expense
 - 3. Amortization expense
 - 4. Net Interest Expense
 - 5. Non-cash stock compensation expense
 - 6. One-time non-recurring expenses approved by the Bank in its sole discretion
 - 7. The sum of lines 1 through 6

- C. EBITDA (line I.A plus line I.B.7)

Is line I.C equal to or greater than \$ _____ ?

No, not in compliance

Yes, in compliance

II. **Adjusted Quick Ratio** (Section 6.9(b))

Required: Borrower shall maintain at all times, to be tested as of the last day of each month,
an Adjusted Quick Ratio of at least 1.20 to 1.00.

Actual:

A.	Unrestricted cash maintained with Bank	\$
B.	Accounts receivable net of allowance for doubtful accounts	\$
C.	Quick Assets (line II.A. plus line II.B.)	\$
D.	All Obligations and liabilities of Borrower owed to Bank	\$
E.	Without duplication of line II.D., the aggregate amount of Borrower's Total Liabilities that mature within one (1) year	\$
F.	Current Liabilities (line II.D. plus line II.E.)	\$
G.	Current portion of Deferred Revenue	\$
H.	Current portion of the PPP Forgivable Amount	\$
I.	Current portion of any Pre-Payment Balance or any other prepayment amount under the Supply Agreement	\$
J.	Dollar Equivalent amount of all outstanding Letters of Credit	\$
K.	Amount of any Pre-Payment Balance or any other prepayment amount due to BASF following a BASF Request	\$
L.	Line II.F minus line II.G minus II.H minus line II.I minus line II.J plus line II.K	\$
M.	Adjusted Quick Ratio (line II.C divided by line II.L)	:1.00

Is line M equal to or greater than 1.20:1:00?

No, not in compliance

Yes, in compliance

Annex 1

Section 2 of the Perfection Certificate is hereby updated to refer to the following filed reports:

Public Disclosures By Borrower Since March 2021

Date	Filing Type
March 15, 2021	S-3
March 23, 2021	Press Release – Water Tower Fireside Chat Series
April 7, 2021	Press Release – Q1 2021 Earnings Release and Conference Call Date
April 19, 2021	DEFA 14A
April 23, 2021	Effectiveness Order
April 29, 2021	8-K - Press Release Q1 2021 Financial Results
April 29, 2021	Press Release – Q1 2021 Financial Results
May 4, 2021	10-Q (Q1 2021)
May 6, 2021	Press Release – Italian Building Materials Lawsuit
May 6, 2021	8-K – Press Release Patent Infringement Action
May 17, 2021	Press Release – Water Tower Fireside Chat Series
May 18, 2021	Press Release – Needham Technology & Media Conference
June 1, 2021	8-K – Annual Meeting Voting Results
June 1, 2021	Press Release – Fireside Chat at Cowen Technology
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 3, 2021	Form 4 – Non-Employee Director Stock Award
June 8, 2021	Press Release - Water Tower Fireside Chat Series
June 29, 2021	Press Release\$75 Million Private Placement with Koch Strategic Platforms
June 30, 2021	8-K – Securities Purchase Agreement
July 1, 2021	D – Small Company Offereing and Sale of Securities Without Registration
July 1, 2021	Form 4 – Employee Director Stock Award
July 8, 2021	Press Release – Q2 2021 Earnings Release and Conference Call Date
July 29, 2021	8-K – Press Release Q1 2021 Financial Results
July 29, 2021	Press Release – Q2 2021 Financial Results
August 4, 2021	Form 4 – Whitaker exercise/sale
August 4, 2021	Form 4 – Landes sale
August 4, 2021	10-Q (Q2 2021)
August 5, 2021	Fireside Chat at Canaccord Genuity 41 st Annual Growth Conference
August 27, 2021	Form 4 – Conte exercise/sale
September 1, 2021	Fireside Chat at Cowen 14 th Annual Global Transportation & Sustainable Mobilit Conference
September 10, 2021	S-3
September 20, 2021	Effectiveness Order
September 24, 2021	424B3 - Prospectus

October 1, 2021	Current report filing
October 28, 2021	Current report filing
November 3, 2021	Form 4 – Young sale
November 4, 2021	8-K - Press Release Q3 2021 Financial Results
November 10, 2021	Form 4 – Whitaker exercise/sale
November 29, 2021	Form 4 – Gervis exercise
December 1, 2021	Form 4 – Conte exercise/sale

EXECUTIVE AGREEMENT

This Executive Agreement (this “**Agreement**”) is dated as of January 4, 2022 and will be effective as of January 1, 2022 (the “**Effective Date**”), by and between Aspen Aerogels, Inc., a Delaware corporation (the “**Company**”), and Donald R. Young (the “**Executive**”).

Recitals:

- A. The Company and the Executive previously entered into an executive agreement, dated as of November 7, 2018, as amended from time to time (the “**Prior Agreement**”). The Prior Agreement expires by its terms as of December 31, 2021.
- B. The Company and the Executive desire to continue Executive’s employment on the terms and conditions set forth in this Agreement, and replace the Prior Agreement in its entirety with this Agreement.
- C. As an employee of the Company, the Executive has previously received and will continue to be given access to or come into contact with certain proprietary and/or confidential information of the Company.
- D. The Company and the Executive are parties to an Employment, Confidentiality and Non-Competition Agreement dated December 16, 2015 (the “**Confidentiality and Non-Competition Agreement**”).
- E. The foregoing recitals shall be incorporated into and be a part of this Agreement.

Agreement:

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

1. **Definitions.** As used herein, the following terms shall have the following meanings.

“**Affiliate**” means with respect to any Person, any other Person that, directly or indirectly through one or more intermediaries controls, is controlled by, or is under common control with, such Person and/or one or more Affiliates thereof. As used in this definition, the term “control,” including the correlative terms “controlling,” “controlled by” and “under common control with,” means the possession, directly or indirectly, of the power to direct or cause the direction of the management or policies (whether through the ownership of securities or any partnership or other ownership interests, by contract or otherwise) of a Person.

“**Board**” means the Company’s board of directors.

“**Cause**” means: (i) willful misconduct, dishonesty, fraud or breach of fiduciary duty to the Company; (ii) deliberate disregard of the lawful rules or policies of the Company, failure to perform assigned duties, or breach of an employment or other agreement with the Company, which results in direct or indirect loss, damage or injury to the Company; (iii) the unauthorized disclosure of any trade secret or confidential information of the Company; (iv) the commission of an act which constitutes unfair competition with the Company or which induces any customer or supplier to breach a contract with the Company; (v) conduct substantially prejudicial to the business of the Company; or (vi) the indictment of Executive for any felony involving deceit, dishonesty or fraud, or any criminal conduct by the Executive that would reasonably be expected to result in material injury or reputational harm to the Company. For purposes hereof, whether or not the Executive has committed an act or omission of the type referred to in subparagraphs (i) through (vi) above will be determined by the Board in its reasonable, good faith discretion, based upon the facts known to the Board at the relevant time.

“**Change of Control**” shall mean the first to occur of any of the following events: (i) the consummation of a reorganization, merger, consolidation or other similar transaction of the Company with or into any other Person or Group (within the meaning of Section 13(d)(3) of the Securities Act of 1934, as amended) in which holders of the Company’s voting securities immediately prior to such reorganization, merger, consolidation or other similar transaction will not, directly or indirectly, continue to hold at least a majority of the outstanding voting securities of the Company; (ii) a sale, lease, exchange or other transfer (in one transaction or a related series of transactions) of all or substantially all of the Company’s assets; (iii) the acquisition by any Person or any Group of such quantity of the Company’s voting securities as causes such Person or Group (other than a Person or Group who is a shareholder of the Company on the Effective Date) to own beneficially, directly or indirectly, as of the time immediately after such transaction or series of transactions, more than 50% of the combined voting power of the voting securities of the Company other than as a result of (a) an acquisition of securities directly from the Company or, (b) an acquisition of securities by the Company which by reducing the voting securities outstanding increases the proportionate voting power represented by the voting securities owned by any such Person or Group to more than 50% of the combined voting power of such voting securities; or (iv) a change in the composition of the Board within a two (2) year period such that a majority of the members of the Board are not Continuing Directors. As used herein, the term “**Continuing Directors**” shall mean as of any date of determination, any member of the Board who (a) was a member of the Board immediately after the Effective Date, or (b) was nominated for election or elected to the Board with the approval of, or whose election to the Board was ratified by, at least a majority of the Continuing Directors who were members of the Board at the time of that nomination or election; provided, however, that in no case shall (1) the public offering and sale of the Company’s common stock by its shareholders pursuant to a registered secondary offering or (2) the voluntary or involuntary bankruptcy of the Company constitute a Change of Control.

“**Future Payment Event**” means all or any part of the Proceeds payable in connection with a Change of Control that are to be paid to the Company’s equity holders after the effective date of the Change of Control: (a) in connection with escrowed or withheld Proceeds for purposes of satisfying any indemnification claims or other obligation to the acquirer; (b) in installment payments over time; (c) in connection with an earnout; (d) in connection with the Company’s or its successor’s achievement of a milestone; or (e) a similar mechanism to defer or condition payment.

“**Good Reason**” means: (i) any material breach by the Company of this Agreement; (ii) a material reduction or material adverse change in the Executive’s current duties, responsibilities and authority, without his consent; (iii) the demand by the Company for the Executive to relocate or commute more than 40 miles from Northborough, Massachusetts without his consent; or (iv) any reduction by the Company in the Executive’s Base Salary or the Executive’s Performance Bonus Target without his consent, except for across-the-board compensation reductions based on the Company’s financial performance similarly affecting all or substantially all senior management employees of the Company. For purposes hereof, whether or not the Executive has Good Reason to terminate his employment by the Company pursuant to subparagraphs (i) through (iv) above will be determined by the Board in its reasonable, good faith discretion, based upon the facts known to the Board at the relevant time.

“**Net Proceeds**” means Proceeds, less any indebtedness for borrowed money and other liabilities of the Company and its Affiliates required by the buyer to be paid out of the Proceeds (other than the payment of bonuses pursuant to this Agreement) and the Transaction Expenses, actually received by the Company’s equity holders in connection with a Change of Control. Net Proceeds shall include any Proceeds payable in connection with a Future Payment Event.

“**Permanent Disability**” means the Executive is unable to perform, by reason of physical or mental incapacity, his then duties or obligations to the Company, for a total period of one hundred eighty (180) days in any three hundred sixty (360) day period.

“**Person**” means an individual, a partnership, a corporation, a limited liability company, an association, a joint stock company, a trust, a joint venture, an unincorporated organization or any other entity, including a governmental entity or any department, agency or political subdivision thereof.

“**Proceeds**” means the gross amount that, absent this Agreement and any other substantially similar agreements, would have been received by or distributable to the Company’s equity holders in connection with a

Change of Control, including any initial payment and any subsequent payments received in connection with a Future Payment Event. Any non-cash Proceeds will be valued in good faith by the Board.

“**Qualifying Termination**” means the date on which the Executive’s employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates employment for Good Reason as provided in Section 3(e).

“**Substantial Risk of Forfeiture**” means that future Proceeds otherwise payable in connection with a Change of Control are conditioned on the occurrence of a future milestone (such as, without limitation, the attainment of a prescribed level of sales, revenues, earnings, equity value, return on invested capital or internal rate of return), such that, at the time the milestone is established, the possibility that the milestone will not be achieved is substantial, as further defined in Treasury Regulation §1.409A-1(d), without regard to the provision of that section under which additions or extensions of forfeiture conditions are disregarded.

“**Transaction Expenses**” means all fees and expenses payable by the Company or the Company’s equity holders for services provided to the Company and/or its equity holders in connection with the consummation of a Change of Control or any Future Payment Event, including without limitation, investment banking, accounting and attorneys’ fees.

2. Employment. The Company agrees to employ the Executive, and the Executive hereby accepts employment with the Company consistent with the Executive’s position and duties, upon the terms and conditions set forth in this Agreement.

(a) Term. The term of this Agreement shall commence on the Effective Date and continue until the earlier of (i) December 31, 2024 or (ii) the termination of this Agreement in accordance with the provisions of Section 3 (the “**Employment Period**”). The Executive’s employment with the Company shall be “at will,” meaning that the Executive’s employment may be terminated by the Company or the Executive at any time and for any reason.

(b) Position and Duties.

(i) During the Employment Period, the Executive shall serve as the Chief Executive Officer of the Company and shall have the duties, responsibilities and authority consistent with such position that are designated by the Board, subject to the direction and supervision of the Board.

(ii) The Executive shall devote his best efforts and his full business time and attention (except for permitted vacation periods and reasonable periods of illness or other incapacity) to the business and affairs of the Company. The Executive shall perform his duties and responsibilities to the best of his abilities in a diligent, trustworthy businesslike and efficient manner. Notwithstanding the foregoing, the Executive may, to the extent not otherwise prohibited by this Agreement, devote such amount of time as does not interfere or compete with the performance of the Executive’s duties under this Agreement to any one or more of the following activities: (i) engaging in charitable activities, including serving on the boards of directors of charitable organizations or (ii) serving on the board of directors of any other company with the prior written approval of the Board.

(iii) The Executive agrees to abide by the Company’s Code of Business Conduct and Ethics, Anti-Corruption Policy, Complaints Handling Policy, Insider Trading Policy, Disclosure Controls and Procedures Under the Securities Exchange Act of 1934, Form 8-K Disclosure Compliance Policy, Regulation FD Disclosure Policy, the Chief Executive Officer’s Delegation of Authority and the Short-Term Investment Policy, each as in effect from time to time and such other policies, rules and regulations as the Company may adopt from time to time.

(c) Salary and Benefits.

During the Employment Period, Executive shall be entitled to the following compensation and benefits:

(i) **Base Salary.** During the Employment Period, Executive shall be entitled to the following compensation and benefits: The Executive's base salary shall be \$515,000 (such annual salary, as it may be adjusted upward by the Board in its discretion, being referred to as the "**Base Salary**"). The Base Salary shall be payable in regular installments in accordance with the Company's general payroll practices, shall be subject to customary withholding and may be increased (but not decreased) at the discretion of the Board.

(ii) **Annual Performance Bonus.** The Executive shall be eligible to earn an annual cash incentive bonus (the "**Performance Bonus**") of not less than one-hundred and ten percent (110%) of the Executive's then effective Base Salary (each, a "**Performance Bonus Target**"), subject in all respects to the terms and conditions established by the Board.

(iii) **Expense Reimbursement.** The Company will reimburse the Executive for all reasonable travel and other expenses incurred by the Executive in connection with the performance of his duties and obligations under this Agreement. The Executive shall comply with such reasonable limitations and reporting requirements with respect to expenses as may be established by the Company from time to time.

(iv) **Benefit Plans and Programs.** The Executive shall be entitled to participate in all compensation or employee benefit plans or programs and receive all benefits and perquisites for which salaried employees of the Company generally are eligible under any plan or program now or established later by the Company on the same basis as similarly situated senior executives of the Company. The Executive may participate to the extent permissible under the terms and provisions or such plans or programs, in accordance with program provisions. Nothing in this Agreement will preclude the Company from amending or terminating any of the plans or programs applicable to salaried employees or senior executives of the Company as long as such amendment or termination is applicable to all salaried employees or senior executives, as the case may be, so long as such plans or programs are replaced with plans no less favorable, in the aggregate, than existing plans.

(v) The Executive shall also be eligible for grants of long-term incentive compensation, including, options to purchase the Company's common stock, restricted stock and/or restricted stock units, all on terms and conditions established by the Board.

(vi) **Clawback Policy.** All compensation shall be subject to any forfeiture or clawback policy established by the Company or the Board generally for senior executives from time to time and any other such policy required by applicable law.

(d) **Change of Control.**

(i) **Options and Stock-Based Awards.** In the event of a Change of Control, notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement to the extent any outstanding stock options and other stock-based awards are not assumed by the Company's successor in a Change of Control, the vesting of all stock options and other stock-based awards outstanding and held by the Executive as of the Change of Control shall immediately accelerate and become fully vested and exercisable, subject to any permitted action by the Board upon a Change of Control under the Company's applicable equity plan to terminate the stock options or other stock-based awards upon a Change of Control, provided, however, that the foregoing shall not apply to any outstanding equity award to the extent such acceleration of vesting would result in a violation of Section 409A of the Code.

3. **Termination.** During the Employment Period, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) **Death.** The Executive's employment hereunder shall terminate upon his death.

(b) **Disability.** The Company may terminate the Executive's employment upon the Executive's Permanent Disability. If any question shall arise as to whether the Executive has a Permanent Disability so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the

Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 et seq. and the Americans with Disabilities Act, 42 U.S.C. §12101 et seq.

(c) **Termination by Company for Cause.** The Company may terminate the Executive's employment hereunder for Cause.

(d) **Termination by Company Without Cause.** The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or Permanent Disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) **Termination by the Executive.** The Executive may terminate his employment hereunder at any time for any reason, including but not limited to Good Reason. For purposes of this Agreement, "Good Reason" shall mean that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any purported Good Reason event without the Executive's express written consent. "**Good Reason Process**" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the Good Reason condition within sixty (60) days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than thirty (30) days following receipt of such notice (the "**Cure Period**") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his employment within sixty (60) days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) **Notice of Termination.** Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) **Date of Termination.** "**Date of Termination**" shall mean: (i) if the Executive's employment is terminated by his death, the date of his death; (ii) if the Executive's employment is terminated on account of Permanent Disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, thirty (30) days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date which is specified in the Notice of Termination, provided that such date must occur within the sixty (60) day period after the end of the Cure Period. Notwithstanding the foregoing, in the event that either party gives a Notice of Termination, the Company may unilaterally accelerate the Date of Termination.

4. **Compensation on Termination.**

(a) **Termination Generally.** If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and, to the extent required by law, unused vacation that accrued through the Date of Termination, such amounts to be paid no more than thirty (30) days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company

through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the “**Accrued Benefits**”).

(b) **Qualifying Termination Prior to a Change of Control.** If the Executive incurs a Qualifying Termination during the Employment Period and prior to a Change of Control, then in addition to the Accrued Benefits, and subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, non-compete, return of property and non-disparagement, in a form and manner satisfactory to the Company (the “**Separation Agreement and Release**”) and the Separation Agreement and Release becoming fully effective, all within sixty (60) days of the Date of Termination (the “**Release Period**”):

(i) the Company shall pay the Executive an amount equal to two hundred percent (200%) of the sum of (A) the Executive’s then effective Base Salary and (B) an amount equal to the Executive’s then effective Performance Bonus Target (the “**Severance Amount**”);

(ii) the Company shall pay the Executive any accrued but unpaid Performance Bonus for the prior fiscal year then owed or fully earned by the Executive in accordance with Section 2(c)(ii) above (the “**Earned Performance Bonus**”);

(iii) the Company shall pay the Executive a pro-rata portion of the Performance Bonus based upon actual achievement of the performance metrics for the fiscal year in which the Termination Date occurs (calculated by dividing the number of full months of the applicable fiscal year through the Date of Termination by 12, and multiplying this fraction by the Executive’s then effective Performance Bonus Target) (the “**Pro-Rata Bonus**”);

(iv) the COBRA eligible health care insurance benefits (e.g., health, dental) being provided by the Company to the Executive on the Date of Termination shall continue in place at the same cost to the Executive as applied to “active” participants on the Date of Termination for a period equal to the lesser of (i) the COBRA Benefit Period or (ii) twenty-four (24) months (“**Health Care Continuation Benefit**”). The “COBRA Benefit Period” means the period of time after such termination during which COBRA benefits are available to the Executive as of the Date of Termination as set forth in the Company’s health care plan. The Executive shall be responsible for applying for the COBRA eligible health care insurance benefit, paying for the same and submitting evidence of such premium costs to the Company for reimbursement during the COBRA Benefit Period. The Company shall reimburse the Executive for the employer’s portion of such premiums (as applicable to the active rate) within 15 days of receipt of evidence of the payment of the premium costs to the Company (“**Premium Reimbursement Payments**”). Notwithstanding the foregoing, if the Company determines, in its sole discretion, that such reimbursement of the premiums would result in a violation of the nondiscrimination rules of Section 105(h)(2) of the Internal Revenue Code of 1986, as amended (the “**Code**”) or any statute or regulation of similar effect (including but not limited to the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then in lieu of reimbursing the premiums, the Company, in its sole discretion, may elect to instead pay the Executive on the first day of each month of such period, a fully taxable cash payment equal to the premiums for that month, subject to applicable tax withholdings (such amount, the “**Special Severance Payment**”), for the remainder of such period. The Executive may, but is not obligated to, use such Special Severance Payment toward the cost of premiums;

(v) if the Executive requests, the Company shall pay (“**Outplacement Payments**”) for an outplacement service (to be selected by the Company) for services rendered in assisting the Executive in locating another job, for a period of six (6) months following the Date of Termination or until the Executive begins working for another employer, whichever occurs first (“**Outplacement Services**”). These Outplacement Payments, which the Company shall make directly to the vendor providing Outplacement Services, are contingent upon the Executive’s cooperation with the outplacement service and upon active efforts by the Executive to locate another position;

(vi) notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement (other than the Restricted Stock Agreement (defined herein), which will continue to be governed in accordance with its terms), (a) the vesting of such number of stock options and other stock-based awards outstanding and held by the Executive as would have vested in the three (3) months immediately following the Date of Termination had the Executive continued his employment for such three (3) month period shall

immediately accelerate and become vested and exercisable as of the Date of Termination and (b) subject to any permitted action by the Board upon a Change of Control or other merger, sale, dissolution, or liquidation of the Company under the Company's applicable equity plan to terminate the stock options or other stock-based awards, all vested stock options shall be exercisable for not less than one (1) year from the Date of Termination.

(c) **Timing and Form of Severance Payments.** The benefits provided to Executive under Sections 4(b)(i), (ii), (iii), (iv) and (v) shall be paid in the form and at the time specified below:

(i) Severance Amount shall be paid in substantially equal installments in accordance with the Company's payroll practice over twenty-four (24) months commencing within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(ii) Earned Performance Bonus shall be paid in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Earned Performance Bonus shall be paid in the second calendar year by the last day of such 60-day period.

(iii) The Pro-Rata Bonus shall be paid when the annual performance bonus would have been otherwise paid if Executive had continued his employment through the applicable performance period.

(iv) Health Care Continuation Benefit shall commence immediately upon the Executive's Date of Termination and the Executive shall immediately become eligible for Reimbursement Payments in accordance with Section 4(b)(iv), provided however if an executed Separation Agreement and Release has not become fully effective within Release Period, the Company shall immediately cease making Premium Reimbursement Payments (or, if applicable, Special Severance Payments) and the Executive shall be obligated to promptly repay to the Company any previously received Premium Reimbursement Payments (or, if applicable, any Special Severance Payments).

(v) Outplacement Services shall commence immediately upon the Executive's Date of Termination, provided however if an executed Separation Agreement and Release has not become fully effective within the Release Period, Outplacement Services shall immediately cease and the Executive shall be obligated to promptly repay to the Company any previously made Outplacement Payments.

(d) **Rights to Severance.** The receipt of any severance payments or benefits pursuant to Section 4 shall be subject to (i) the Executive's submission to the Company of an executed Separation Agreement and Release that becomes fully effective within the Release Period and (ii) the Executive's continued compliance with the Confidentiality and Non-Competition Agreement. In the event an executed Separation and Release Agreement does not become fully effective within the Release Period, the Executive shall forfeit his right to receive any severance payments or benefits under Section 4 and, as specified in paragraph (c) above, the Company shall have the right to recoup from the Executive any previously made severance payments or benefits. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 4 without affecting the effectiveness of the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(e) **Other Termination Events.** The Executive hereby agrees that no severance compensation shall be payable upon termination of the Executive's employment with the Company (i) by the Company with Cause; (ii) by the Executive without Good Reason; or (iii) as a result of the Executive's death or Permanent Disability, and the Executive hereby waives any claim for severance compensation except as set forth in Section 4(b).

5. **Change of Control.** The provisions of this Section 5 shall apply in lieu of, and expressly supersede, other than with respect to the requirement for the execution and delivery of a Separation Agreement and Release, the provisions of Section 4 regarding severance pay and benefits upon a Qualifying Termination, if a Qualifying Termination occurs within twenty-four (24) months after the occurrence of a Change of Control (“**CIC Qualifying Termination**”). This Section 5 shall terminate and be of no force or effect beginning twenty-four (24) months after the occurrence of a Change of Control.

(a) **Qualifying Termination after a Change of Control.** During the Employment Period, if the Executive incurs a CIC Qualifying Termination, then in addition to the Accrued Benefits, and subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable within the Release Period:

(i) the Company shall pay the Executive an amount equal to two hundred percent (200%) of the sum of (A) the Executive’s then effective Base Salary and (B) the Executive’s then effective Performance Bonus Target (“**CIC Severance Amount**”);

(ii) the Company shall pay the Executive any accrued but unpaid Performance Bonus for the prior fiscal year then owed or fully earned by the Executive in accordance with Section 2(c)(ii) above (“**CIC Earned Performance Bonus**”);

(iii) the Company shall pay the Executive the Pro-Rata Bonus;

(iv) the COBRA eligible health care insurance benefits (e.g., health, dental) being provided by the Company to the Executive on the Date of Termination shall continue in place at the same cost to the Executive as applied to “active” participants on the Date of Termination for a period equal to the lesser of (i) the COBRA Benefit Period or (ii) twenty-four (24) months (“**CIC Health Care Continuation Benefits**”). The Executive shall be responsible for applying for the COBRA eligible health care insurance benefit, paying for the same and submitting evidence of such premium costs to the Company for reimbursement during the COBRA Benefit Period. The Company shall reimburse the Executive for the employer’s portion of such premiums (as applicable to the active rate) within 15 days of receipt of evidence of the payment of the premium costs to the Company. (“**CIC Premium Reimbursement Payments**”).

Notwithstanding the foregoing, if the Company determines, in its sole discretion, that such reimbursement of the premiums would result in a violation of the nondiscrimination rules of Section 105(h)(2) of the Code or any statute or regulation of similar effect (including but not limited to the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then in lieu of reimbursing the premiums, the Company, in its sole discretion, may elect to instead pay the Executive on the first day of each month of such period a fully taxable cash payment equal to the premiums for that month, subject to applicable tax withholdings (such amount, the “**CIC Special Severance Payment**”), for the remainder of such period. The Executive may, but is not obligated to, use such Special Severance Payment toward the cost of premiums;

(v) if the Executive wishes, the Company will pay for an outplacement service (“**CIC Outplacement Payments**”) (to be selected by the Company) for services rendered in assisting the Executive in locating another job, for a period of six (6) months following the Date of Termination or until the Executive begins working for another employer, whichever occurs first (“**CIC Outplacement Services**”). These CIC Outplacement Payments, which the Company shall make directly to the vendor providing the CIC Outplacement Services, are contingent upon the Executive’s cooperation with the outplacement service and upon active efforts by the Executive to locate another position;

(vi) CIC Severance Amount shall be payable in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(vii) CIC Earned Performance Bonus shall be paid in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Earned Performance Bonus shall be paid in the second calendar year by the last day of such 60-day period.

(viii) The Pro-Rata Bonus shall be paid when the annual performance would have been paid if Executive had continued his employment through the payment date.

(ix) CIC Health Care Continuation Benefit shall commence immediately upon the Executive's Date of Termination and the Executive shall immediately become eligible for Reimbursement Payments in accordance with Section 5(a)(iv), provided however if an executed Separation Agreement and Release has not become fully effective within the CIC Release Period, the Company shall immediately cease making CIC Premium Reimbursement Payments (or, if applicable, any CIC Special Severance Payments) and the Executive shall be obligated to promptly repay to the Company any previously received CIC Premium Reimbursement Payments (or, if applicable, any CIC Special Severance Payments).

(x) CIC Outplacement Services shall commence immediately upon the Executive's Date of Termination, provided however if an executed Separation Agreement and Release has not become fully effective within the CIC Release Period, CIC Outplacement Services shall immediately cease and the Executive shall be obligated to promptly repay to the Company any previously made CIC Outplacement Payments.

(xi) Notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement (other than the Restricted Stock Agreement, which will continue to be governed in accordance with its terms), the vesting of all stock options and other stock-based awards outstanding and held by the Executive shall immediately accelerate and become fully vested and exercisable as of the Date of Termination, and subject to any permitted action by the Board upon a Change of Control under the Company's applicable equity plan to terminate the stock options or other stock-based awards, all vested stock options shall be exercisable for one (1) year from the Date of Termination.

(b) **Right to Severance under Section 5.** The receipt of any severance payments or benefits pursuant to Section 5 shall be subject (i) to the Executive's submission to the Company of an executed Separation Agreement and Release that becomes fully effective within the CIC Release Period and (ii) to the Executive's continued compliance with the Confidentiality and Non-Competition Agreement. In the event an executed Separation and Release Agreement does not become fully effective within the Release Period, the Executive shall forfeit his right to receive any severance payments or benefits under Section 5 and, as specified in paragraph (a) above, the Company shall have the right to recoup from the Executive any previously made severance payments or benefits. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 5 without affecting the effectiveness of the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(c) **Continued Compliance.** The receipt of any severance payments or benefits pursuant to Section 5 shall be subject to the Executive not violating any of the provisions set forth in the Confidentiality and Non-Competition Agreement. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 5 without affecting the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(d) **Other Termination Events.** The Executive hereby agrees that no severance compensation shall be payable upon termination of the Executive's employment with the Company (i) by the Company with Cause; (ii) by the Executive without Good Reason; or (iii) as a result of the Executive's death or Permanent Disability, and the Executive hereby waives any claim for severance compensation except as set forth in Section 5(a).

(e) **Parachute Payments.** If Independent Tax Counsel (as that term is defined below) determines that the aggregate payments and benefits provided or to be provided to the Executive pursuant to this Agreement, and any other payments and benefits provided or to be provided to the Executive from the Company or any of its subsidiaries or other affiliates or any successors thereto constitute “parachute payments” as defined in Section 280G of the Code (“**Parachute Payments**”) that would be subject to the excise tax imposed by Section 4999 of the Code (the “**Excise Tax**”), then, except as otherwise provided in the next sentence, such Parachute Payments shall be reduced to the extent the Independent Tax Counsel shall determine is necessary (but not below zero) so that no portion thereof shall be subject to the Excise Tax. If Independent Tax Counsel determines that the Executive would receive in the aggregate greater payments and benefits on an after tax basis if the Parachute Payments were not reduced pursuant to this Section 5(f), then no such reduction shall be made. The determination of which payments or benefits shall be reduced to avoid the Excise Tax shall be made by the Independent Tax Counsel, provided that the Independent Tax Counsel shall reduce or eliminate, as the case may be, payments or benefits in the following order (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order. The determination of the Independent Tax Counsel under this Section 5(f) shall be final and binding on all parties hereto. For purposes of this Section 5(f), “**Independent Tax Counsel**” shall mean a lawyer, a certified public accountant with a nationally recognized accounting firm, or a compensation consultant with a nationally recognized actuarial and benefits consulting firm with expertise in the area of executive compensation tax law, who shall be selected by the Board, and whose fees and disbursements shall be paid by the Company.

6. **Tax and Insurance.**

(a) **Insurance.** In no event shall the termination of the Executive’s employment by the Company or any such termination by the Executive pursuant to this Agreement release any claim by the Executive for indemnification that he is otherwise entitled to under any director or officer’s insurance policy or any articles, bylaws or other foundation documents of the Company. Without limiting the foregoing, the Company shall provide Executive with reasonable director’s and officer’s insurance coverage that is at least as favorable as the coverage in existence on the date of this Agreement (the “**Existing D&O Coverage**”); provided, however, that in no event shall the Company be obligated to maintain director’s and officer’s insurance coverage to the extent that premiums thereunder exceed 200% of the premiums payable by the Company under the Existing D&O Coverage on the date hereof (the “**Threshold**”); provided, further, that to the extent such premiums exceed the foregoing Threshold, the Company shall obtain director’s and officer’s insurance coverage on terms as similar as reasonably practicable to the terms of the Existing D&O Coverage without exceeding the Threshold. Such insurance coverage shall continue in effect during the Employment Period and after the Employment Period ends for a period of six (6) years thereafter. The cost of such coverage shall be paid by the Company. Notwithstanding anything to the contrary in this Agreement, upon the occurrence of a Change of Control, the obligations set forth in this section shall terminate, provided that the Company shall (x) secure “tail insurance” with respect to the Existing D&O Coverage on reasonable terms and conditions of coverage, and (y) require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company to honor any indemnification obligations that the Executive is otherwise entitled to under any articles, bylaws or other foundation documents of the Company in the same manner as the Company’s directors and officers immediately prior to such Change of Control.

(b) **409A.**

(i) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the twenty percent (20%) additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section 409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six (6) months and one (1) day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(ii) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one (1) taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(iii) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(iv) The parties intend that this Agreement shall be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(v) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. **Representations and Warranties of the Executive.** Executive hereby represents and warrants to the Company that:

(a) **The Executive:**

(i) has not been convicted within the last five (5) years of any felony or misdemeanor in connection with the offer, purchase, or sale of any security or any felony involving fraud or deceit, including, but not limited to, forgery, embezzlement, obtaining money under false pretenses, larceny, or conspiracy to defraud;

(ii) is not currently subject to any state administrative enforcement order or judgement entered by a state securities administrator within the last five (5) years and is not subject to any state's administrative enforcement order or judgement in which fraud or deceit (including, but not limited to, making untrue statements of material facts and omitting to state material facts) was found in which the order or judgement was entered within the last five (5) years; and

(iii) is legally authorized to work in the United States of America.

(b) This Agreement constitutes the legal, valid and binding obligations of the Executive, enforceable in accordance with its terms, and execution, delivery and performance of this Agreement by the Executive does not and will not conflict with, violate or cause a breach of any agreement, contract or instrument to which the Executive is a party or any judgement, order or decree to which the Executive is subject.

8. Representations and Warranties of the Company. The Company hereby represents and warrants to the Executive that:

(a) The Company is a corporation duly organized, validly existing and in good standing under the laws of the State of Delaware. The Company has all requisite corporate power and authority to carry out the transactions contemplated by this Agreement.

(b) The execution, delivery and performance of this Agreement has been duly authorized by the Company. This Agreement constitutes a valid and binding obligation of the Company, enforceable in accordance with its terms. The execution and delivery by the Company of this Agreement, and the fulfillment of and compliance with the respective terms hereof by the Company, do not and shall not (i) conflict with or result in a breach of the terms, (ii) constitute a default under, (iii) result in the creation of any lien, security interest, charge or encumbrance upon the Company's capital stock or assets pursuant to, (iv) give any third party the right to modify, terminate or accelerate any obligation under, (v) result in a violation of, or (vi) require any authorization, consent, approval, exemption or other action by or notice to any court or administrative or governmental body pursuant to, the charter or bylaws of the Company, or any law, statute, rule or regulation to which the Company is subject, or any agreement, instrument, order judgement or decree to which the Company is subject.

9. Notices. All notices, demands or other communications to be given or delivered under or by reason of the provisions of this Agreement will be in writing and will be deemed to have been given when delivered personally, mailed by certified or registered mail, return receipt requested and postage prepaid, or sent via a nationally recognized overnight courier, or sent via facsimile to the recipient with a confirmation of receipt and accompanied by a certified or registered mailing. Such notices, demands and other communications will be sent to the address indicated below:

To the Company:

Aspen Aerogels, Inc.
30 Forbes Road
Northborough, MA 01532
Telephone: (508) 691-1111
Facsimile: (508) 691-1200
Attention: Board of Directors

with copies (which shall not constitute notice) to:

Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.
One Financial Center
Boston, MA 02111
Telephone: (617) 348-3013
Facsimile: (617) 542-2241
Attention: Sahir Surmeli

To the Executive:

Address specified on signature page

or to such other address or to the attention of such other person as the recipient party has specified by prior written notice to the sending party.

10. Miscellaneous.

(a) **Severability.** Whenever possible, each provision of this Agreement will be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement is held to be invalid, illegal or unenforceable in any respect under any applicable law or rule in any jurisdiction, such invalidity, illegality or unenforceability will not affect any other provision or any other jurisdiction, but this Agreement will be reformed, construed and enforced in such jurisdiction as if such invalid, illegal or unenforceable provision had never been contained herein.

(b) **Complete Agreement.** This Agreement and the agreements referred to herein (including, without limitation, the Confidentiality and Non-Competition Agreement) embody the complete agreement and understanding among the parties and supersede and preempt any prior understandings, agreements or representations by or among the parties, written or oral, which may have related to the subject matter hereof. This Agreement supersedes and terminates the Prior Agreement. For the avoidance of doubt, this Agreement has no effect on the Performance-Based Restricted Stock Agreement signed by the Company and the Executive on June 29, 2021 (the "**Restricted Stock Agreement**").

(c) **Waiver of Jury trial.** The parties to this Agreement each hereby waives, to the fullest extent permitted by law, any right to trial by jury of any claim, demand, action, or cause of action (i) arising under this Agreement or (ii) in any way connected with or related or incidental to the dealings of the parties hereto in respect of this Agreement or any of the transactions related hereto, in each case whether now existing or hereafter arising, and whether in contract, tort, equity, or otherwise. The parties to this Agreement each hereby agrees and consents that any such claim, demand, action, or cause of action shall be decided by court trial without a jury and that the parties to this Agreement may file an original counterpart or a copy of this Agreement with any court as written evidence of the consent of the parties hereto to the waiver of their right to trial by jury.

(d) **Counterparts; Facsimile Transmission.** This Agreement may be executed simultaneously in two or more counterparts, any one of which need not contain the signatures of more than one party, but all such counterparts taken together will constitute one and the same Agreement. This Agreement may also be executed and delivered by facsimile transmission.

(e) **Successors and Assigns.** The provisions hereof shall inure to the benefit of, and be binding upon and assignable to, successors of the Company by way of merger, consolidation or sale. The Executive may not assign or delegate to any third person the Executive's obligations under this Agreement. The rights and benefits of the Executive under this Agreement are personal to him and no such right or benefit shall be subject to voluntary or involuntary alienation, assignment or transfer. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business and/or assets of the Company expressly to assume and agree to perform this Agreement in the same manner and to the same extent that the Company would have been required to perform it if no such succession had taken place. As used in this Agreement, "the Company" shall mean both the Company as defined above and any such successor that assumes and agrees to perform this Agreement, by operation of law or otherwise.

(f) **Governing Law.** All issues concerning this Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without giving effect to any choice of law or conflict of law provision or rule (whether of the Commonwealth of Massachusetts or any other jurisdiction) that would cause the application of the law of any jurisdiction other than the Commonwealth of Massachusetts.

(g) **Remedies.** The parties hereto agree and acknowledge that money damages may not be an adequate remedy for any breach of the provisions of the Agreement and that any party may in its sole discretion apply to any court of law or equity of competent jurisdiction (without posting any bond or deposit) for specific performance and/or injunctive or other relief in order to enforce or prevent any violations of the provisions of this Agreement.

(h) **Amendment and Waiver.** The provisions of this Agreement may be amended and waived only with the prior written consent of the Company and the Executive.

(i) **Certain Expenses.** The Company agrees to pay, as incurred, to the fullest extent permitted by law, or indemnify the Executive if such payment is not legally permitted, for all legal fees and expenses that the Executive may in good faith incur as a result of any contest by the Company, the Executive or others of the validity or enforceability of or liability under, or otherwise involving, any provision of this Agreement; provided, however, that the Executive shall reimburse the Company for all such payments made by the Company in connection with a contest by the Company if a court of competent jurisdiction or an arbitrator shall find that the Executive did not act in good faith in connection with such contest.

(j) **Withholding.** All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

(k) **Litigation and Regulatory Cooperation.** During and after the Executive's employment, the Executive shall cooperate fully with the Company in the defense or prosecution of any claims or actions now in existence or which may be brought in the future against or on behalf of the Company which relate to events or occurrences that transpired while the Executive was employed by the Company. The Executive's full cooperation in connection with such claims or actions shall include, but not be limited to, being available to meet with counsel to prepare for discovery or trial and to act as a witness on behalf of the Company at mutually convenient times. During and after the Executive's employment, the Executive also shall cooperate fully with the Company in connection with any investigation or review of any federal, state or local regulatory authority as any such investigation or review relates to events or occurrences that transpired while the Executive was employed by the Company. The Company shall reimburse the Executive for any reasonable out-of-pocket expenses incurred in connection with the Executive's performance of obligations pursuant to this Section 11(k).

(l) **Survival.** The provisions of Sections 1, 2, 4, 5, 6, 9 and 10 of this Agreement shall survive any termination of this Agreement in accordance with the terms of such sections.

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

THE COMPANY:

ASPEN AEROGELS, INC.

By: /s/John F. Fairbanks
Name: John Fairbanks
Title: Chief Financial Officer

THE EXECUTIVE:

By: /s/Donald R. Young
Name: Donald R. Young

Address: ***

Portions of this Exhibit, indicated by the mark "[***]," were omitted and have been filed separately with the Securities and Exchange Commission pursuant to the Registrant's application requesting confidential treatment pursuant to Rule 24b-2 of the Securities Exchange Act of 1934, as amended.

EXECUTIVE AGREEMENT

This Executive Agreement (this “**Agreement**”) is dated as of [DATE] and will be effective as of January 1, 2022 (the “**Effective Date**”), by and between Aspen Aerogels, Inc., a Delaware corporation (the “**Company**”), and [NAME] (the “**Executive**”).

Recitals:

- A.** The Company and the Executive previously entered into an executive agreement, dated December 21, 2018, as amended from time to time (the “**Prior Agreement**”).
- B.** The Company and the Executive desire to continue Executive’s employment on the terms and conditions set forth in this Agreement, and replace the Prior Agreement in its entirety with this Agreement.
- C.** As an employee of the Company, the Executive has previously received and will continue to be given access to or come into contact with certain proprietary and/or confidential information of the Company.
- D.** The Company and the Executive are parties to an Employment, Confidentiality and Non-Competition Agreement dated December 16, 2015 (the “**Confidentiality and Non-Competition Agreement**”).
- E.** The foregoing recitals shall be incorporated into and be a part of this Agreement.

Agreement:

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

- 1. Definitions.** As used herein, the following terms shall have the following meanings.

“**Board**” means the Company’s board of directors.

“**Cause**” means: (i) willful misconduct, dishonesty, fraud or breach of fiduciary duty to the Company; (ii) deliberate disregard of the lawful rules or policies of the Company, failure to perform assigned duties, or breach of an employment or other agreement with the Company, which results in direct or indirect loss, damage or injury to the Company; (iii) the unauthorized disclosure of any trade secret or confidential information of the Company; (iv) the commission of an act which constitutes unfair competition with the Company or which induces any customer or supplier to breach a contract with the Company; (v) conduct substantially prejudicial to the business of the Company; or (vi) the indictment of the Executive for any felony involving deceit, dishonesty or fraud, or any criminal conduct by the Executive that would reasonably be expected to result in material injury or reputational harm to the Company. For purposes hereof, whether or not the Executive has committed an act or omission of the type referred to in subparagraphs (i) through (vi) above will be determined by the Company in its reasonable, good faith discretion, based upon the facts known to the Company at the relevant time.

“**Change of Control**” shall mean the first to occur of any of the following events: (i) the consummation of a reorganization, merger, consolidation or other similar transaction of the Company with or into any other Person or Group (within the meaning of Section 13(d)(3) of the Securities Act of 1934, as amended) in which holders of the Company’s voting securities immediately prior to such reorganization, merger, consolidation or other similar transaction will not, directly or indirectly, continue to hold at least a majority of the outstanding voting securities of the Company; (ii) a sale, lease, exchange or other transfer (in one transaction or a related series of transactions) of all or substantially all of the Company’s assets; (iii) the acquisition by any Person or any Group of such quantity of the Company’s voting securities as causes such Person or Group (other than a Person or Group who is a shareholder of the Company on the Effective Date) to own beneficially, directly or indirectly, as of the time

immediately after such transaction or series of transactions, more than 50% of the combined voting power of the voting securities of the Company other than as a result of (a) an acquisition of securities directly from the Company or (b) an acquisition of securities by the Company which by reducing the voting securities outstanding increases the proportionate voting power represented by the voting securities owned by any such Person or Group to more than 50% of the combined voting power of such voting securities; or (iv) a change in the composition of the Board within a two (2) year period such that a majority of the members of the Board are not Continuing Directors. As used herein, the term “**Continuing Directors**” shall mean as of any date of determination, any member of the Board who (a) was a member of the Board immediately after the Effective Date, or (b) was nominated for election or elected to the Board with the approval of, or whose election to the Board was ratified by, at least a majority of the Continuing Directors who were members of the Board at the time of that nomination or election; provided, however, that in no case shall (1) the public offering and sale of the Company’s common stock by its shareholders pursuant to a registered secondary offering or (2) the voluntary or involuntary bankruptcy of the Company constitute a Change of Control.

“**Good Reason**” means: (i) any material breach by the Company of this Agreement; (ii) a change in the Executive’s reporting relationships such that the Executive no longer directly reports to the President or Chief Executive Officer; (iii) only in connection with a CIC Qualifying Termination as defined in Section 5 below, a material reduction or material adverse change in the Executive’s current duties, responsibilities and authority, without his or her consent; (iv) the demand by the Company for the Executive to relocate or commute more than 40 miles from Northborough, Massachusetts without his or her consent; or (v) any reduction by the Company in the Executive’s Base Salary or the Executive’s Performance Bonus Target without his or her consent, except for across-the-board compensation reductions based on the Company’s financial performance similarly affecting all or substantially all senior management employees of the Company. For purposes hereof, whether or not the Executive has Good Reason to terminate his or her employment by the Company pursuant to subparagraphs (i) through (v) above will be determined by the Company in its reasonable, good faith discretion, based upon the facts known to the Company at the relevant time.

“**Permanent Disability**” means the Executive is unable to perform, by reason of physical or mental incapacity, his or her then duties or obligations to the Company, for a total period of one hundred eighty (180) days in any three hundred sixty (360) day period.

“**Person**” means an individual, a partnership, a corporation, a limited liability company, an association, a joint stock company, a trust, a joint venture, an unincorporated organization or any other entity, including a governmental entity or any department, agency or political subdivision thereof.

“**Qualifying Termination**” means the date on which the Executive’s employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates employment for Good Reason as provided in Section 3(e).

2. Employment. The Company agrees to employ the Executive, and the Executive hereby accepts employment with the Company consistent with the Executive’s position and duties, upon the terms and conditions set forth in this Agreement.

(a) **Term.** The term of this Agreement shall commence on the Effective Date and continue until the earlier of (i) December 31, 2022 or (ii) the termination of this Agreement in accordance with the provisions of Section 3 (the “**Employment Period**”). The Executive’s employment with the Company shall be “at will,” meaning that the Executive’s employment may be terminated by the Company or the Executive at any time and for any reason.

(b) **Position and Duties.**

(i) During the Employment Period, the Executive shall serve as [Title] of the Company and shall have the duties, responsibilities and authority consistent with such position that are designated by the Company’s Chief Executive Officer, subject to the direction and supervision of the Board.

(ii) The Executive shall devote his or her best efforts and his or her full business time and attention (except for permitted vacation periods and reasonable periods of illness or other incapacity) to the business and affairs of the Company. The Executive shall perform his or her duties and responsibilities to the best of his or her abilities in a diligent, trustworthy businesslike and efficient manner. Notwithstanding the foregoing, the Executive may, to the extent not otherwise prohibited by this Agreement, devote such amount of time as does not interfere or compete with the performance of the Executive's duties under this Agreement to any one or more of the following activities: (i) engaging in charitable activities, including serving on the boards of directors of charitable organizations or (ii) serving on the board of directors of any other company with the prior written approval of the Company.

(iii) The Executive agrees to abide by the Company's Code of Business Conduct and Ethics, Anti-Corruption Policy, Complaints Handling Policy, Insider Trading Policy, Disclosure Controls and Procedures Under the Securities Exchange Act of 1934, Form 8-K Disclosure Compliance Policy, Regulation FD Disclosure Policy, the Chief Executive Officer's Delegation of Authority and the Short-Term Investment Policy, each as in effect from time to time and such other policies, rules and regulations as the Company may adopt from time to time.

(c) **Salary and Benefits.**

During the Employment Period, Executive shall be entitled to the following compensation and benefits:

(i) **Base Salary.** During the Employment Period, the Executive's base salary shall be \$[Amount] (such annual salary, as it may be adjusted upward by the Board in its discretion, being referred to as the "**Base Salary**"). The Base Salary shall be payable in regular installments in accordance with the Company's general payroll practices, shall be subject to customary withholding and may be increased (but not decreased) at the discretion of the Board.

(ii) **Annual Performance Bonus.** The Executive shall be eligible to earn an annual cash incentive bonus (the "**Performance Bonus**") of not less than []% of the Executive's then effective Base Salary (each, a "**Performance Bonus Target**"), subject in all respects to the terms and conditions established by the Board.

(iii) **Expense Reimbursement.** The Company will reimburse the Executive for all reasonable travel and other expenses incurred by the Executive in connection with the performance of his or her duties and obligations under this Agreement. The Executive shall comply with such reasonable limitations and reporting requirements with respect to expenses as may be established by the Company from time to time.

(iv) **Benefit Plans and Programs.** The Executive shall be entitled to participate in all compensation or employee benefit plans or programs and receive all benefits and perquisites for which salaried employees of the Company generally are eligible under any plan or program now or established later by the Company on the same basis as similarly situated senior executives of the Company. The Executive may participate to the extent permissible under the terms and provisions of such plans or programs, in accordance with program provisions. Nothing in this Agreement will preclude the Company from amending or terminating any of the plans or programs applicable to salaried employees or senior executives of the Company as long as such amendment or termination is applicable to all salaried employees or senior executives, as the case may be, so long as such plans or programs are replaced with plans no less favorable, in the aggregate, than existing plans.

(v) **Grants of Long-Term Compensation.** The Executive shall also be eligible for grants of long-term incentive compensation, including, options to purchase the Company's common stock, restricted stock and/or restricted stock units, all on terms and conditions established by the Board.

(vi) Clawback Policy. All compensation shall be subject to any forfeiture or clawback policy established by the Company or the Board generally for senior executives from time to time and any other such policy required by applicable law.

(d) Change of Control: Options and Stock-Based Awards.

In the event of a Change of Control, notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement to the extent any outstanding stock options and other stock-based awards are not assumed by the Company's successor in a Change of Control, the vesting of all stock options and other stock-based awards outstanding and held by the Executive as of the Change of Control shall immediately accelerate and become fully vested and exercisable, subject to any permitted action by the Board upon a Change of Control under the Company's applicable equity plan to terminate the stock options or other stock-based awards upon a Change of Control, provided, however, that the foregoing shall not apply to any outstanding equity award to the extent such acceleration of vesting would result in a violation of Section 409A of the Code.

3. Termination. During the Employment Period, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) Death. The Executive's employment hereunder shall terminate upon his or her death.

(b) Disability. The Company may terminate the Executive's employment upon the Executive's Permanent Disability. If any question shall arise as to whether the Executive has a Permanent Disability so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 et seq. and the Americans with Disabilities Act, 42 U.S.C. §12101 et seq.

(c) Termination by Company for Cause. The Company may terminate the Executive's employment hereunder for Cause.

(d) Termination by Company Without Cause. The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or Permanent Disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) Termination by the Executive. The Executive may terminate his or her employment hereunder at any time for any reason, including but not limited to Good Reason. In the event the Executive seeks to terminate his or her employment for Good Reason, the Executive shall comply with the "Good Reason Process" (hereinafter defined) following the occurrence of any purported Good Reason. "Good Reason Process" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the Good Reason condition within sixty (60) days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than thirty (30) days following receipt of such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his or her employment within sixty (60) days after the end of the Cure Period. If the Company cures the Good Reason or

determines in its reasonable good faith discretion that a Good Reason condition has not occurred during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) **Notice of Termination.** Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) **Date of Termination.** "Date of Termination" shall mean: (i) if the Executive's employment is terminated by his or her death, the date of his or her death; (ii) if the Executive's employment is terminated on account of Permanent Disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, thirty (30) days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date which is specified in the Notice of Termination, provided that such date must occur within the sixty (60) day period after the end of the Cure Period. Notwithstanding the foregoing, in the event that either party gives a Notice of Termination, the Company may unilaterally accelerate the Date of Termination.

4. **Compensation on Termination.**

(a) **Termination Generally.** If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his or her authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and, to the extent required by law, unused vacation that accrued through the Date of Termination, such amounts to be paid no more than thirty (30) days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the "Accrued Benefits").

(b) **Qualifying Termination Prior to A Change of Control.** If the Executive incurs a Qualifying Termination during the Employment Period and prior to a Change of Control, then in addition to the Accrued Benefits, and subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, non-compete, return of property and non-disparagement, in a form and manner satisfactory to the Company (the "Separation Agreement and Release") and the Separation Agreement and Release becoming fully effective, all within sixty (60) days of the Date of Termination (the "Release Period"):

(i) the Company shall pay the Executive an amount equal to one hundred percent (100%) of the sum of (A) the Executive's then effective Base Salary and (B) an amount equal to the Executive's then effective Performance Bonus Target (the "Severance Amount").

(ii) the Company shall pay the Executive any accrued but unpaid Performance Bonus for the prior fiscal year then owed or fully earned by the Executive in accordance with Section 2(c)(ii) above (the "Earned Performance Bonus").

(iii) the Company shall pay the Executive a pro-rata portion of the Performance Bonus based upon actual achievement of the performance metrics for the fiscal year in which the Termination Date occurs (calculated by dividing the number of full months of the applicable fiscal year through the Date of Termination by 12, and multiplying this fraction by the Executive's then effective Performance Bonus Target) (the "Pro-Rata Bonus").

(iv) the COBRA eligible health care insurance benefits (e.g., health, dental) being provided by the Company to the Executive on the Date of Termination shall continue in place at the same cost

to the Executive as applied to “active” participants on the Date of Termination for a period equal to the lesser of (i) the COBRA Benefit Period or (ii) twelve (12) months (“**Health Care Continuation Benefit**”). The “COBRA Benefit Period” means the period of time after such termination during which COBRA benefits are available to the Executive as of the Date of Termination as set forth in the Company’s health care plan. The Executive shall be responsible for applying for the COBRA eligible health care insurance benefit, paying for the same and submitting evidence of such premium costs to the Company for reimbursement during the COBRA Benefit Period. The Company shall reimburse the Executive for the employer’s portion of such premiums (as applicable to the active rate) within 15 days of receipt of evidence of the payment of the premium costs to the Company (“**Premium Reimbursement Payments**”). Notwithstanding the foregoing, if the Company determines, in its sole discretion, that such reimbursement of the premiums would result in a violation of the nondiscrimination rules of Section 105(h)(2) of the Internal Revenue Code of 1986, as amended (the “**Code**”) or any statute or regulation of similar effect (including but not limited to the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then in lieu of reimbursing the premiums, the Company, in its sole discretion, may elect to instead pay the Executive on the first day of each month of such period, a fully taxable cash payment equal to the premiums for that month, subject to applicable tax withholdings (such amount, the “**Special Severance Payment**”), for the remainder of such period. The Executive may, but is not obligated to, use such Special Severance Payment toward the cost of premiums.

(v) if the Executive requests, the Company shall pay (“**Outplacement Payments**”) for an outplacement service (to be selected by the Company) for services rendered in assisting the Executive in locating another job, for a period of six (6) months following the Date of Termination or until the Executive begins working for another employer, whichever occurs first (“**Outplacement Services**”). These Outplacement Payments, which the Company shall make directly to the vendor providing Outplacement Services, are contingent upon the Executive’s cooperation with the outplacement service and upon active efforts by the Executive to locate another position.

(vi) Notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement, (a) the vesting of such number of stock options and other stock-based awards outstanding and held by the Executive as would have vested in the three (3) months immediately following the Date of Termination had the Executive continued his or her employment for such three (3) month period shall immediately accelerate and become vested and exercisable as of the Date of Termination, and (b) subject to any permitted action by the Board upon a Change of Control or other merger, sale, dissolution or liquidation of the Company under Company’s applicable equity plan to terminate the stock options or other stock-based awards, all vested stock options held by the Executive shall be exercisable for one (1) year from the Date of Termination.

(c) **RESERVED.**

(d) **Timing and Form of Severance Payments.**

The benefits provided to Executive under Sections 4(b)(i), (ii), (iii), (iv), and (v) shall be paid in the form and at the time specified below:

(i) Severance Amount shall be paid in substantially equal installments in accordance with the Company’s payroll practice over twelve (12) months commencing within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(ii) Earned Performance Bonus shall be paid in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Earned Performance Bonus shall be paid in the second calendar year by the last day of such 60-day period.

(iii) The Pro-Rata Bonus shall be paid when the annual performance bonus would have been otherwise paid if Executive had continued his or her employment through the applicable performance period.

(iv) Health Care Continuation Benefit shall commence immediately upon the Executive's Date of Termination and the Executive shall immediately become eligible for Reimbursement Payments in accordance with Section 4(b)(iii), provided however if an executed Separation Agreement and Release has not become fully effective within Release Period, the Company shall immediately cease making Premium Reimbursement Payments (or, if applicable, Special Severance Payments) and the Executive shall be obligated to promptly repay to the Company any previously received Premium Reimbursement Payments (or, if applicable, any Special Severance Payments).

(v) Outplacement Services shall commence immediately upon the Executive's Date of Termination, provided however if an executed Separation Agreement and Release has not become fully effective within the Release Period, Outplacement Services shall immediately cease and the Executive shall be obligated to promptly repay to the Company any previously made Outplacement Payments.

(e) **Rights to Severance.** The receipt of any severance payments or benefits pursuant to Section 4 shall be subject to (i) the Executive's submission to the Company of an executed Separation Agreement and Release that becomes fully effective within the Release Period and (ii) the Executive's continued compliance with the Confidentiality and Non-Competition Agreement. In the event an executed Separation and Release Agreement does not become fully effective within the Release Period, the Executive shall forfeit his or her right to receive any severance payments or benefits under Section 4 and, as specified in paragraph (d) above, the Company shall have the right to recoup from the Executive any previously made severance payments or benefits. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 4 without affecting the effectiveness of the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(f) **Other Termination Events.** The Executive hereby agrees that no severance compensation shall be payable upon termination of the Executive's employment with the Company (i) by the Company with Cause; (ii) by the Executive without Good Reason; or (iii) as a result of the Executive's death or Permanent Disability, and the Executive hereby waives any claim for severance compensation except as set forth in Section 4(b).

5. **Change of Control.** The provisions of this Section 5 shall apply in lieu of, and expressly supersede, other than with respect to the requirement for the execution and delivery of a Separation Agreement and Release, the provisions of Section 4 regarding severance pay and benefits upon a Qualifying Termination, if a Qualifying Termination occurs within twenty-four (24) months after the occurrence of a Change of Control ("**CIC Qualifying Termination**"). This Section 5 shall terminate and be of no force or effect beginning twenty-four (24) months after the occurrence of a Change of Control.

(a) **Qualifying Termination after a Change of Control.** During the Employment Period, if the Executive incurs a CIC Qualifying Termination, then in addition to the Accrued Benefits, and subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable within the Release Period:

(i) the Company shall pay the Executive an amount equal to two hundred percent (200%) of the sum of (A) the Executive's then effective Base Salary and (B) the Executive's then effective Performance Bonus Target ("**CIC Severance Amount**").

(ii) the Company shall pay the Executive any accrued but unpaid Performance Bonus for the prior fiscal year then owed or fully earned by the Executive in accordance with Section 2(c)(ii) above ("**CIC Earned Performance Bonus**").

(iii) the Company shall pay the Executive the Pro-Rata Bonus.

(iv) the COBRA eligible health care insurance benefits (e.g., health, dental) being provided by the Company to the Executive on the Date of Termination shall continue in place at the same cost to the Executive as applied to “active” participants on the Date of Termination for a period equal to the lesser of (i) the COBRA Benefit Period or (ii) twenty-four (24) months (“**CIC Health Care Continuation Benefits**”). The Executive shall be responsible for applying for the COBRA eligible health care insurance benefit, paying for the same and submitting evidence of such premium costs to the Company for reimbursement during the COBRA Benefit Period. The Company shall reimburse the Executive for the employer’s portion of such premiums (as applicable to the active rate) within 15 days of receipt of evidence of the payment of the premium costs to the Company (“**CIC Premium Reimbursement Payments**”). Notwithstanding the foregoing, if the Company determines, in its sole discretion, that such reimbursement of the premiums would result in a violation of the nondiscrimination rules of Section 105(h)(2) of the Code or any statute or regulation of similar effect (including but not limited to the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then in lieu of reimbursing the premiums, the Company, in its sole discretion, may elect to instead pay the Executive on the first day of each month of such period a fully taxable cash payment equal to the premiums for that month, subject to applicable tax withholdings (such amount, the “**CIC Special Severance Payment**”), for the remainder of such period. The Executive may, but is not obligated to, use such Special Severance Payment toward the cost of premiums.

(v) if the Executive wishes, the Company will pay for an outplacement service (“**CIC Outplacement Payments**”) (to be selected by the Company) for services rendered in assisting the Executive in locating another job, for a period of six (6) months following the Date of Termination or until the Executive begins working for another employer, whichever occurs first (“**CIC Outplacement Services**”). These CIC Outplacement Payments, which the Company shall make directly to the vendor providing the CIC Outplacement Services, are contingent upon the Executive’s cooperation with the outplacement service and upon active efforts by the Executive to locate another position.

(vi) CIC Severance Amount shall be payable in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(vii) CIC Earned Performance Bonus shall be paid in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the Earned Performance Bonus shall be paid in the second calendar year by the last day of such 60-day period.

(viii) The Pro-Rata Bonus shall be paid when the annual performance would have been paid if Executive had continued his or her employment through the payment date.

(ix) CIC Health Care Continuation Benefit shall commence immediately upon the Executive’s Date of Termination and the Executive shall immediately become eligible for Reimbursement Payments in accordance with Section 5(a)(iv), provided however if an executed Separation Agreement and Release has not become fully effective within the CIC Release Period, the Company shall immediately cease making CIC Premium Reimbursement Payments (or, if applicable, any CIC Special Severance Payments) and the Executive shall be obligated to promptly repay to the Company any previously received CIC Premium Reimbursement Payments (or, if applicable, any CIC Special Severance Payments).

(x) CIC Outplacement Services shall commence immediately upon the Executive’s Date of Termination, provided however if an executed Separation Agreement and Release has not become fully effective within the CIC Release Period, CIC Outplacement Services shall immediately cease and the Executive shall be obligated to promptly repay to the Company any previously made CIC Outplacement Payments.

(xi) Notwithstanding anything to the contrary in any then outstanding option agreement or stock-based award agreement, the vesting of all stock options and other stock-based awards outstanding and held by the Executive shall immediately accelerate and become fully vested and exercisable as of the Date of Termination, and subject to any permitted action by the Board upon a Change of Control under Company's applicable equity plan to terminate the stock options or other stock-based awards upon a Change of Control, all vested stock options shall be exercisable for one (1) year from the Date of Termination.

(b) **RESERVED.**

(c) **Right to Severance under Section 5.** The receipt of any severance payments or benefits pursuant to Section 5 shall be subject (i) the Executive's submission to the Company of an executed Separation Agreement and Release that becomes fully effective within the CIC Release Period and (ii) to the Executive's continued compliance with the Confidentiality and Non-Competition Agreement. In the event an executed Separation and Release Agreement does not become fully effective within the Release Period, the Executive shall forfeit his or her right to receive any severance payments or benefits under Section 5 and, as specified in paragraph (c) above, the Company shall have the right to recoup from the Executive any previously made severance payments or benefits. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 5 without affecting the effectiveness of the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(d) **Continued Compliance.** The receipt of any severance payments or benefits pursuant to Section 5 shall be subject to the Executive not violating any of the provisions set forth in the Confidentiality and Non-Competition Agreement. In the event the Executive breaches any of the provisions set forth in the Confidentiality and Non-Competition Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which the Executive may otherwise be entitled pursuant to Section 5 without affecting the Executive's release or the Executive's obligations under the Separation Agreement and Release.

(e) **Other Termination Events.** The Executive hereby agrees that no severance compensation shall be payable upon termination of the Executive's employment with the Company (i) by the Company with Cause; (ii) by the Executive without Good Reason; or (iii) as a result of the Executive's death or Permanent Disability, and the Executive hereby waives any claim for severance compensation except as set forth in Section 5(a).

(f) **Parachute Payments.** If Independent Tax Counsel (as that term is defined below) determines that the aggregate payments and benefits provided or to be provided to the Executive pursuant to this Agreement, and any other payments and benefits provided or to be provided to the Executive from the Company or any of its subsidiaries or other affiliates or any successors thereto constitute "parachute payments" as defined in Section 280G of the Code ("**Parachute Payments**") that would be subject to the excise tax imposed by Section 4999 of the Code (the "**Excise Tax**"), then, except as otherwise provided in the next sentence, such Parachute Payments shall be reduced to the extent the Independent Tax Counsel shall determine is necessary (but not below zero) so that no portion thereof shall be subject to the Excise Tax. If Independent Tax Counsel determines that the Executive would receive in the aggregate greater payments and benefits on an after tax basis if the Parachute Payments were not reduced pursuant to this Section 5(f), then no such reduction shall be made. The determination of which payments or benefits shall be reduced to avoid the Excise Tax shall be made by the Independent Tax Counsel, provided that the Independent Tax Counsel shall reduce or eliminate, as the case may be, payments or benefits in the following order (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order. The determination of the Independent Tax Counsel under this Section 5(f) shall be final and binding on all parties hereto. For purposes of this Section 5(f), "**Independent Tax Counsel**" shall mean a lawyer, a certified public accountant with a nationally recognized accounting firm, or a compensation consultant with a nationally recognized actuarial and benefits consulting firm with expertise in the area of executive compensation tax law, who shall be selected by the Board, and whose fees and disbursements shall be paid by the Company.

6. **Tax and Insurance.**

(a) **Insurance.** In no event shall the termination of the Executive's employment by the Company or any such termination by the Executive pursuant to this Agreement release any claim by the Executive for indemnification that he or she is otherwise entitled to under any director or officer's insurance policy or any articles, bylaws or other foundation documents of the Company. Without limiting the foregoing, the Company shall provide Executive with reasonable director's and officer's insurance coverage that is at least as favorable as the coverage in existence on the date of this Agreement (the "**Existing D&O Coverage**"); provided, however, that in no event shall the Company be obligated to maintain director's and officer's insurance coverage to the extent that premiums thereunder exceed 200% of the premiums payable by the Company under the Existing D&O Coverage on the date hereof (the "**Threshold**"); provided, further, that to the extent such premiums exceed the foregoing Threshold, the Company shall obtain director's and officer's insurance coverage on terms as similar as reasonably practicable to the terms of the Existing D&O Coverage without exceeding the Threshold. Such insurance coverage shall continue in effect during the Employment Period and after the Employment Period ends for a period of six (6) years thereafter. The cost of such coverage shall be paid by the Company. Notwithstanding anything to the contrary in this Agreement, upon the occurrence of a Change of Control, the obligations set forth in this section shall terminate, provided that the Company shall (x) secure "tail insurance" with respect to the Existing D&O Coverage on reasonable terms and conditions of coverage, and (y) require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company to honor any indemnification obligations that the Executive is otherwise entitled to under any articles, bylaws or other foundation documents of the Company in the same manner as the Company's directors and officers immediately prior to such Change of Control.

(b) **409A.**

(i) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the twenty percent (20%) additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section 409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six (6) months and one (1) day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(ii) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one (1) taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(iii) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(iv) The parties intend that this Agreement shall be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its

compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(v) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. **Representations and Warranties of the Executive.** Executive hereby represents and warrants to the Company that:

(a) **The Executive:**

(i) has not been convicted within the last five (5) years of any felony or misdemeanor in connection with the offer, purchase, or sale of any security or any felony involving fraud or deceit, including, but not limited to, forgery, embezzlement, obtaining money under false pretenses, larceny, or conspiracy to defraud.

(ii) is not currently subject to any state administrative enforcement order or judgement entered by a state securities administrator within the last five (5) years and is not subject to any state's administrative enforcement order or judgement in which fraud or deceit (including, but not limited to, making untrue statements of material facts and omitting to state material facts) was found in which the order or judgement was entered within the last five (5) years.

(iii) is legally authorized to work in the United States of America.

(b) This Agreement constitutes the legal, valid and binding obligations of the Executive, enforceable in accordance with its terms, and execution, delivery and performance of this Agreement by the Executive does not and will not conflict with, violate or cause a breach of any agreement, contract or instrument to which the Executive is a party or any judgement, order or decree to which the Executive is subject.

8. **Representations and Warranties of the Company.** The Company hereby represents and warrants to the Executive that:

(a) The Company is a corporation duly organized, validly existing and in good standing under the laws of the State of Delaware. The Company has all requisite corporate power and authority to carry out the transactions contemplated by this Agreement.

(b) The execution, delivery and performance of this Agreement has been duly authorized by the Company. This Agreement constitutes a valid and binding obligation of the Company, enforceable in accordance with its terms. The execution and delivery by the Company of this Agreement, and the fulfillment of and compliance with the respective terms hereof by the Company, do not and shall not (i) conflict with or result in a breach of the terms, (ii) constitute a default under, (iii) result in the creation of any lien, security interest, charge or encumbrance upon the Company's capital stock or assets pursuant to, (iv) give any third party the right to modify, terminate or accelerate any obligation under, (v) result in a violation of, or (vi) require any authorization, consent, approval, exemption or other action by or notice to any court or administrative or governmental body pursuant to, the charter or bylaws of the Company, or any law, statute, rule or regulation to which the Company is subject, or any agreement, instrument, order judgement or decree to which the Company is subject.

9. **Notices.** All notices, demands or other communications to be given or delivered under or by reason of the provisions of this Agreement will be in writing and will be deemed to have been given when delivered

personally, mailed by certified or registered mail, return receipt requested and postage prepaid, or sent via a nationally recognized overnight courier, or sent via facsimile to the recipient with a confirmation of receipt and accompanied by a certified or registered mailing. Such notices, demands and other communications will be sent to the address indicated below:

To the Company:

Aspen Aerogels, Inc.
30 Forbes Road
Northborough, MA 01532
Telephone: (508) 691-1111
Facsimile: (508) 691-1200
Attention: Board of Directors

with copies (which shall not constitute notice) to:

Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.
One Financial Center
Boston, MA 02111
Telephone: (617) 348-3013
Facsimile: (617) 542-2241
Attention: Sahir Surmeli

To the Executive:

Address specified on signature page

or to such other address or to the attention of such other person as the recipient party has specified by prior written notice to the sending party.

10. Miscellaneous.

(a) **Severability.** Whenever possible, each provision of this Agreement will be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement is held to be invalid, illegal or unenforceable in any respect under any applicable law or rule in any jurisdiction, such invalidity, illegality or unenforceability will not affect any other provision or any other jurisdiction, but this Agreement will be reformed, construed and enforced in such jurisdiction as if such invalid, illegal or unenforceable provision had never been contained herein.

(b) **Complete Agreement.** This Agreement and the agreements referred to herein (including, without limitation, the Confidentiality and Non-Competition Agreement) embody the complete agreement and understanding among the parties and supersede and preempt any prior understandings, agreements or representations by or among the parties, written or oral, which may have related to the subject matter hereof. This Agreement supersedes and terminates the Prior Agreement.

(c) **Waiver of Jury trial.** The parties to this Agreement each hereby waives, to the fullest extent permitted by law, any right to trial by jury of any claim, demand, action, or cause of action (i) arising under this Agreement or (ii) in any way connected with or related or incidental to the dealings of the parties hereto in respect of this Agreement or any of the transactions related hereto, in each case whether now existing or hereafter arising, and whether in contract, tort, equity, or otherwise. The parties to this Agreement each hereby agrees and consents that any such claim, demand, action, or cause of action shall be decided by court trial without a jury and that the parties to this Agreement may file an original counterpart or a copy of

this Agreement with any court as written evidence of the consent of the parties hereto to the waiver of their right to trial by jury.

(d) **Counterparts; Facsimile Transmission.** This Agreement may be executed simultaneously in two or more counterparts, any one of which need not contain the signatures of more than one party, but all such counterparts taken together will constitute one and the same Agreement. This Agreement may also be executed and delivered by facsimile transmission.

(e) **Successors and Assigns.** The provisions hereof shall inure to the benefit of, and be binding upon and assignable to, successors of the Company by way of merger, consolidation or sale. The Executive may not assign or delegate to any third person the Executive's obligations under this Agreement. The rights and benefits of the Executive under this Agreement are personal to him and no such right or benefit shall be subject to voluntary or involuntary alienation, assignment or transfer. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business and/or assets of the Company expressly to assume and agree to perform this Agreement in the same manner and to the same extent that the Company would have been required to perform it if no such succession had taken place. As used in this Agreement, "the Company" shall mean both the Company as defined above and any such successor that assumes and agrees to perform this Agreement, by operation of law or otherwise.

(f) **Governing Law.** All issues concerning this Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without giving effect to any choice of law or conflict of law provision or rule (whether of the Commonwealth of Massachusetts or any other jurisdiction) that would cause the application of the law of any jurisdiction other than the Commonwealth of Massachusetts.

(g) **Remedies.** The parties hereto agree and acknowledge that money damages may not be an adequate remedy for any breach of the provisions of the Agreement and that any party may in its sole discretion apply to any court of law or equity of competent jurisdiction (without posting any bond or deposit) for specific performance and/or injunctive or other relief in order to enforce or prevent any violations of the provisions of this Agreement.

(h) **Amendment and Waiver.** The provisions of this Agreement may be amended and waived only with the prior written consent of the Company and the Executive.

(i) **Certain Expenses.** The Company agrees to pay, as incurred, to the fullest extent permitted by law, or indemnify the Executive if such payment is not legally permitted, for all legal fees and expenses that the Executive may in good faith incur as a result of any contest by the Company, the Executive or others of the validity or enforceability of or liability under, or otherwise involving, any provision of this Agreement; provided, however, that the Executive shall reimburse the Company for all such payments made by the Company in connection with a contest by the Company if a court of competent jurisdiction or an arbitrator shall find that the Executive did not act in good faith in connection with such contest.

(j) **Withholding.** All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

(k) **Litigation and Regulatory Cooperation.** During and after the Executive's employment, the Executive shall cooperate fully with the Company in the defense or prosecution of any claims or actions now in existence or which may be brought in the future against or on behalf of the Company which relate to events or occurrences that transpired while the Executive was employed by the Company. The Executive's full cooperation in connection with such claims or actions shall include, but not be limited to, being available to meet with counsel to prepare for discovery or trial and to act as a witness on behalf of the Company at mutually convenient times. During and after the Executive's employment, the Executive also shall cooperate fully with the Company in connection with any investigation or review of any federal, state or local regulatory authority as any such investigation or review relates to events or occurrences that transpired while the Executive was employed by the Company. The

Company shall reimburse the Executive for any reasonable out-of-pocket expenses incurred in connection with the Executive's performance of obligations pursuant to this Section 11(k).

(l) **Survival.** The provisions of Sections 1, 2, 4, 5, 6, 9 and 10 of this Agreement shall survive any termination of this Agreement in accordance with the terms of such sections.

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IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

THE COMPANY:

ASPEN AEROGELS, INC.

By:
Name: Donald R. Young
Title: Chief Executive Officer

THE EXECUTIVE:

By:
[NAME]

Address: _____

ASPEN AEROGELS, INC.

NON-EMPLOYEE DIRECTOR COMPENSATION POLICY¹

The Board of Directors of Aspen Aerogels, Inc. (the “Company”) has approved the following Non-Employee Director Compensation Policy (this “Policy”) which establishes compensation to be paid to non-employee directors of the Company to provide an inducement to obtain and retain the services of qualified persons to serve as members of the Company’s Board of Directors.

Applicable Persons

This Policy shall apply to each director of the Company who is not an employee of, or consultant to, the Company or any Affiliate (each, an “Outside Director”). “Affiliate” shall mean a corporation which is a direct or indirect parent or subsidiary of the Company, as determined pursuant to Section 424 of the Internal Revenue Code of 1986, as amended.

Equity Grants

All equity grant amounts set forth herein shall be subject to automatic adjustment in the event of any stock split or other recapitalization affecting the Company’s common stock.

Annual Restricted Stock Grants

Commencing in calendar year 2015, each Outside Director shall be granted (i) restricted shares of the Company’s common stock (the “Annual Stock Grant”) equal in value to \$51,000 under the Company’s 2014 Employee, Director and Consultant Equity Incentive Plan or such plan in effect on the date of grant (the “Stock Plan”) and (ii) stock options to purchase shares of the Company’s common stock (the “Annual Option Grant”, and together with the Annual Stock Grant, the “Annual Equity Grant”) equal in value to \$34,000 under the Stock Plan each year on or about the time of the annual meeting of the Board of Directors following the Company’s annual meeting of stockholders; provided that if there has been no annual meeting of stockholders held by the first day of the third fiscal quarter, each Outside Director will still receive any Annual Equity Grant provided for under this Policy on the first day of the third fiscal quarter of such year. The number of shares of common stock to be granted to each Outside Director as his or her Annual Stock Grant shall be calculated using the fair market value of the Company’s common stock as of the grant date, which shall be deemed to be the closing price on such date of the Company’s common stock on a national securities exchange. The number of shares of common stock subject to the Annual Option Grant to be granted to each Outside Director as his or her Annual Option Grant shall be calculated using the fair value of the dollar amount of the Annual Option Grant computed in accordance with FASB ASC Topic 718. For any new Outside Director joining the Board of Directors after the date of the Annual Equity Grant, such new Outside Director shall receive equity grants on the first day of his or her service on the Board of Directors equal to the pro rata share of that year’s (i) Annual Stock Grant calculated by multiplying the number of days of such year that the such new director will serve by the quotient of \$51,000 divided by 365 and (ii) Annual Option Grant calculated by multiplying the number of days of such year that the such new director will serve by the quotient of \$34,000 divided by 365 and in each case calculating the number of shares using the methodology set forth above for Annual Equity Grants but calculated using the closing stock price and other values on such new Outside Director’s first day of service on the Board of Directors.

Terms for All Equity Awards

Unless otherwise specified by the Board of Directors or the Compensation and Leadership Development Committee (the “Compensation Committee”) at the time of grant, all equity awards granted under this Policy shall

¹ This revised Non-Employee Director Compensation Policy replaces and supersedes the Company’s prior Non-Employee Director Compensation Policy, and became effective on February 23, 2022.

(i) vest on the earlier of (a) one year from the date of the grant with respect to an Annual Equity Grant or (b) the day prior to the annual meeting for the fiscal year following the date of grant, subject to the Outside Director's continued service on the Board of Directors, (ii) each stock option shall terminate ten years from the date of grant of such stock option, and (iii) each equity award shall be granted under the Company's standard form of agreement unless on or prior to the date of grant the Board of Directors or the Compensation Committee shall determine that other terms or conditions shall be applicable prior to the grant of such equity award.

Such restricted stock and stock options shall become fully vested immediately prior to a Change of Control. "Change of Control" means the occurrence of any of the following events: (i) Any "Person" (as such term is used in Sections 13(d) and 14(d) of the Securities Exchange Act of 1934, as amended (the "Exchange Act")) becomes the "Beneficial Owner" (as defined in Rule 13d-3 under the Exchange Act), directly or indirectly, of securities of the Company representing 50% or more of the total voting power represented by the Company's then outstanding voting securities (excluding for this purpose any such voting securities held by the Company or its affiliates or by any employee benefit plan of the Company) pursuant to a transaction or a series of related transactions; or (ii) (a) a merger or consolidation of the Company whether or not approved by the Board of Directors, other than a merger or consolidation which would result in the voting securities of the Company outstanding immediately prior thereto continuing to represent (either by remaining outstanding or by being converted into voting securities of the surviving entity or the parent of such corporation) more than 50% of the total voting power represented by the voting securities of the Company or such surviving entity or parent of such corporation, as the case may be, outstanding immediately after such merger or consolidation; or (b) the sale or disposition by the Company of all or substantially all of the Company's assets in a transaction requiring stockholder approval.

Notwithstanding the foregoing, in the event that an Outside Director departs from the Board of Directors other than as a result of removal from the Board of Directors for cause (as defined in the Stock Plan) (the "Departing Director"), the Departing Director will have two years from the date of departure to exercise all stock options, to the extent vested and exercisable as of the date of departure, subject to the provisions of the Stock Plan, and provided, however, that in no event shall the Departing Director be permitted to exercise such stock options following the expiration of the term of such stock options. The Board of Directors retains the discretion to add additional time to such exercise period when considering each such departure. In addition, if the Departing Director has served on the Board of Directors for at least three years at the time of departure, the Board of Directors retains the discretion to provide for the acceleration of vesting of some or all of the Departing Director's unvested stock options or restricted stock.

Cash Fees

Annual Cash Payments

The following annual cash fees shall be paid to the Outside Directors serving on the Board of Directors and the Audit Committee, Compensation Committee and Nominating and Governance Committee, as applicable.

Board of Directors or Committee of Board of Directors	Annual Retainer Amount for Chair (in lieu of the annual retainer amount for a member)	Annual Retainer Amount for Member
Board of Directors	\$70,000	\$35,000
Audit Committee	\$15,000	\$7,500
Compensation Committee	\$10,000	\$5,000
Nominating and Governance Committee	\$8,000	\$4,000

If the Company holds more than 12 board meetings in a calendar year, each Outside Director will receive a fee of \$1,500 for each additional board meeting attended in person and a fee of \$1,500 for each additional board meeting attended by telephone or by other means of communication. If the Company holds more than 12 meetings of the Audit Committee in a calendar year, each member of such committee will receive a fee of \$1,500 for each additional committee meeting attended in person and a fee of \$1,500 for each additional committee meeting attended by telephone or by other means of communication. If the Company holds more than 8 meetings of either of the Compensation Committee or the Nominating and Governance Committee in a calendar year, each member of such

committee will receive a fee of \$1,500 for each additional committee meeting attended in person and a fee of \$1,500 for each additional committee meeting attended by telephone or by other means of communication.

Payment Terms for All Cash Fees

Cash payments payable to Outside Directors shall be paid quarterly in arrears as of the last day of each fiscal quarter.

Following an Outside Director's first election or appointment to the Board of Directors, such Outside Director shall receive his or her cash compensation pro rated beginning on the date he or she was initially appointed or elected. If an Outside Director dies, resigns or is removed during any quarter, he or she shall be entitled to a cash payment on a pro rated basis through his or her last day of service.

Maximum Compensation

In any fiscal year that ends on or after December 31, 2018, the sum of the grant date fair value (determined as of the date of grant in accordance with FASB ASC Topic 718) of all awards made pursuant to the Stock Plan, to an individual as compensation for service as a non-employee director, together with cash compensation earned by the non-employee director during any fiscal year, shall not exceed \$500,000.

In a fiscal year in which a non-employee director serves the Company in another capacity (including as an interim officer), the non-employee director compensation limit shall not apply to any compensation arrangements established with respect to such service.

Expenses

Upon presentation of documentation of such expenses reasonably satisfactory to the Company, each Outside Director shall be reimbursed for his or her reasonable out-of-pocket business expenses incurred in connection with attending meetings of the Board of Directors and Committees thereof or in connection with other business related to the Board of Directors.

Amendments

The Nominating and Governance Committee or the Board of Directors shall review this Policy from time to time to assess whether any amendments in the type and amount of compensation provided herein should be adjusted in order to fulfill the objectives of this Policy.

FIRST AMENDMENT TO THE AMENDED AND RESTATED SUPPLY AGREEMENT, AND TERMINATION OF THE SIDE AGREEMENT

This First Amendment to the Amended and Restated Supply Agreement and termination of the Side Agreement (this “**1st Amendment**”) is effective December 15, 2021 (the “**Effective Date**”) and is entered into by and between Aspen Aerogels, Inc, a Delaware corporation with a principal place of business at 30 Forbes Road, Bldg. B, Northborough, MA 01532 (“**ASPEN**”), **BASF Polyurethanes GmbH**, with a principal place of business at Elastogranstraße 60, 49448 Lemförde, Germany (“**BASF PU**”), **BASF SE**, Carl-Bosch-Straße 38, 37056 Ludwigshafen, German (individually “**BASF SE**” and collectively **BASF PU** and **BASF SE** are referred to as “**BASF**”, and together with **ASPEN**, the “**Parties**”, and each a “**Party**”).

RECITALS

WHEREAS, the Parties, and certain other identified related entities, are parties to and entered into the agreements (collectively, the “**Agreements**” or an “**Agreement**” if singular) listed on **Exhibit 1**, and unless defined specifically herein, capitalized terms used herein shall have the meaning as ascribed in **Exhibit 1** and the relevant **Agreements** unless any such **Agreement** has a conflicting definition with any other such **Agreement**, in which case the Definition of the **AR Agreement** shall be controlling if applicable; and,

WHEREAS, **ASPEN** desires to sell the **Products** and **New Product** directly to customers and **BASF** desires to discontinue marketing, market development and sale of **Products** and **New Product**, and **BASF** agrees that **ASPEN** should have the right to sell the **Products** and **New Products** in all markets (including, but not limited to, the **BASF Markets** and the **BASF Restated Core Markets**), and effective as of the **Effective Date**, **BASF** will discontinue further marketing of the **Products** and the **New Product**; and,

WHEREAS, in order to ensure a smooth transition for current and prospective **BASF** customers, **BASF** wishes for **ASPEN** to sell the **SLENTEX®** brand direct to certain limited customers for a limited period.

NOW THEREFORE, in consideration of the mutual covenants and agreements as set forth herein and for good and valuable consideration, the receipt and sufficiency of which Parties hereby acknowledge, the Parties agree as follows:

1. The Recitals set forth above are hereby incorporated into this amendment by reference as if fully stated herein.

Section I: Deletion of Certain Provisions in the AR Agreement and First Addendum as of the Effective Date

2. The following sections of the **AR Agreement** are stricken in their entirety: Sections 1, 2, 3, 4, 6, 9.1.
3. The following sections of the **First Addendum** are stricken in their entirety: Sections 2, 3, 4, 5, 6
4. The **Side Agreement** is hereby terminated in its entirety.

Section II: Clarification; License

5. All terms related to **ASPEN**'s repayment of any **Pre-Payment Balance** to **BASF** shall be governed by the existing terms of **AR Agreement**.
 6. The Parties affirm that **ASPEN** has any and all rights to sell, manufacture, market, develop the market or take any other action necessary or desired by **ASPEN** to sell the **Products** or **New Product** in any market, including, but not limited to, any previously specified **BASF Markets** and **BASF Restated Core Markets**.
 7. Effective as of the **Effective Date**, **BASF** grants to **ASPEN** a royalty free, non-exclusive, limited-time license to use, any intellectual property rights necessary for **ASPEN** to sell the **SLENTEX®** branded product to only those customers **BASF** identified on **Exhibit 2 (“BASF Customers”)** for the period of time as identified
-

Exhibit 2 (“Period”), which shall be amended from from-to-time if the Parties mutually agree to add or remove such additional BASF Customers. Included in this limited license shall be the right to create and/or distribute any documents/materials necessary to effectuate any such sale, including, but not limited to, Safety Data Sheets. The products delivered by Aspen hereunder to BASF Customers must comply with the Specification. Together with the execution of each delivery Aspen will provide the respective quality certificates to BASF. Further, BASF reserves the right to employ an independent third-party auditor to examine whether Aspen complies with the stipulations herein, especially with the limitation to use the SLENTEX® brand only for sales to BASF Customers during the Period.

Section III: BASF Obligations Post Prepayment

8. Upon final repayment of any Pre-Payment Balance by ASPEN pursuant to Section 5 of the AR Agreement, BASF PU shall within five (5) business days take all necessary steps to the discharge any Security Interest in ASPEN’s assets in accordance with Annex 4 of the AR Agreement, including, but not limited to:
 - a. Termination of the RI UCC.
 - b. Termination of the ASPEN UCC.
 - c. Termination of the Security Agreement.
 - d. Discharge of the Mortgage by executing the Form Discharge attached hereto as **Exhibit 3**.
 - e. Termination of the Intercreditor Agreement.

Section IV: Miscellaneous

9. Entire Agreement. This 1st Amendment constitutes the sole and entire agreement of the Parties with respect to the subject matter contained herein and therein, and supersedes all prior and contemporaneous understandings, agreements, representations, and warranties, both written and oral, regarding such subject matter.
 10. Severability. If any term or provision of this 1st Amendment is invalid, illegal, or unenforceable in any jurisdiction, such invalidity, illegality, or unenforceability shall not affect any other term or provision of this 1st Amendment.
 11. Section 14 of the AR Agreement (Law and Jurisdiction) is hereby incorporated into this 1st Amendment as if fully stated herein.
 12. Any alterations or amendments to any provision of this 1st Amendment, including amendments to the Exhibits hereto, shall only be valid if made in writing by authorized representatives of the Parties.
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IN WITNESS WHEREOF, the parties hereto have executed this 1st Amendment as of the Effective Date.

ASPEN

By /s/John F. Fairbanks

Name: John Fairbanks

Title: Chief Financial Officer

BASF

By /s/Jens Goeker

Name: Jens Goeker

Title: Chief Financial Officer

By /s/Burchard Graf. V. Westerholt

Name: Burchard Graf. V. Westerholt

Title: General Counsel

Exhibit 1

1. ASPEN and BASF entered into an Amended and Restated Supply Agreement with an effective date of February 16, 2018 (the “AR Agreement”).
 2. ASPEN and BASF SE entered into an Amended and Restated Side Agreement dated February 16, 2018 (the “Side Agreement”).
 3. ASPEN and ASPEN Aerogels Rhode Island, LLC and BASF entered into a Security Agreement dated February 16, 2018 (the “Security Agreement”).
 4. Silicon Valley Bank and BASF entered into an Intercreditor Agreement with an effective date of February 16, 2018 (the “Intercreditor Agreement”).
 5. Aspen Aerogels Rhode Island, LLC executed a Mortgage Deed, Security Agreement and Fixture Filing dated February 16, 2018 and recorded at Book 3995, Page 164 in the County of Providence in the State of Rhode Island (the “Mortgage”).
 6. BASF is a Secured Party and ASPEN is a Debtor in a UCC Financing Statement filed on February 21, 2018 (the “ASPEN UCC”).
 7. BASF is a Secured Party and Aspen Aerogels Rhode Island, LLC is a Debtor in a UCC-1 filed on February 22, 2018 (the “RI UCC”).
 8. ASPEN and BASF entered into a First Addendum to the AR Agreement dated January 14, 2019 (the “First Addendum”).
-

Exhibit 2

BASF Customers

BASF Customer

1. [***]

Period:

[***]

Max. Quantity:

[***]

Portions of this Exhibit, indicated by the mark “[***],” were omitted and have been filed separately with the Securities and Exchange Commission pursuant to the Registrant’s application requesting confidential treatment pursuant to Rule 24b-2 of the Securities Exchange Act of 1934, as amended.

Exhibit 3

DISCHARGE OF MORTGAGE

Address of Premises: 3 Dexter Road, East Providence, Rhode Island 02914

[Name], [title] of the [entity], holder of a Mortgage Deed, Security Agreement and Fixture Filing from ASPEN AEROGELS RHODE ISLAND, LLC to BASF POLYURETHANES GMBH, a company organized under the laws of Germany having an address at Elastogranstraße 60, 49443 Lemforde, Germany,

dated February 16, 2018

and recorded with the County of Providence in the State of Rhode Island Registry of Deeds in Book 3995, Page 164

hereby acknowledges satisfaction of same and releases all interest acquired under said Mortgage.

Executed as a sealed instrument this ___ day of ____, 20__.

[Name]
[Title]

[Notary]

On this __ day of ____, 20__, before me, the undersigned notary public, personally appeared _____, [_Title _] of **BASF Polyurethanes GmbH**, personally known to me to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purpose.

Notary Public:

SUBSIDIARIES OF ASPEN AEROGELS, INC.

Aspen Aerogels Germany GmbH, a German entity

Aspen Aerogels Rhode Island, LLC, a Rhode Island limited liability company

Aspen Aerogels Georgia, LLC, a Georgia limited liability company

Consent of Independent Registered Public Accounting Firm

The Board of Directors
Aspen Aerogels, Inc.:

We consent to the incorporation by reference in the registration statements (Nos. 333-227158, 333-259449, and 333-254250) on Form S-3 and registration statements (Nos. 333-254247, 333-230165, 333-223380, 333-216434, 333-209995, and 333-198124) on Form S-8 of our report dated February 28, 2022, with respect to the consolidated financial statements and financial statement schedule II – Valuation and Qualifying Accounts, of Aspen Aerogels, Inc. and the effectiveness of internal control over financial reporting.

/s/ KPMG LLP

Hartford, Connecticut
February 28, 2022

CERTIFICATIONS UNDER SECTION 302

I, Donald R. Young, certify that:

1. I have reviewed this annual report on Form 10-K of Aspen Aerogels, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a) all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b) any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 28, 2022

/s/ Donald R. Young

Donald R. Young
President and Chief Executive Officer
(principal executive officer)

CERTIFICATIONS UNDER SECTION 302

I, John F. Fairbanks, certify that:

1. I have reviewed this annual report on Form 10-K of Aspen Aerogels, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a) all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b) any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 28, 2022

/s/ John F. Fairbanks

John F. Fairbanks

Vice President, Chief Financial Officer and Treasurer

(principal financial officer and principal accounting officer)

CERTIFICATIONS UNDER SECTION 906

Pursuant to section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, chapter 63 of title 18, United States Code), each of the undersigned officers of Aspen Aerogels, Inc., a Delaware corporation (the "Company"), does hereby certify, to such officer's knowledge, that:

The Annual Report for the year ended December 31, 2021 (the "Form 10-K") of the Company fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, and the information contained in the Form 10-K fairly presents, in all material respects, the financial condition and results of operations of the Company.

Dated: February 28, 2022

/s/ Donald R. Young

Donald R. Young
President and Chief Executive Officer
(principal executive officer)

Dated: February 28, 2022

/s/ John F. Fairbanks

John F. Fairbanks
Vice President, Chief Financial Officer and Treasurer
(principal financial officer and principal accounting officer)