MATERION

2022 ANNUAL REPORT

TO OUR SHAREHOLDERS

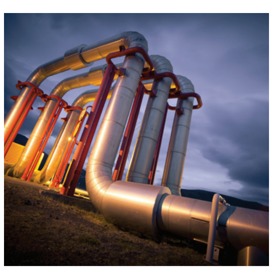
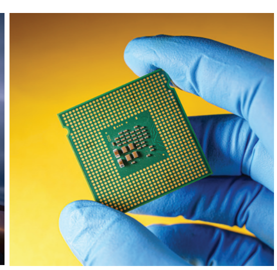
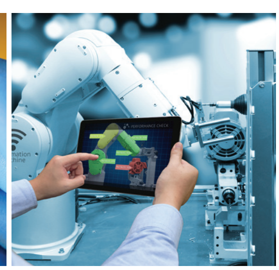
We push the boundaries of innovation to enable breakthrough solutions that move the world forward.

At Materion we are guided by this purpose, which has fueled our transformation into a global leader in advanced materials solutions. With our successful execution on key organic growth investments and the flawless integration of the HCS-Electronic Materials business, we delivered another year of **record financial performance and above-market growth** in 2022. With new customer partnerships across a variety of industries aligned with key global megatrends, we also **continued to seed the pipeline for long-term sustainable success**.

Our customers further validated that our deep technical expertise and capabilities are uniquely suited to serve the innovation required to support global shifts toward **stronger and more ubiquitous connectivity, advanced mobility, and clean energy**, solidifying new avenues for future growth. These megatrends are creating profound possibilities for Materion's products and services to shape the world.

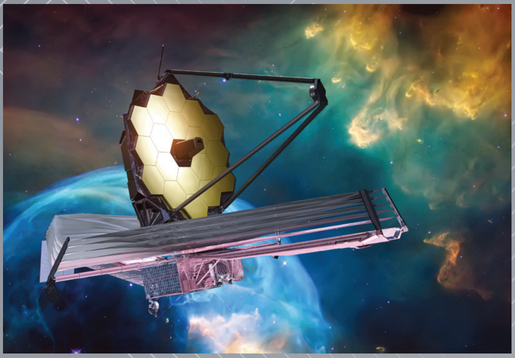
To deliver on these opportunities, we have added critical talent to our company and our global team now stands at more than 3,700 people worldwide. Living our core values of **safety, ethics, social responsibility, collaboration,** and **diversity and inclusion**, our people are integral to our customers' success. Working safely continues to be our overriding priority, and in 2022 we continued to make progress toward our goal of zero injuries.

Our commitment to Environmental, Social and Governance (ESG) initiatives aligned with our business strategy continued to gain traction as we set performance goals and further developed procedures and systems necessary for tracking and measurement. In addition to supporting customer projects that will advance global ESG priorities, some of our operational wins in 2022 included our Milwaukee facility's perfect Responsible Business Alliance audit score and the continued success of our precious metals and other advanced materials recycling and reclamation programs. As we continue to grow our company, we are determined to deliver on our ESG commitment for the benefit of our people, our company, customers, and the planet.


Another year of record business performance validated our long-term strategy, even as some markets began to face headwinds. Our new customer-funded Precision Clad Strip facility achieved full qualification and is contributing meaningfully to our results. In a strong show of confidence, this customer broadened their partnership with Materion with a second investment that will further expand the new facility's capacity starting in 2024. Our integration of the HCS-Electronic Materials business enabled us to bring a broader portfolio of semiconductor products to the market, generating value ahead of our expectations. We also announced plans to invest $20 Million in this business to grow capacity and enhance capabilities to support the logic and advanced chips required to power the most cutting-edge and fastest-growing electronics applications. *(Continued on next page)*

JAMES WEBB SPACE TELESCOPE DELIVERS FIRST IMAGES



NASA released its first, full-color images captured by the James Webb Space Telescope in 2022. They revealed the deepest look into space that's ever been captured in history, characterized by NASA as the "dawn of a new era in astronomy."

Our people at Materion couldn't be more proud of seeing the culmination of our focused efforts on collaborating with some of the world's greatest scientists and organizations on material science and engineering challenges to deliver next-generation materials and optical solutions that enabled the world's largest and most powerful space telescope. It features an array of technical solutions from all three of our business segments that were specifically developed to enable the enormous telescope to function in the most demanding conditions in the universe.

(Continued from previous page)

We were thrilled to announce plans to establish **a new advanced chemicals facility in Milwaukee, Wisconsin, further expanding our capabilities to support the development of the most sophisticated semiconductor chips and enhance our position in the electric vehicles market**. A leading electric vehicle battery customer will help fund a prototype production line for next-generation battery solutions at the new site, which is scheduled to ramp up production in the first half of next year. At our Elmore, Ohio, site we also advanced another critical customer investment with the joint commissioning of a molten salt purification plant with our partner Kairos Power. This project will support the development of a molten salt coolant used in a zero-carbon source of electricity that will help enable the world's transition to clean energy.

The delivery on our strategy is dependent on our continued investment in core strategic pillars that are foundational to the long-term success of the company. We continue to make advancements in R&D, commercial excellence, and in the formation of deep customer partnerships that are vital to continuing to expand our product portfolio. **We are driving operational excellence initiatives that will enable us to continually enhance the level of service we provide for our customers**. Smart information technology investments that facilitate new ways of working – the digital shop floor, manufacturing execution systems, and more automated business processes will enable achievement of our long-term performance goals.

We continue to invest in improved cybersecurity tools and processes to ensure we have state-of-the-art protection of our digital assets.

The most critical component of our strategy is our Materion people. We have strengthened our focus on attracting and retaining the industry's most exceptional talent and on further advancing our high-performance culture. We've enhanced recognition programs, improved communications, and are introducing new training and development programs to support the ongoing professional growth of our people.

With our strong team in place, we enter 2023 prepared to navigate various anticipated economic headwinds and pockets of softness in the markets we serve. Despite these challenges, the outlook for our company remains bright. We have a strong order book and with a broad pipeline of organic projects poised to deliver. We expect our growth to continue to outpace that of the industries we serve. We also plan to maintain our disciplined focus on the future, tracking our global megatrends as they continue to uncover even more pathways for long-term growth.

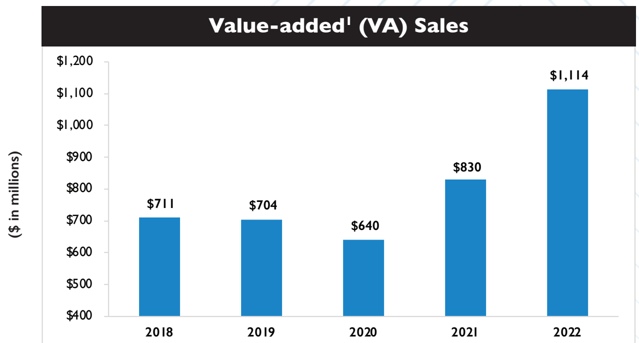
I want to sincerely thank our customers for their trust, our people for their commitment to our business, and you, our shareholders, for your continued investment and confidence in our company.

Jugal Vijayvargiya
President and Chief Executive Officer

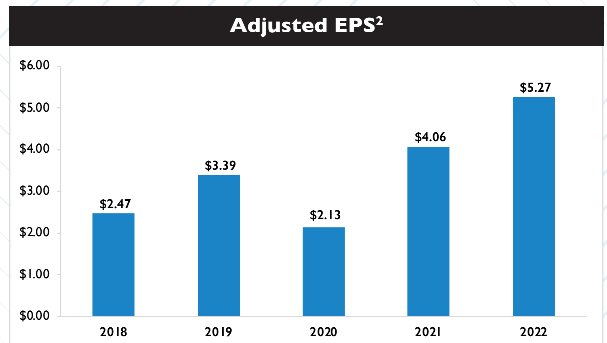
MATERION

2022 STRATEGIC HIGHLIGHTS

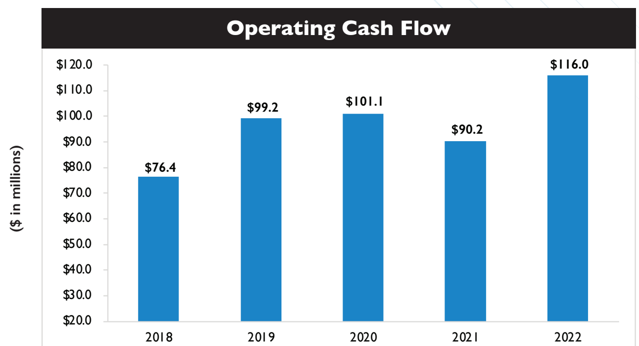
- Delivered record financial performance with year-on-year increases of more than 30% across sales, EBITDA, and earnings-per-share
- Secured meaningful wins and additional customer-funded partnerships in semiconductor, automotive, aerospace, and defense to deliver continued market outgrowth in 2023
- Completed qualification of customer-funded Precision Clad Strip facility and awarded significant capacity expansion from the customer
- Flawlessly integrated the recently acquired HCS-Electronic Materials business, generating value beyond expectations
- Established a new advanced chemicals facility to accelerate growth in semiconductor and electric vehicle applications
- Invested ~$80M in capital expenditures to support accelerated organic growth
- Increased shareholder dividend for 10th consecutive year
- Closed 2022 with a healthy balance sheet and meaningful available liquidity to support growth initiatives

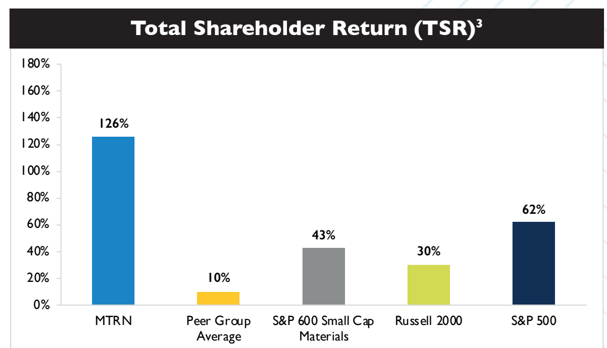


[1] Non-GAAP, excludes pass-through metal costs



[2] Non-GAAP, excludes special items and acquisition amortization





[3] Reflects the change in closing price from 3/6/2018 - 3/6/2023 and assumes quarterly reinvestment of dividends.

MATERION CELEBRATES 50 YEARS ON THE NYSE

President and Chief Executive Officer Jugal Vijayvargiya and the Materion leadership team ring the opening bell at the New York Stock Exchange on October 4, 2022, to celebrate 50 years of trading on the exchange. Materion (NYSE:MTRN) is among the top 10% of longest listed companies on the NYSE.

MATERION

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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, 2022

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 1-15885

MATERION CORPORATION

(Exact name of registrant as specified in its charter)

Ohio	**34-1919973**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
6070 Parkland Blvd., Mayfield Heights, Ohio	**44124**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code

216-486-4200

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Trading Symbol(s)	Name of Each Exchange on Which Registered
Common Stock, no par value	MTRN	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:

None

(Title of Class)

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 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	☒	Accelerated filer	☐	Emerging growth company	☐
Non-accelerated filer	☐	Smaller reporting company	☐		

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. ☒

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b).to §240.10D-1(b). ☐

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

The aggregate market value of common shares, no par value, held by non-affiliates of the registrant (based upon the closing sale price on the New York Stock Exchange) on July 1, 2022 was $1,488,381,335.

As of January 31, 2023, there were 20,543,518 common shares, no par value, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for the 2023 Annual Meeting of Shareholders are incorporated by reference into Part III.

TABLE OF CONTENTS

Forward-looking Statements: *Portions of the narrative set forth in this document that are not statements of historical or current facts are forward-looking statements. Our actual future performance may materially differ from that contemplated by the forward-looking statements as a result of a variety of factors. These factors include, in addition to those mentioned elsewhere herein: the ultimate impact of the COVID-19 pandemic on our business, results of operations, financial condition, and liquidity, including shut downs of our facilities; the global economy, including inflationary pressures, potential future recessionary conditions and the impact of tariffs and trade agreements; the impact of any U.S. Federal Government shutdowns or sequestrations; the condition of the markets which we serve, whether defined geographically or by segment; changes in product mix and the financial condition of customers; our success in developing and introducing new products and new product ramp-up rates; our success in passing through the costs of raw materials to customers or otherwise mitigating fluctuating prices for those materials, including the impact of fluctuating prices on inventory values; our success in identifying acquisition candidates and in acquiring and integrating such businesses, including the integration of the HCS-Electronic Materials business; the impact of the results of acquisitions on our ability to fully achieve the strategic and financial objectives related to these acquisitions; our success in implementing our strategic plans and the timely and successful start-up and completion of any capital projects; other financial and economic factors, including the cost and availability of raw materials (both base and precious metals), physical inventory valuations, metal consignment fees, tax rates, exchange rates, interest rates, pension costs and required cash contributions and other employee benefit costs, energy costs, regulatory compliance costs, the cost and availability of insurance, credit availability, and the impact of the Company's stock price on the cost of incentive compensation plans; the uncertainties related to the impact of war, terrorist activities, and acts of God; changes in government regulatory requirements and the enactment of new legislation that impacts our obligations and operations; the conclusion of pending litigation matters in accordance with our expectation that there will be no material adverse effects; the disruptions in operations from, and other effects of, catastrophic and other extraordinary events including the COVID-19 pandemic and the conflict between Russia and Ukraine; and the risk factors set forth in Part 1, Item 1A of this Form 10-K.*

Item 1. BUSINESS

THE COMPANY

Materion Corporation (referred to herein as the Company, our, we, or us), through its wholly owned subsidiaries, is an integrated producer of high-performance advanced engineered materials used in a variety of electrical, electronic, thermal, and structural applications with $1.8 billion in net sales in 2022. The Company was incorporated in Ohio in 1931. Our products are sold into numerous end markets, including semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center.

SEGMENT INFORMATION

Our businesses are organized under four reportable segments: Performance Materials, Electronic Materials, Precision Optics, and Other. Our Other reportable segment includes unallocated corporate costs. Additional information regarding our segments and business is presented below.

Performance Materials

Performance Materials provides advanced engineered solutions comprised of beryllium and non-beryllium containing alloy systems and custom engineered parts in strip, bulk, rod, plate, bar, tube, and other customized shapes produced at manufacturing facilities located throughout the United States and Europe and sold through distribution global hubs. This segment operates the world's largest bertrandite ore mine and refinery, which is located in Utah, providing feedstock hydroxide for our beryllium businesses and external sale. In addition to the products described below, this segment globally provides engineering and product development services to help our customers and partners with product design, including delivering prototype parts and other data to demonstrate that the products will perform under the required design specifications. Performance Materials operates through three global product lines: Advanced Alloys, Specialty Materials, and Performance Solutions, as described below:

- *Advanced Alloys* manufactures and globally provides to our customers three upstream (primary) product lines: alloyed metals, high-performance beryllium products, and beryllium hydroxide. Alloyed metals are made with copper and/or nickel (with or without beryllium) in ingot, shot, billet, plate, rod, bar, tube forms, and customized shapes. Depending on the application, the materials may provide one or a combination of superior strength, specific strength, wear and corrosion resistance, thermal and electrical conductivity, tribological benefits, and machinability. Applications for alloyed metals products include oil & gas drilling and production components, bearings, bushings, welding electrodes, plastic injection or metal die casting mold tooling, and electrical or electronic connectors. Major end markets for alloyed metals include industrial, automotive, aerospace and defense, energy, and telecom and data center. Alloyed metals competes with companies around the world that produce alloys with similar properties. High performance beryllium products are primarily beryllium metal products, which may also be alloys or other mixtures with aluminum and may be beryllium oxide. The materials are manufactured in billet, ingot, plate, sheet, powder, and customized shape forms. These materials are used in applications that require high stiffness and/or low density or high thermal conductivity and/or high electrical resistance. The properties are provided from the unique combination of material properties, or in applications requiring specific interactions with sub-atomic, high-energy particles, or in applications requiring strong affinity for oxygen such as in the manufacture of primary aluminum and magnesium. Beryllium hydroxide is produced at our milling operations in Utah from our bertrandite ore mine and purchased beryl ore. The hydroxide is used primarily as a raw material input for beryllium-containing alloys and, to a lesser extent, beryllium products. Key competitors include NGK Insulators, IBC Advanced Alloys Corp., Ningxia Orient Tantalum Industry Co., Ltd., Le Bronze Alloys, Minotti Metals, SA, KME AG & Co. KG, Aurubis AG, MKM Mansfelder Kupfer und Messing GmbH, AMPCO Metal, Chuetsu Metal Works Ltd, American Beryllia Inc., CBL Ceramics Limited, CoorsTek, Inc., and Ulba Metallurgical.

- *Specialty Materials* produces and provides our customers various thicknesses of precision strip products as well as various diameters of rod and wire products. The strip, rod, and wire products are beryllium and non-beryllium containing alloys that are made primarily with copper and nickel to provide unique combinations of high conductivity, high reliability, and high formability for use as connectors, contacts, springs, switches, relays, shielding, and bearings. In addition, Specialty Materials also produces and provides unique engineered strip metal products, which incorporate clad inlay and overlay metals, including precious and base metal electroplated systems, electron beam welded systems, contour profiled systems, and solder-coated metal systems. These engineered strip metal products provide a variety of thermal, electrical, or mechanical properties from a surface area or particular section of the material. Our precision cladding and plating capabilities allow for precious metal or other base metals to be applied in continuous strip form, only where it is needed, reducing the material cost to our customers as well as providing design flexibility and performance. Major end markets include consumer electronics, telecom and data center, automotive, aerospace and defense, industrial, and energy. Key competitors include NGK Insulators, Wieland Electric, Inc., Aurubis Stolberg GmbH, Diehl Metall Stiftung & Co. KG, Nippon Mining, Wickeder Group, Heraeus Inc., AMI Doduco, Inc., and other North American continuous strip and plating companies.

- *Performance Solutions* provides engineered end-product technologies to our customers, including near-net shape and finished machined beryllium containing and non-beryllium containing products. These products and materials are suitable for applications that require high stiffness and/or low density due to their unique combination of properties. Performance Solutions provides beryllium metal and beryllium alloy components mainly to the aerospace and defense and energy end markets. Beryllium foil products are provided for radiographic and acoustic applications, beryllium oxide ceramics are provided for a wide range of heat sink and high temperature industrial applications, and our copper beryllium products meet the demanding strength and corrosion resistance specifications required for sub-sea telecommunication equipment. In addition, our engineering teams have developed several innovative non-beryllium materials to meet demanding wear resistance or strength-to-weight applications used in a variety of industries. Our ToughMet™ alloys provide extended life for industrial bushings and bearings and tremendous wear resistance in oil and gas rig components. Our SupremEX™ products offer the industry's highest quality aluminum silicon carbide metal matrix composite formulation, well suited for a wide range of applications from high performance engine components and aerospace structural components to high-stiffness consumer electronic components. Direct competitors include IBC Advanced Alloys, NGK Metals, CBL Ceramics Limited, and CoorsTek, Inc.

Performance Material's products are primarily sold directly from its facilities throughout the United States, Asia, and Europe, as well as distributed internationally through a network of Company-owned service centers, outside distributors, and agents.

Electronic Materials

Electronic Materials produces advanced chemicals, microelectronics packaging, precious metal, non-precious metal, and specialty metal products, including vapor deposition targets, frame lid assemblies, clad and precious metal pre-forms, high temperature braze materials, and ultra-pure wire. These products are used in high-performance logic, advanced memory
high-performance logic, advanced memory, micro-electromechanical systems and power management integrated circuits, radio frequency devices, data storage, display, architectural glass, solar, optical coating, and other applications within the semiconductor, energy, and industrial end markets. Electronic Materials also has metal recovery operations and in-house refining that allow for the recycling of precious metals. This business includes a portion of HCS-Electronic Materials. See Note B to the Consolidated Financial Statements for additional discussion regarding our acquisition of HCS-Electronic Materials.

Electronic Materials products are sold directly from its facilities throughout the United States, Asia, and Europe, as well as through direct sales offices and independent sales representatives throughout the world. Principal competition includes companies such as Honeywell International, Inc., Praxair, Inc., Solar Applied Materials Technology Corp., Grikin, Solaris, Ametek Electronic Components and Packaging, and Tanaka Holding Co., Ltd., as well as a number of smaller regional and national suppliers.

The majority of the sales into the semiconductor end market from this segment are vapor deposition targets, lids, wire, other related precious and non-precious metal products, advanced chemicals, and other microelectronic applications. These materials are used in wireless, light-emitting diode, handheld devices, and other applications, as well as in a number of applications within the energy and industrial end markets. Since we are an up-front material supplier, changes in our semiconductor sales levels do not necessarily correspond to changes in the end-use consumer demand in the same period due to down-stream inventory positions, the time to develop and deploy new products, and manufacturing lead times and scheduling. While our product and market development efforts allow us to capture new applications, we may lose existing applications and customers from time to time due to the rapid change in technologies and other factors.

Precision Optics

Precision Optics designs and produces precision thin film coatings, optical filters and assemblies. Headquartered in Westford, Massachusetts, the business has manufacturing facilities in Europe, Asia and the United States and its products are sold directly from these facilities, as well as through direct sales offices and independent sales representatives throughout the world. Principal competition includes Viavi Corporation, Coherent Corporation, MKS Newport Optics, Alluxa, and a number of smaller regional and national suppliers. While our product and market development efforts allow us to capture new applications, we may lose existing applications and customers from time to time due to the rapid change in technologies and other factors.

Other

The Other segment is comprised of unallocated corporate costs.

OTHER GENERAL INFORMATION

Products

We are committed to providing high-quality, innovative, and reliable products that will enable our customers' technologies and fuel their own technological breakthroughs and growth.

Our products include precious and non-precious specialty metals, inorganic chemicals and powders, specialty coatings, specialty engineered beryllium and copper-based alloys, beryllium composites, ceramics, and engineered clad and plated metal systems.

We are constantly looking ahead to realign product and service portfolios toward the latest market and technology trends so that we are able to provide customers with an even broader scope of products, services, and specialized expertise. We believe we are an established leader in our markets.

Approximately 800 customers purchase our products throughout the semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center end markets. No single customer accounted for more than 10% of our total net sales for 2022.

Availability of Raw Materials

The principal raw materials we use are beryllium, tantalum, aluminum, cobalt, copper, gold, nickel, palladium, platinum, ruthenium, silver, and tin. Ore reserve data can be found in Part II, Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations." The availability of these raw materials, as well as other materials used by us, is adequate and generally not dependent on any one supplier.

Patents and Licenses

We own patents, patent applications, and licenses relating to certain of our products and processes. While our rights under these patents and licenses are of some importance to our operations, our business is not materially dependent on any one patent or license or on all of our patents and licenses as a group.

Backlog

The backlog of unshipped orders as of December 31, 2022, 2021, and 2020 was $576.2 million, $541.1 million, and $279.2 million, respectively. Backlog is generally represented by purchase orders that may be terminated under certain conditions. We expect that substantially all of our backlog of orders at December 31, 2022 will be filled over the next 18 months.

Acquisitions

On November 1, 2021, the Company acquired HCS-Electronic Materials for a purchase price of approximately $395.9 million in cash, on a cash-free, debt-free basis, subject to a customary purchase price adjustment mechanism. This business operates within the Performance Materials and Electronic Materials segments, and the results of operations are included as of the date of acquisition. Refer to Note B to the Consolidated Financial Statements for additional detail on the acquisition of HCS-Electronic Materials.

Regulatory Matters

We are subject to a variety of laws that regulate the manufacturing, processing, use, handling, storage, transport, treatment, emission, release, and disposal of substances and wastes used or generated in manufacturing. For decades, we have operated our facilities under applicable standards of inplant and outplant emissions and releases. The inhalation of airborne beryllium particulate may present a health hazard to certain individuals.

On January 9, 2017, the U.S. Occupational Safety and Health Administration (OSHA) published a new standard for workplace exposure to beryllium that, among other things, lowered the permissible exposure by a factor of ten and established new requirements for respiratory protection, personal protective clothing and equipment, medical surveillance, hazard communication, and record-keeping. Materion was a participant in the development of the new standards, which fundamentally represent our current health and safety operating practices. On July 6, 2018, OSHA issued a Direct Final Rule that amended the text of the new standard to clarify OSHA's intent with respect to certain terms and provisions of the standard, and on December 11, 2018, OSHA issued a Notice of Proposed Rulemaking concerning additional modifications to the standard "to clarify certain provisions and to simplify or improve compliance." OSHA issued the final beryllium standard incorporating these additional modifications on July 14, 2020. Other government and standard-setting organizations are also reviewing beryllium-related worker safety rules and standards, and will likely make them more stringent. The development, proposal, or adoption of more stringent standards may affect the buying decisions of the users of beryllium-containing products. If the standards are made more stringent and/or our customers or other downstream users decide to reduce their use of beryllium-containing products, our results of operations, liquidity, and financial condition could be materially adversely affected. The impact of this potential adverse effect would depend on the nature and extent of the changes to the standards, the cost and ability to meet the new standards, the extent of any reduction in customer use, and other factors. The magnitude of this potential adverse effect cannot be estimated.

In addition to laws that regulate the manufacturing, processing, use, handling, storage, transport, treatment, emission, release, and disposal of substances and wastes used or generated in manufacturing, we are subject to various laws around the world. For example, trade regulations, including tariffs or other import or export restrictions, may increase the cost of some of our raw materials or cross-border shipments, and limit our ability to do business in certain countries or with certain individuals. We are also required to comply with increasingly complex and changing laws and regulations enacted to protect business and personal data in the United States and other jurisdictions regarding privacy, data protection and data security, including those related to the collection, storage, use, transmission and protection of personal information and other consumer, customer, vendor or employee data. With respect to the laws and regulations noted above, as well as other applicable laws and regulations, the Company's compliance programs may, under certain circumstances, involve material investments in the form of additional processes, training, personnel, information technology, and capital.

Human Capital Management

Materion employees are located throughout the world. Employee levels are managed to align with the pace of business and management believes it has sufficient human capital to operate its business successfully. We employed approximately 3,723 people globally as of December 31, 2022. Approximately 574 were in the Asia–Pacific region, 488 were in the Europe, the Middle East, and Africa (EMEA) region, and 2,661 were in the North America region. Among our total global employee population, approximately 2,336 were employed in manufacturing. Our strong employee base, along with their commitment to customer service excellence and uncompromising values, provides the foundation for our Company's success.

Our employees are responsible for upholding our core values, which include working safely and collaboratively, conducting all aspects of business with the highest standards of ethics and integrity, leveraging processes and data to drive continuous improvement, empowering individuals and teams, embracing change, attracting and developing diverse global talent, and partnering for the betterment of the communities where we live and operate.

Health and Safety

The health, safety, and well-being of our employees is our highest priority and is a Materion core value. We have a strong Environmental, Health, and Safety (EHS) program that focuses on implementing policies and training programs, as well as performing self-audits to ensure our colleagues leave their workplace safely, every day. We continue to invest in safety improvements such as capital improvements, new safety technology, safety controls, and engineering ergonomic solutions. On an annual basis, our corporate long-range strategies are reviewed and updated, improvement plans are developed for each global location, progress is tracked, and daily critical safety statistics and metrics are published internally. Our corporate intranet site is visible to all global employees, where we share detailed descriptions of serious injuries and near misses and their corrective actions, as well as other proactive measures to promote lessons learned and ensure worker safety. Safety awareness and employee engagement programs have been implemented at all global facilities. We also have onsite medical teams at two key manufacturing sites to provide medical testing for employees to determine any potential exposure to beryllium, of which Materion is a leading global supplier.

Diversity and Inclusion

As part of our human capital management initiatives to attract, develop, and retain diverse global talent, we track and report internally on key talent metrics including workforce demographics, critical role pipeline data, and diversity hiring analytics. This data-driven approach helps ensure that we stay aligned to our goal of creating a positive and dynamic global work environment where all employees can flourish. A truly innovative workforce needs to be diverse and leverage the skills and perspectives of a broad range of backgrounds and experiences. To attract a global workforce, we strive to create and embed a culture where employees can bring their whole selves to work.

Our employee resource groups (ERGs) are Company-sponsored groups of global employees that support and promote the specific mutual objectives of both the employees and the Company, with emphasis on the inclusion, diversity, and professional development of employees. The ERGs provide opportunities for employees to connect, develop, and grow together in a supportive environment. As of December 31, 2022, we had four ERGs: ELEVATE (Women); V.E.T. (veterans and allies of the military); LGBTQ+; and United Voices of Materion (all ethnic backgrounds). Our focus continues to be on the recruitment of diverse candidates as well as the development of our internal cadres of diverse leaders so that they can advance their careers and move into leadership positions throughout the Company.

Talent Development

We continue to prioritize professional development and training for all global employees. By providing employees with wide-ranging development programs, opportunities, and paths to success, we empower them to realize their full potential. Our development activities provide further opportunities to retain employees and build upon critical capabilities. We strongly encourage employees to build development plans in partnership with their managers and supervisors, providing both ongoing and specific opportunities for two-way communication and corresponding action. Apprenticeship programs have been implemented in some of our large plant sites, and we continue to introduce similar programs throughout the Company. Likewise, we have implemented career development programs in other key professional functional areas.

We are committed to identifying and developing the talents of our next generation of leaders. Our robust and fully integrated talent and succession-planning process supports the development of our talent pipeline for critical roles in operations management, commercial excellence and engineering. We have continued to grow our campus recruitment initiatives while building programs that develop and grow our early career talent. Additionally, Company development programs have been designed to target and accelerate key leadership and functional skill sets. On an annual basis, we conduct organizational reviews with our Chief Executive Officer and all business unit and function senior leaders to identify and evaluate our high potential, diverse talent and succession plans for our most critical roles.

Available Information

We are subject to the informational requirements of the Securities Exchange Act of 1934. Therefore, we file periodic reports, proxy statements, and other information with the Securities and Exchange Commission (SEC).

We use our investor relations website, https://investor.materion.com/, as a channel for routine distribution of important information, including news releases, analyst presentations, and financial information. As soon as reasonably practicable, we make all documents that we file with, or furnish to, the SEC, including our annual report on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and any amendments to these reports, available free of charge via this website. The content on any website referred to in this Form 10-K is not incorporated by reference into this Form 10-K unless expressly noted.

Executive Officers of the Registrant

Incorporated by reference from information with respect to executive officers of Materion Corporation set forth in Item 10 in Part III of this Form 10-K.

Item 1A. RISK FACTORS

Our business, financial condition, results of operations, and cash flows can be affected by a number of factors, including, but not limited to, those set forth below and elsewhere in this Form 10-K, any one of which could cause our actual results to vary materially from recent results or from our anticipated future results. Therefore, an investment in us involves some risks, including the risks described below. Although the risks are organized by headings, and each risk is discussed separately, many are interrelated. You should not interpret the disclosure of any risk factor to imply that the risk has not already materialized. The risks discussed below are not the only risks that we may experience. If any of the following risks occur, our business, results of operations, or financial condition could be negatively impacted.

Risks Relating to Economic Conditions

The businesses of many of our customers are subject to significant fluctuations as a result of the cyclical nature of their industries and their sensitivity to general economic conditions, which could adversely affect their demand for our products and reduce our sales and profitability.

A substantial number of our customers are in the semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center end markets. Each of these end markets is cyclical in nature, influenced by a combination of factors which could have a negative impact on our business, including, among other things, periods of economic growth or recession, inflation, rising interest rates and the strength or weakness of the U.S. dollar, the strength of the semiconductor, automotive electronics, and oil and gas industries, the rate of construction of telecommunications infrastructure equipment, and government spending on defense.

Also, in times when growth rates in our markets are lower, or negative, there may be temporary inventory adjustments by our customers that may negatively affect our business.

Risks Relating to the COVID-19 Pandemic

The COVID-19 pandemic has had, and may continue to have, an adverse impact on our business.

The worldwide spread of the COVID-19 virus resulted in a global slowdown of economic activity which could continue to impact demand for a broad variety of goods and services, including from the Company's customers, while also continuing to disrupt sales channels and marketing activities for an unknown period of time. New and potentially more contagious variants of the virus have emerged over the course of the pandemic, along with a surge in cases in several regions across the globe, including Europe and Asia, resulting in renewed shutdown, mandatory quarantines and shelter in place orders in certain regions. These events have led, at times, to slowdowns in our operations, including the temporary shutdown of the Company's Shanghai facility in the first half of 2022. Through continued economic challenges, there continue to be periodic shipping and logistics challenges and continued supply chain constraints, shortages and delays, along with inflationary pricing pressures.

As normal business operations resume, we continue to practice enhanced sanitation procedures, health checks and social distancing protocols, however, none of these measures can completely eliminate the risk of exposure or spread of COVID-19. There could be additional waves or spikes in infection, again causing widespread social, economic and operational impacts. Further, the lingering impacts of the COVID-19 pandemic may continue to adversely affect the economies and financial markets in many countries.

Any prolonged disruption of manufacturing or shipment of our products caused by the COVID-19 pandemic or any future pandemics could materially and adversely affect our results of operations and financial conditions. Surges in infection rate, new shutdowns or quarantines, emergence of new and potentially more contagious variants of the virus and staffing and labor supply challenges may impact our suppliers and our ability to source materials in a timely manner. Further, ongoing supply chain constraints and inflationary pressure could have a negative impact on our results.

Risks Relating to Our Business and Operations

Because we experience seasonal fluctuations in certain end-market sales, our quarterly results will fluctuate, and our annual performance will be affected by the fluctuations.

We expect seasonal patterns to continue, which may cause our quarterly results to fluctuate. If our revenue during any quarter were to fall below the expectations of investors or securities analysts, our share price could decline, perhaps significantly. Unfavorable economic conditions, lower than normal levels of demand, and other occurrences in any quarter could also harm our results of operations. For example, we have experienced customers building inventory in anticipation of increased demand, whereas in other periods, demand decreased because our customers had excess inventory.

A portion of our revenue is derived from the sale of defense-related products through various contracts and subcontracts. These contracts may be suspended, canceled, or delayed, which could have an adverse impact on our revenues.

In 2022, 16% of our value-added sales were to customers in the aerospace and defense end market. A portion of these customers operate under contracts with the U.S. Government, which are vulnerable to termination at any time, for convenience or default. Some of the reasons for cancellation include, but are not limited to, budgetary constraints or re-appropriation of government funds, timing of contract awards, violations of legal or regulatory requirements, and changes in political agenda. If cancellations were to occur, it would result in a reduction in our revenue. Furthermore, significant reductions to defense spending could occur over the next several years due to government spending cuts, which could have a significant adverse impact on us. For example, high-margin defense application delays and/or push-outs may adversely impact our results of operations, including quarterly earnings.

The markets for our products are experiencing rapid changes in technology.

We operate in markets driven by rapidly changing technology and evolving customer specifications and industry standards. Next-generation solutions may quickly render an existing product obsolete and unmarketable. For example, for many years thermal and mechanical performance have been at the forefront of device packaging for wireless communications infrastructure devices. In recent years, a tremendous effort has been put into developing disruptive thermal spreading materials which requires newer technology that replaces the traditional approach of building package. Our growth and future results of operations depend in part upon our ability to enhance existing products and processes which introduce newly developed products on a timely basis that conform to prevailing and evolving industry standards, meet or exceed technological advances in the marketplace, meet changing customer specifications, achieve market acceptance, and respond to our competitors' products.

The process of developing new products can be technologically challenging and requires the accurate anticipation of technological and market trends. We may not be able to introduce new products successfully or do so on a timely basis. If we fail to develop new products that are appealing to our customers or fail to develop products on time and within budgeted amounts, we may lose customers or otherwise be unable to recover our research and development costs, which could adversely affect our margins and profitability.

The availability of competitive substitute materials for beryllium-containing products may reduce our customers' demand for these products and reduce our sales.

In certain product applications, we compete with manufacturers of non-beryllium-containing products, including organic composites, metal alloys or composites, titanium, and aluminum. Our customers may choose to use substitutes for beryllium-containing products in their products for a variety of reasons, including, among other things, the lower costs of those substitutes, the health and safety concerns relating to these products (despite numerous studies affirming the safety of beryllium in these products), and the risk of litigation relating to beryllium-containing products. If our customers use substitutes for beryllium-containing materials in their products, the demand for beryllium-containing products may decrease, which could reduce our sales.

Our long and variable sales and development cycle makes it difficult for us to predict if and when a new product will be sold to customers.

Our sales and development cycle, which is the period from the generation of a sales lead or new product idea through the development of the product and the recording of sales, may typically take several years, making it very difficult to forecast sales and results of operations. Our inability to accurately predict the timing and magnitude of sales of our products, especially newly introduced products, could affect our ability to meet our customers' product delivery requirements or cause our results of operations to suffer if we incur expenses in a particular period that do not translate into sales during that period, or at all. In addition, these failures would make it difficult to plan future capital expenditure needs and could cause us to fail to meet our cash flow requirements.

The availability and prices of some raw materials we use in our manufacturing operations fluctuate, and increases in raw material costs can adversely affect our operating results and our financial condition.

We manufacture advanced engineered materials using various precious and non-precious metals, including beryllium, tantalum, aluminum, cobalt, copper, gold, nickel, palladium, platinum, ruthenium, silver, tin, iridium, rhodium, niobium, hafnium, and tungsten. The availability of, and prices for, these raw materials are volatile and are influenced by worldwide economic conditions, speculative action, world supply and demand balances, inventory levels, availability of substitute metals, the U.S. dollar exchange rate, production costs of U.S. and foreign competitors, anticipated or perceived shortages, and other factors. Prices for precious metal and certain non-precious metals including tantalum, nickel, iridium, rhodium, niobium, hafnium and tungsten have fluctuated significantly in recent years. Additionally, geopolitical instability and the inflationary environment have added to the volatility. Higher prices can cause adjustments to our inventory carrying values, whether as a result of quantity discrepancies, normal manufacturing losses, differences in scrap rates, theft or other factors, which could have a negative impact on our profitability and cash flows. Also, the price of our products will generally increase in tandem with rising metal prices, as a result of changes in precious metal prices that are passed through to our customers, which could deter them from purchasing our products and adversely affect our net sales and operating profit.

Further, we maintain some precious metals and copper on a consigned inventory basis. The owners of the precious metals and copper charge a fee that fluctuates based on the market price of those metals and other factors. A significant increase in the market price or the consignment fee of precious metals and/or copper would increase our costs, negatively impacting our operating profit.

We are not dependent on any one supplier for our primary raw materials, but the business could be impacted by supply constraints. If, in the future, we are unable to obtain sufficient amounts of metals on a timely basis, we may not be able to obtain metals from alternate sources at competitive prices. In addition, interruptions or reductions in our supply of metals could make it difficult to satisfy our customers' delivery requirements, which could have a material adverse effect on our business, financial condition, results of operations and cash flows.

Utilizing precious metals in the manufacturing process creates challenges in physical inventory valuations that may impact earnings.

We manufacture precious, non-precious, and specialty metal products and also have metal cleaning operations and in-house refineries that allow for the reclaim of precious metals from internally generated or customer scrap. We refine that scrap through our internal operations and externally through outside vendors.

When taking periodic physical inventories in our refinery operations, we reconcile the actual precious metals to what was estimated prior to the physical inventory count. Those estimates are based in part on assays or samples of precious metals taken during the refining process. If those estimates are inaccurate, we may have an inventory long (more physical precious metal than what we had estimated) or short (less physical precious metal than what we had estimated). These fluctuations could have a material impact on our financial statements and may impact earnings. In the past, our gross margin has been reduced by a net quarterly physical inventory adjustment. Higher precious metal prices may magnify the value of any potential inventory long or short.

Because we maintain a significant inventory of precious metals, we may experience losses due to theft or employee error.

Because we manufacture products that contain precious metals, we maintain a significant amount of precious metals at certain of our manufacturing facilities. Accordingly, we are subject to the risk of precious metal shortages resulting from employee error or theft. In the past, we have had precious metal shortages resulting from theft and employee error, which could reoccur in the future.

While we maintain controls to prevent theft, including physical security measures, if our controls do not operate effectively or are designed ineffectively, our profitability could be adversely affected, including any charges that we might incur as a result of the shortage of our inventory and by costs associated with increased security, preventative measures, and insurance. Additionally, while we maintain insurance to cover the theft of our inventory, such coverage may not sufficiently cover any loss.

Access to consigned metals may restrict our operations

We use gold and other precious metals in the production of some of our products. We obtain most precious metals from consignors under consignment agreements. The consignors retain ownership of the precious metals and charge us fees based on the amounts we consign and the period of consignment. Because we do not control the consigned inventory, we may not be able to access the inventory to meet our forecasted needs, which could adversely impact our results of operations.

We have a limited number of manufacturing facilities, and damage to those facilities, or to critical pieces of equipment in these facilities, could interrupt our operations, increase our costs of doing business, and impair our ability to deliver our products on a timely basis.

Some of our facilities are interdependent. For instance, our manufacturing facility in Elmore, Ohio relies on our mining operation for its supply of beryllium hydroxide used in production of most of its beryllium-containing materials. Additionally, our Reading, Pennsylvania and Tucson, Arizona manufacturing facilities are dependent on materials produced by our Elmore, Ohio manufacturing facility, and our Wheatfield, New York manufacturing facility is dependent on our Buffalo, New York manufacturing facility. The destruction or closure of our mine, any of our manufacturing facilities, or to critical pieces of equipment within these facilities for a significant period of time as a result of harsh weather (including that caused by climate change), fire, explosion, act of war or terrorism, or other natural disaster or unexpected event may interrupt our manufacturing capabilities, increase our capital expenditures and our costs of doing business, and impair our ability to deliver our products on a timely basis. In addition, many of our manufacturing facilities depend on one source for electric power and natural gas, which could be interrupted due to equipment failures, terrorism, or another cause.

If such events occur, we may need to resort to an alternative source of manufacturing or to delay production, which could increase our costs of doing business and/or result in lost sales. Our property damage and business interruption insurance may not cover all of our potential losses and may not continue to be available to us on acceptable terms, if at all.

A security breach of customer, employee, supplier, or Company information may have a material adverse effect on our business, financial condition, and results of operations.

In the conduct of our business, we collect, use, transmit, store, and report data on information systems and interact with customers, vendors, and employees. Increased global information technology (IT) security threats and more sophisticated and targeted computer crime pose a risk to the security of our systems and networks and the confidentiality, availability, and integrity of our data. We protect our sensitive information and confidential personal data, our facilities, and information technology systems, but we may be vulnerable to future security breaches. Despite our security measures, our IT systems and infrastructure may be vulnerable to customer viruses, cyber-attacks, security breaches caused by employee error or malfeasance, or other disruptions. Any such threat could compromise our networks and the information stored there could be accessed, publicly disclosed, lost, or stolen. A security breach of our computer systems could interrupt or damage our operations or harm our reputation, resulting in a loss of sales, operating profits, and assets. The Company has taken steps to protect our computer systems however there is always a risk of undetected successful intrusions. The Company requires employees to complete information security training programs multiple times a year to reinforce the importance of protecting company information and assets. Materion has not experienced a known information security breach to our systems, however intrusions could pose a risk of undetected data loss or theft that could later be used to harm the Company. There have been no financial penalties or settlements associated with an information security breach within the last three years.

Similar security threats exist with respect to the IT systems of our lenders, suppliers, consultants, advisers, and other third parties with whom we conduct business. A security breach of those computer systems could result in the loss, theft, or disclosure of confidential information and could also interrupt or damage our operations, harm our reputation, and subject us to legal claims.

Data privacy breaches and the evolving global governmental regulation relating to data privacy could adversely affect our results of operations and profitability.

We collect, store, access and otherwise process certain confidential or sensitive data, including proprietary customer and business information, personal data or other information that is subject to privacy and security laws, regulations and customer-imposed requirements. The data privacy laws of the specific jurisdictions in which we operate may vary and potentially conflict. As such, we cannot predict the cost of compliance with future data privacy laws, regulations and standards, future interpretations of current laws, regulations and standards, or the potential effects on our business.

Government enforcement actions can be costly and interrupt the regular operation of our business, and a violation of data privacy laws or a security breach involving personal data can result in fines, reputational damage and civil lawsuits, any of which may adversely affect our results of operations and profitability.

Our defined benefit pension plans and other post-employment benefit plans are subject to financial market risks that could adversely impact our financial performance.

In 2019, the Company's Board of Directors approved changes to the U.S. defined benefit pension plan. The Company froze the pay and service amounts used to calculate the pension benefits for active participants as of January 1, 2020. The Company has defined benefit pension plans in other non-U.S. locations. Our pension expense and our required contributions to our pension plans are directly affected by the value of plan assets, the projected rate of return on plan assets, the actual rate of return on plan assets, and the actuarial assumptions we use to measure our defined benefit pension plan obligations, including the rate at which future obligations are discounted to a present value, or the discount rate. Significant changes in market interest rates and decreases in the fair value of plan assets and investment losses on plan assets would increase funding requirements and expenses and may adversely impact our results of operations.

We provide post-employment health benefits to eligible employees. Our retiree health expense is directly affected by the assumptions we use to measure our retiree health plan obligations, including the assumed rate at which health care costs will increase and the discount rate used to calculate future obligations. For retiree health accounting purposes, we have used a graded assumption schedule to assume the rate at which health care costs will increase. We cannot predict whether changing market or economic conditions, regulatory changes, or other factors will further increase our retiree health care expenses or obligations, diverting funds we would otherwise apply elsewhere.

Unexpected events and natural disasters at our mine or manufacturing facilities could increase the cost of operating our business.

A portion of our production costs at our mine are fixed regardless of current operating levels. Our operating levels are subject to conditions beyond our control that may increase the cost of mining for varying lengths of time. These conditions include, among other things, weather (including severe weather caused by climate change), fire, natural disasters, pit wall failures, and ore processing changes. Our operations also involve the handling and production of potentially explosive materials. It is possible that an explosion at our mine or other manufacturing facilities could result in death or injuries to employees and others and material property damage to third parties and us. Any explosion could expose us to adverse publicity or liability for damages and materially adversely affect our operations. Any of these events could increase our cost of operations.

Tax increases and changes in tax rules may adversely affect our financial results

As a company conducting business on a global basis with material operations throughout the United States, we are exposed, both directly and indirectly, to the effects of changes in U.S., state, local, and foreign tax rules. Taxes for financial reporting purposes and cash tax liabilities in the future may be adversely affected by changes in such tax rules. Such changes may put us at a competitive disadvantage compared to some of our major competitors, to the extent we are unable to pass the tax costs through to our customers.

The Biden administration has announced in 2021 and 2022, and in certain cases has enacted, a number of tax proposals to fund new government investments in infrastructure, healthcare, and education, among other things. Certain of these proposals involve an increase in the domestic corporate tax rate, which if implemented could have a material impact on our future results of operations and cash flows.

Economic and geopolitical instability including as a result of military conflict could have a material adverse effect on our operating results, financial condition, and cash flows

Geopolitical conflict may have a global impact on our operations, customers, or suppliers. Conflicts may result in various sanctions, including asset freezes and prohibitions on transactions. These sanctions could have a larger impact that expands into other geographies where we do business, including our supply chain, business partners, and customers in those markets, which could result in lost sales, supply shortages, commodity price fluctuations, increased manufacturing costs, transportation logistics challenges, customer credit and liquidity issues, and lost efficiencies.

Risks Related to Legal, Compliance and Regulatory Matters

We conduct our sales and distribution operations on a worldwide basis and are subject to the risks associated with doing business outside the United States.

We sell to customers outside of the United States from our domestic and international operations. Revenue from international operations (principally Europe and Asia) accounted for approximately 51% in 2022, 47% in 2021, and 45% in 2020 of Net sales. We anticipate that international shipments will account for a significant portion of our sales for the foreseeable future. There are a number of risks associated with international business activities, including:

- burdens to comply with multiple and potentially conflicting foreign laws and regulations, including export requirements, tariffs and other barriers, environmental health and safety requirements, increasingly complex requirements concerning privacy and data security, including the European Union's General Data Protection Regulation, and unexpected changes in any of these factors;
- difficulty in obtaining export licenses from the U.S. Government;
- political and economic instability and disruptions, including terrorist attacks;
- disadvantages of competing against companies from countries that are not subject to U.S. laws and regulations, including the Foreign Corrupt Practices Act (FCPA);
- potentially adverse tax consequences due to overlapping or differing tax structures;
- fluctuations in currency exchange rates; and

- disruptions in our business or the businesses of our suppliers or customers due to cyber security incidents, public health concerns (including viral outbreaks, such as COVID-19), the ongoing conflict between Russia and Ukraine or natural disasters.

Any of these risks could have an adverse effect on our international operations by reducing the demand for our products or reducing the prices at which we can sell our products, which could result in an adverse effect on our business, financial position, results of operations, or cash flows. We may hedge our currency transactions to mitigate the impact of currency price volatility on our earnings; however, hedging activities may not be successful. For example, hedging activities may not cover the Company's net euro and yen exposure, which could have an unfavorable impact on our results of operations.

In addition, we could be adversely affected by violations of the FCPA and similar worldwide anti-bribery laws. The FCPA and similar anti-bribery laws in other jurisdictions generally prohibit companies and their intermediaries from making improper payments to non-U.S. officials for the purpose of obtaining or retaining business. While policies mandate compliance with these anti-bribery laws, we operate in many parts of the world that have experienced governmental corruption to some degree and, in certain circumstances, strict compliance with anti-bribery laws may conflict with local customs and practices. We cannot assure that our internal controls and procedures will always protect us from the reckless or criminal acts committed by our employees or agents. If we are found to be liable for FCPA violations or other anti-bribery laws, we could suffer from criminal or civil penalties or other sanctions, which could have a material adverse effect on our business.

Changes in laws or regulations or the manner of their interpretation or enforcement could adversely impact our financial performance and restrict our ability to operate our business or execute our strategies.

New laws or regulations, or changes in existing laws or regulations, or the manner of their interpretation or enforcement, could increase our cost of doing business and restrict our ability to operate our business or execute our strategies. In particular, there may be significant changes in U.S. laws and regulations and international trade agreements that could affect a wide variety of industries and businesses, including those businesses we own and operate.

We may be exposed to certain regulatory and financial risks related to climate change.

Growing concerns about climate change may result in the imposition of additional regulations or restrictions to which we may become subject. A number of governments or governmental bodies have introduced or are contemplating regulatory changes in response to climate change, including regulating greenhouse gas emissions. The outcome of new legislation or regulation in the U.S. and other jurisdictions in which we operate may result in new or additional requirements, additional charges to fund energy efficiency activities, and fees or restrictions on certain activities. Compliance with these climate change initiatives may also result in additional costs to us, including, among other things, increased production costs, additional taxes, reduced emission allowances or additional restrictions on production or operations. Any adopted future climate change regulations could also negatively impact our ability to compete with companies situated in areas not subject to such limitations. Even without such regulation, increased public awareness and adverse publicity about potential impacts on climate change emanating from us or our industry could harm us. We may not be able to recover the cost of compliance with new or more stringent laws and regulations, which could adversely affect our results of operations, financial position or cash flows.

We are exposed to lawsuits in the normal course of business, which could harm our business.

During the ordinary conduct of our business, we may become involved in certain legal proceedings, including those involving product liability claims, third-party lawsuits relating to exposure to beryllium, claims against us of infringement of intellectual property rights of third parties, or other litigation matters. Due to the uncertainties of litigation, we can give no assurance that we will prevail in the resolution of future claims. Certain of these matters involve types of claims that, if they result in an adverse ruling to us, could give rise to substantial liability, which could have a material adverse effect on our business, operating results, or financial condition.

Although we have insurance which may be applicable in certain circumstances, some jurisdictions preclude insurance coverage for punitive damage awards. Accordingly, our profitability could be adversely affected if any current or future claimants obtain judgments for any uninsured compensatory or punitive damages. Further, an unfavorable outcome or settlement of a pending beryllium case or adverse media coverage could encourage the commencement of additional similar litigation.

Health issues, litigation, and government regulations relating to our beryllium operations could significantly reduce demand for our products, limit our ability to operate, and adversely affect our profitability.

If exposed to respirable beryllium fumes, dusts, or powder, some individuals may demonstrate an allergic reaction and may later develop a chronic lung disease known as chronic beryllium disease (CBD). Severe cases of CBD can cause disability or death.

Further, some scientists claim there is evidence of an association between beryllium exposure and lung cancer, and certain standard-setting organizations have classified beryllium and beryllium compounds as human carcinogens.

The health risks relating to exposure to beryllium have been, and will continue to be, a significant issue confronting the beryllium-containing products industry. The health risks associated with beryllium have resulted in product liability claims, employee, and third-party lawsuits. As of December 31, 2022, we had one CBD case outstanding.

The increased levels of scrutiny by federal, state, foreign, and international regulatory authorities could lead to regulatory decisions relating to the approval or prohibition of the use of beryllium-containing materials for various uses. Concerns over CBD and other potential adverse health effects relating to beryllium, as well as concerns regarding potential liability from the use of beryllium, may discourage our customers' use of our beryllium-containing products and significantly reduce demand for our products. In addition, adverse media coverage relating to our beryllium-containing products could damage our reputation or cause a decrease in demand for beryllium-containing products, which could adversely affect our profitability.

Additionally we, as well as our customers, are subject to laws regulating worker exposure to beryllium. OSHA has published a new standard for workplace exposure to beryllium that, among other things, lowered the permissible exposure by a factor of ten and established new requirements for respiratory protection, personal protective clothing and equipment, medical surveillance, hazard communication, and recordkeeping. Materion was a participant in the development of the new standards, which fundamentally represent our current health and safety operating practices. Other government and standard-setting organizations are also reviewing beryllium-related worker safety rules and standards, and will likely make them more stringent. The development, proposal, or adoption of more stringent standards may affect buying decisions by the users of beryllium-containing products. If the standards are made more stringent and/or our customers or other downstream users decide to reduce their use of beryllium-containing products, our results of operations, liquidity, and financial condition could be materially adversely affected. The impact of this potential adverse effect would depend on the nature and extent of the changes to the standards, the cost and ability to meet the new standards, the extent of any reduction in customer use, and other factors. The magnitude of this potential adverse effect cannot be estimated.

Our bertrandite ore mining and manufacturing operations are subject to extensive environmental regulations that impose, and will continue to impose, significant costs and liabilities on us, and future regulation could increase these costs and liabilities or prevent production of beryllium-containing products.

We are subject to a variety of governmental regulations relating to the environment, including those relating to our handling of hazardous materials and air and wastewater emissions. Some environmental laws impose substantial penalties for non-compliance. Others, such as the federal Comprehensive Environmental Response, Compensation, and Liability Act, impose strict, retroactive, and joint and several liability upon entities responsible for releases of hazardous substances. Bertrandite ore mining is also subject to extensive governmental regulation on matters such as permitting and licensing requirements, plant and wildlife protection, reclamation and restoration of mining properties, the discharge of materials into the environment, and the effects that mining has on groundwater quality and availability. Future requirements could impose on us significant additional costs or obligations with respect to our extraction, milling, and processing of ore. If we fail to comply with present and future environmental laws and regulations, we could be subject to liabilities or our operations could be interrupted. In addition, future environmental laws and regulations could restrict our ability to expand our facilities or extract our bertrandite ore deposits. These environmental laws and regulations could also require us to acquire costly equipment, obtain additional financial assurance, or incur other significant expenses in connection with our business, which would increase our costs of production.

Expectations relating to environmental, social and governance considerations expose us to potential liabilities, increased costs and other adverse effects on our business.

Many governments, regulators, investors, employees, customers and other stakeholders are increasingly focused on environmental, social and governance considerations relating to businesses, including climate change and greenhouse gas emissions, human capital and diversity, equity and inclusion. The Company is committed to ensuring that our organization's governance and operations are fully aligned with environmentally and socially responsible practices. We make statements about our environmental, social and governance goals and initiatives through information provided on our website and other communications. Responding to these environmental, social and governance considerations and implementation of these goals and initiatives involves risks and uncertainties, requires investments, which could be material, and are impacted by factors that may be outside our control. In addition, some stakeholders may disagree with our goals and initiatives and the focus of stakeholders may change and evolve over time. Stakeholders also may have very different views on where environmental, social and governance focus should be placed, including differing views of regulators in various jurisdictions in which we operate. Any failure, or perceived failure, by us to achieve our goals, further our initiatives, adhere to our public statements, comply with federal, state or international environmental, social and governance laws and regulations, or meet evolving and varied stakeholder expectations and standards could result in legal and regulatory proceedings against us and materially adversely affect our business, reputation, results of operations, financial condition and stock price.

Risks Related to Our Debt

A major portion of our bank debt consists of variable-rate obligations, which subjects us to interest rate fluctuations.

Our credit facilities are secured by substantially all of our assets (other than non-mining real property and certain other assets). Our working capital line of credit includes variable-rate obligations, which expose us to interest rate risks. If interest rates increase, our debt service obligations on our variable-rate indebtedness would increase even if the amount borrowed remained the same, resulting in a decrease in our net income. Additional information regarding our market risks is contained in Item 7A "Quantitative and Qualitative Disclosures About Market Risk."

Our failure to comply with the covenants contained in the terms of our indebtedness could result in an event of default, which could materially and adversely affect our operating results and our financial condition.

The terms of our credit facilities require us to comply with various covenants, including financial covenants. A global economic downturn could have a material adverse impact on our earnings and cash flow, which could adversely affect our ability to comply with our financial covenants and could limit our borrowing capacity. Our ability to comply with these covenants depends, in part, on factors over which we may have no control. A breach of any of these covenants could result in an event of default under one or more of the agreements governing our indebtedness which, if not cured or waived, could give the holders of the defaulted indebtedness the right to terminate commitments to lend and cause all amounts outstanding with respect to the indebtedness to be due and payable immediately. Acceleration of any of our indebtedness could result in cross-defaults under our other debt instruments. Our assets and cash flow may be insufficient to fully repay borrowings under all of our outstanding debt instruments if some or all of these instruments are accelerated upon an event of default, in which case we may be required to seek legal protection from our creditors.

The terms and amount of our indebtedness may restrict our operations, including our ability to pursue our growth and acquisition strategies.

The terms of our credit facilities contain a number of restrictive covenants, including restrictions in our ability to, among other things, borrow and make investments, acquire other businesses, and consign additional precious metals. These covenants could adversely affect our business by limiting our ability to plan for or react to market conditions or to meet our capital needs, as well as adversely affect our ability to pursue our growth and acquisition strategies, and other strategic initiatives.

Adverse business conditions could impact our ability to generate cash and service our indebtedness.

Our ability to pay interest on our debt and to satisfy our other debt obligations depends in part upon our future financial and operating performance and that of our subsidiaries, and upon our ability to renew or refinance borrowings. Prevailing economic conditions and financial, business, competitive, legislative, regulatory and other factors, many of which are beyond our control, affect our ability to make these payments. While we believe that cash flow from our current level of operations, available cash and available borrowings under our revolving credit facility provide adequate sources of liquidity, a significant drop in operating cash flow resulting from economic conditions, competition or other uncertainties beyond our control could create the need for alternative sources of liquidity. If we are unable to generate sufficient cash flow to meet our debt service obligations, we will have to pursue one or more alternatives, such as reducing or delaying capital or other expenditures, refinancing debt, selling assets, or raising equity capital.

Risks Related to the Execution of Our Strategy

We may not be able to complete our acquisition strategy or successfully integrate acquired businesses.

We are active in pursuing acquisitions. We intend to continue to consider further growth opportunities through the acquisition of assets or companies and routinely review acquisition opportunities. We cannot predict whether we will be successful in pursuing any acquisition opportunities or whether we will be able to achieve the strategic and other objectives related to any acquisitions, including our recent acquisition of HCS-Electronic Materials, including the achievement of any expected synergies. Future acquisitions may involve the expenditure of significant funds and management time. Depending upon the nature, size, and timing of future acquisitions, we may be required to raise additional financing, which may not be available to us on acceptable terms, or at all. Further, we may not be able to successfully integrate any acquired business with our existing businesses or recognize any expected advantages from any completed acquisition.

In addition, there may be liabilities that we fail, or are unable, to discover in the course of performing due diligence investigations on the assets or companies we have already acquired or may acquire in the future. We cannot assure that rights to indemnification by the sellers of these assets or companies to us, even if obtained, or applicable representation and warranty insurance, will be enforceable, collectible, or sufficient in amount, scope, or duration to fully offset the possible liabilities associated with the business or property acquired. Any such liabilities, individually or in the aggregate, could have a materially adverse effect on our business, financial condition, and results of operations.

Our products are deployed in complex applications and may have errors or defects that we find only after deployment.

Our products are highly complex, designed to be deployed in complicated applications, and may contain undetected defects, errors, or failures. Although our products are generally tested during manufacturing, prior to deployment, they can only be fully tested when deployed in specific applications. For example, we sell beryllium-copper alloy strip products in a coil form to some customers, who then stamp the alloy for its specific purpose. On occasion, it is not until such customer stamps the alloy that a defect in the alloy is detected. Consequently, our customers may discover errors after the products have been deployed. The occurrence of any defects, errors, or failures could result in installation delays, product returns, termination of contracts with our customers, diversion of our resources, increased service and warranty costs, and other losses to our customers, end users, or to us. Any of these occurrences could also result in the loss of, or delay in, market acceptance of our products, and could damage our reputation, which could reduce our sales.

In addition to the risk of unanticipated warranty or recall expenses, our customer contracts may contain provisions that could cause us to incur penalties, be liable for damages, including liquidated damages, or incur other expenses, if we experience difficulties with respect to the functionality, deployment, operation, and availability of our products and services. In the event of late deliveries, late or improper installations or operations, failure to meet product or performance specifications or other product defects, or interruptions or delays in our managed service offerings, our customer contracts may expose us to penalties, liquidated damages, and other liabilities. In the event we were to incur contractual penalties, such as liquidated damages or other related costs that exceed our expectations, our business, financial condition, and operating results could be materially and adversely affected.

Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

We operate manufacturing plants, service and distribution centers, and other facilities throughout the world. During 2022, we made effective use of our productive capacities at our principal facilities. We believe that the quality and production capacity of our facilities is sufficient to maintain our competitive position for the foreseeable future. Information as of December 31, 2022, with respect to our facilities that are owned or leased, and the respective segments in which they are included, is set forth below:

Location	Owned or Leased	Approximate Number of Square Feet
Corporate and Administrative Offices		
Mayfield Heights, Ohio (1)(2)	Leased	79,100
Manufacturing Facilities		
Albuquerque, New Mexico (2)	Owned/Leased	13,000/63,200
Alzenau, Germany (2)	Leased	136,400
Balzers, Lichtenstein(3)	Leased	83,400
Brewster, New York (2)	Leased	75,000
Buffalo, New York (2)	Owned	110,000
Delta, Utah (1)	Owned	100,800
Elmore, Ohio (1)	Owned/Leased	681,000/191,000
Farnborough, England (1)	Leased	10,000
Jena, Germany (3)	Owned	25,800
Limerick, Ireland (2)	Leased	23,000
Lincoln, Rhode Island (1)	Owned/Leased	166,500/27,100
Lorain, Ohio (1)	Owned	55,000
Milwaukee, Wisconsin (2)	Owned/Leased	106,000/150,000
Newton, MA (1,2)	Owned/Leased	125,000/69,900
Penang, Malaysia (3)	Leased	68,000
Reading, Pennsylvania (1)	Owned/Leased	128,800/287,000
Santa Clara, California (2)	Leased	5,800
Shanghai, China (3)	Leased	101,400
Singapore (1)(2)	Leased	24,500
Subic Bay, Philippines (2)	Leased	5,000
Suzhou, China (2)	Leased	21,700
Taoyuan City, Taiwan (2)	Leased	32,500
Tucson, Arizona (1)	Owned	53,000
Tyngsboro, Massachusetts (3)	Leased	38,000
Westford, Massachusetts (3)	Leased	78,000
Wheatfield, New York (2)	Owned	35,000
Service, Sales, and Distribution Centers		
Elmhurst, Illinois (1)	Leased	28,000
Eschborn, Germany (3)	Leased	500
Seoul, Korea (2)	Leased	2,200
Shanghai, China (1)	Leased	5,000
Stuttgart, Germany (1)	Leased	49,000
Tokyo, Japan (1)	Leased	5,400
Tyngsboro, Massachusetts (3)	Leased	4,200

(1) Performance Materials

(2) Electronic Materials

(3) Precision Optics

Mine Property

The Company holds certain mineral rights on 7,443.5 acres at the Spor Mountain Mining Properties in Juab County, Utah, from which the beryllium-bearing ore, bertrandite, is mined by the open pit method. The Spor Mountain Mining Properties are a part of the Spor Mountain Mine that is owned by Materion. The Spor Mountain Mining Properties are in Juab County, Utah, west of the Thomas Mountain Range, approximately 47 miles northwest of the Spor Mountain Mill, which is 11.5 miles northeast of Delta, Utah, in Millard County. The land surface of the mining areas is owned by Materion. The mineral rights, exclusive of oil and gas, are held by Materion and the State of Utah through the School and Institutional Trust Lands Administration (TLA). TLA beryllium rights are leased by Materion in nine leasing arrangements with varying acreage and expiration dates ranging from 2025 through 2046. The leases have historically been renewed prior to the expiration dates. Several former owners are paid royalties as part of legacy agreements.

Ore resource and reserve data for the Spor Mountain Mine can be found in Part II, Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations". In addition, a Technical Report Summary (TRS) for the Spor Mountain Mine was prepared in 2021, in accordance with Items 1300-1305 of Regulations S-K by qualified persons who have no affiliation with the Company. The TRS, which was filed as Exhibit 96 to our Annual Report on Form 10-K for the year ended December 31, 2021, provides additional details regarding the Spor Mountain Mine, including the technical information and assumptions to support the estimates of mineral resources and mineral reserves.

In accordance with Item 1302 of Regulation S-K, a registrant is required to file a TRS as an exhibit to its Annual Report on Form 10-K when disclosing for the first time ore reserves or resources or when ore reserves or resources have changed materially since the last TRS was filed for the property. Because there have been no material changes to the Company’s reserves or resources in 2022, it is not filing a TRS as an exhibit to this Form 10-K.

Mine Exploration Status

The Spor Mountain Mine has been in production since 1968. Over the years, seven different mining areas have been identified. Development drilling was performed across the site for over 30 years and completed in 2000. Additional details can be found in the TRS.

Item 3. LEGAL PROCEEDINGS

Our subsidiaries and our holding company are subject, from time to time, to a variety of civil and administrative proceedings arising out of our normal operations, including, without limitation, product liability claims, health, safety, and environmental claims, and employment-related actions. Among such proceedings are cases alleging that plaintiffs have contracted, or have been placed at risk of contracting, beryllium sensitization or CBD or other lung conditions as a result of exposure to beryllium (beryllium cases). The plaintiffs in beryllium cases seek recovery under negligence and various other legal theories and demand compensatory and often punitive damages, in many cases of an unspecified sum. Spouses of some plaintiffs claim loss of consortium.

Beryllium Claims

As of December 31, 2022, our subsidiary, Materion Brush Inc., was a defendant in one beryllium case. In Richard Miller v. Dolphin, Inc. et al., case number CV2020-005163, filed in the Superior Court of Arizona, Maricopa County, the Company is one of six named defendants in addition to 100 John/Jane Doe defendants. The plaintiff alleges that he contracted beryllium disease from exposures to beryllium-containing products supplied to his employer, Karsten Manufacturing Corporation, where he was a production worker, and asserts claims for negligence, strict liability – failure to warn, strict liability – design defect, and fraudulent concealment. The plaintiff seeks general damages, medical expenses, loss of earnings, consequential damages, and punitive damages, and his wife claims loss of consortium. A co-defendant, Dolphin, Inc., filed a cross-claim against the Company for indemnification. On August 12, 2020, the Company moved to dismiss the cross-claim for failure to state a claim upon which relief can be granted. The court denied the motion on October 23, 2020. On December 7, 2020, the Company filed a Petition for Special Action in the Court of Appeals seeking to appeal the motion to dismiss the cross-claim. The Court of Appeals declined to accept jurisdiction on December 30, 2020. The court entered a scheduling order on September 14, 2021 that did not set a date for trial. Amended scheduling orders were entered on April 8, 2022, August 4, 2022, and November 1, 2022, that likewise did not set a trial date. The Company believes that it has substantive defenses and intends to vigorously defend itself against this suit.

During 2022, one beryllium case was resolved.

No beryllium cases were filed in 2022.

The Company has insurance coverage, which may respond, subject to an annual deductible.

Other Claims

On October 14, 2020, Garett Lucyk, et al. v. Materion Brush Inc., et. al., case number 20CV0234, a wage and hour purported collective and class action lawsuit, was filed in the Northern District of Ohio against the Company and its subsidiary, Materion Brush Inc. (collectively, the Company). Plaintiff, a former hourly production employee at the Company's Elmore, Ohio facility, alleges that he and other similarly situated employees are not paid for all time they spend donning and doffing personal protective equipment in violation of the Fair Labor Standards Act and Ohio law. Plaintiff filed a motion for conditional certification, which the Company opposed. On August 2, 2022, the Court conditionally certified a class of employees at the Company’s Elmore facility only and rejected certification of a class across the Company’s other facilities.

In November 2022, the parties reached a settlement for an immaterial amount. The settlement is pending court approval.

Item 4. MINE SAFETY DISCLOSURES

Information concerning mine safety violations or other regulatory matters required by Section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act and Item 104 of Regulation S-K (17 CFR 229.104) is included in Exhibit 95 to this Form 10-K.

PART II

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

Market Information

The Company's common shares are listed on the New York Stock Exchange under the symbol "MTRN". As of January 31, 2023, there were 652 shareholders of record.

Share Repurchases

The following table presents information with respect to repurchases of common stock made by us during the three months ended December 31, 2022.

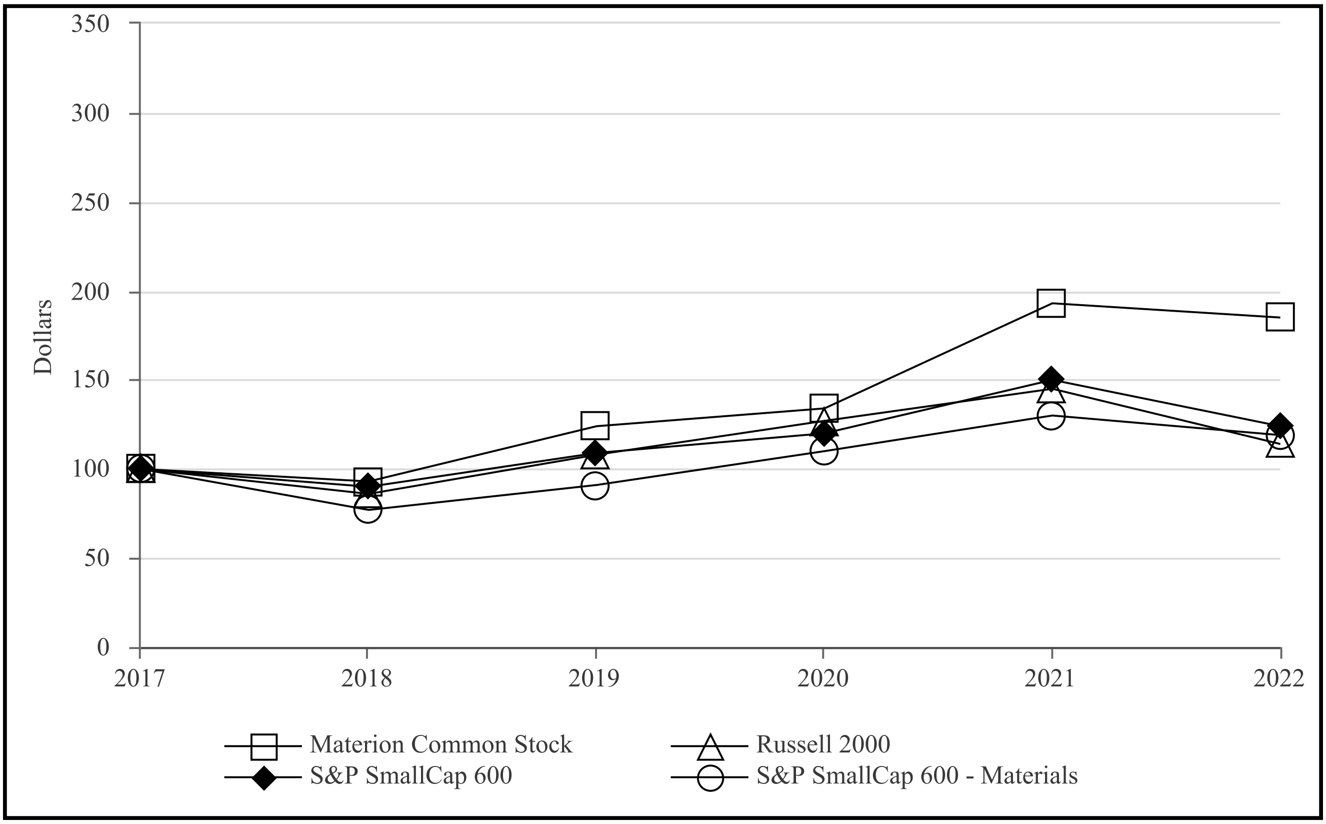
Period	Total Number of Shares Purchased (1)	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs (2)	Maximum Dollar Value that May Yet Be Purchased Under the Plans or Programs (2)
October 1 through November 4, 2022	5,021	$ 84.64	—	$ 8,316,239
November 5 through December 2, 2022	1,403	$ 80.17	—	8,316,239
December 3 through December 31, 2022	—	—	—	8,316,239
Total	6,424	$ —	—	$ 8,316,239

(1) Represents shares surrendered to the Company by employees to satisfy tax withholding obligations on stock appreciation rights issued under the Company's stock incentive plan.

(2) On January 14, 2014, we announced that our Board of Directors authorized the repurchase of up to $50.0 million of our common stock; this Board authorization does not have an expiration date. During the three months ended December 31, 2022, we did not repurchase any shares under this program.

Performance Graph

The following graph sets forth the cumulative shareholder return on our common shares as compared to the cumulative total return of the Russell 2000 Index, the S&P SmallCap 600 Index, and the S&P SmallCap 600 Materials Index, as Materion Corporation is a component of these indices.



	2018	2019	2020	2021	2022
Materion Corporation	$ 93	$ 124	$ 134	$ 193	$ 185
Russell 2000	86	108	127	145	114
S&P SmallCap 600	90	109	120	150	124
S&P SmallCap 600 - Materials	77	91	110	130	119

The above graph assumes that the value of our common shares and each index was $100 on December 31, 2017 and that all applicable dividends were reinvested.

Item 6. [RESERVED]

Reserved.

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

OVERVIEW

We are an integrated producer of high-performance advanced engineered materials used in a variety of electrical, electronic, thermal, and structural applications. Our products are sold into numerous end markets, including semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center.

RESULTS OF OPERATIONS

(Thousands except per share data)	2022	2021	2020
Net sales	**$ 1,757,109**	$ 1,510,644	$ 1,176,274
Value-added sales	**1,143,638**	859,700	665,125
Gross margin	**343,880**	283,762	192,633
Gross margin as a % of Value-added sales	**30 %**	33 %	29 %
Selling, general, and administrative (SG&A) expense	**169,338**	163,777	133,963
SG&A expense as a % of Value-added sales	**15 %**	19 %	20 %
Research and development (R&D) expense	**28,977**	26,575	20,283
R&D expense as a % of Value-added sales	**3 %**	3 %	3 %
Goodwill impairment charges	**—**	—	9,053
Asset impairment charges	**—**	—	1,419
Restructuring expense	**1,573**	(438)	11,237
Other — net	**24,237**	16,737	8,463
Operating profit	**119,755**	77,111	8,215
Other non-operating (income) expense — net	**(5,250)**	(5,115)	(3,939)
Interest expense — net	**21,905**	4,901	3,879
Income before income taxes	**103,100**	77,325	8,275
Income tax expense (benefit)	**17,110**	4,851	(7,187)
Net income	**85,990**	72,474	15,462
Diluted earnings per share	**4.14**	3.50	0.75

2022 Compared to 2021

Net sales of $1,757.1 million in 2022 increased $246.5 million from $1,510.6 million in 2021. Increased net sales in the Performance Materials and Electronic Materials segments were partially offset by a net sales decrease in the Precision Optics segment. Incremental sales from the full year of HCS-Electronic Materials accounted for $153.3 million of the net sales increase, most of which were sales into the semiconductor end market. Additionally, volume and price increases drove organic growth in our industrial (15%), energy (19%) and aerospace and defense (13%) end markets when compared to last year. See Note C to the Consolidated Financial Statements for additional details on the year over year changes in our net sales by segment and market.

The change in precious metal and copper prices, which are passed on to the customer as discussed in the value-added sales section below, unfavorably impacted net sales by $9.2 million in 2022 compared to 2021. This impact was partially offset by an increase in the volume of raw material beryllium hydroxide sales in 2022 of $4.0 million.

Value-added sales is a non-GAAP financial measure that removes the impact of pass-through metal costs and allows for analysis without the distortion of the movement or volatility in metal prices and changes in mix due to customer-supplied material. Internally, we manage our business on this basis, and a reconciliation of net sales, the most directly comparable GAAP financial measure, to value-added sales is included herein. Value-added sales of $1,143.6 million in 2022 were up 33% compared to 2021. Incremental sales from the full year of HCS-Electronic materials accounted for $153.3 million of the value-added sales increase, most of which were sales into the semiconductor end market. Additionally, volume and price increases drove organic growth in our industrial (15%), semi-conductor (11%), energy (43%) and aerospace and defense (8%) end markets. These increases were partially offset by foreign currency headwinds.

Gross margin was $343.9 in 2022, a 21% increase from the $283.8 million gross margin recorded in 2021. Gross margin expressed as a percentage of value-added sales decreased to 30% in 2022 from 33% in 2021 mainly due to lower gross margin on the HCS-Electronic Materials business and the precision clad strip project.

SG&A expense totaled $169.3 million in 2022 as compared to $163.8 million in 2021. The increase in SG&A expense for 2022 was primarily due to incremental HCS-Electronic Materials SG&A expense of $4.8 million. Expressed as a percentage of value-added sales, SG&A expense decreased 400 basis points in 2022 to 15% compared to 19% in 2021.

R&D expense consists primarily of direct personnel costs for pre-production evaluation and testing of new products, prototypes, and applications. R&D expense was $29.0 million in 2022, an increase of 9% compared to 2021. R&D costs as a percentage of value-added sales remained at 3%.

Restructuring expense consists primarily of cost reduction actions taken in order to reduce our fixed cost structure. In 2022, we recorded a combined total of $1.6 million of restructuring charges in our Precision Optics, Electronic Materials and Other segments.

Other-net totaled expense of $24.2 million and $16.7 million in 2022 and 2021, respectively. The increase in Other-net was driven by an increase in acquisition amortization due to a full year of intangible amortization from the HCS-Electronic Materials acquisition and higher metal consignment fees partially offset by foreign exchange gains in 2022 compared to losses in the prior year. Refer to Note E to the Consolidated Financial Statements for the major components within Other-net.

Other non-operating (income) expense-net includes components of pension and post-retirement income other than service costs. Refer to Note O of the Consolidated Financial Statements for details of the components of net periodic benefit costs.

Interest expense - net was $21.9 million in 2022 and $4.9 million in 2021. The increase in interest expense in 2022 compared to 2021 was primarily due to borrowings under our term loan facility and under our revolving credit facility incurred in the fourth quarter of 2021 used to finance the HCS-Electronic Materials acquisition.

Income tax expense (benefit) for 2022 was $17.1 million of expense compared to $4.9 million of benefit in 2021. The effects of percentage depletion, foreign derived intangible income deduction, and the impacts of research and development credits were the primary factors for the difference between the effective and statutory tax rates in 2022. Refer to Note G to the Consolidated Financial Statements for further details on income taxes.

See the Management Discussion and Analysis section of our Annual Report on Form 10-K for the year ended December 31, 2021 for a discussion of our results for 2021 compared to 2020.

Segment Disclosures

The Company has four reportable segments: Performance Materials, Electronic Materials, Precision Optics, and Other. The Other reportable segment includes unallocated corporate costs.

Performance Materials

(Thousands)	2022	2021	2020
Net sales	**$ 671,525**	$ 511,874	$ 394,195
Value-added sales	**589,587**	440,432	345,335
EBITDA	**125,227**	89,028	38,745

2022 Compared to 2021

Net sales from the Performance Materials segment of $671.5 in 2022 increased 31% compared to 2021. The increase in sales was due to higher organic volume in industrial, aerospace and defense, energy and telecom end markets as well as an increase in the volume of raw material beryllium hydroxide sales in the 2022 of $4 million. In addition, sales from HCS-Electronic Materials increased sales in this segment by $27.1 million and incremental sales from the clad strip project increased sales by $54.5 million. These impacts were slightly offset by a decrease in automotive market sales as a result of the global chip shortage impacting the timing of demand and foreign currency headwinds.

Value-added sales of $589.6 million in 2022 were 34% higher than value-added sales of $440.4 million in 2021. The increase in value-added sales was driven by the same factors driving the increase in net sales.

EBITDA for the Performance Materials segment was $125.2 million in 2022 compared to $89.0 million in 2021. The increase in EBITDA was primarily due to the same factors driving the increase in net sales, partially offset by incremental acquisition and integration costs of $1.1 million, primarily related to purchase accounting inventory step up charges, $9.8 million of incremental start up costs and $4.1 million of additional resource costs and scrap for the new wide area precision strip clad facility.

Electronic Materials

(Thousands)	2022	2021	2020
Net sales	**$ 971,902**	$ 866,816	$ 670,867
Value-added sales	**441,955**	289,119	220,516
EBITDA	**67,806**	44,852	30,127

2022 Compared to 2021

Net sales from the Electronic Materials segment of $971.9 million in 2022 were 12% higher than net sales of $866.8 million in 2021. The increase in net sales was primarily due to $126.2 million in net sales from the HCS-Electronic Materials acquisition. The net sales increase from HCS-Electronic Materials was offset by lower precious metal prices impacting net sales by $9.9 million and foreign currency headwinds. In addition, there was an increase in customer-supplied precious metal transactions in 2022, which does not impact value-added sales but would reduce net sales when compared to 2021.

Value-added sales of $442.0 million increased 53% compared to value-added sales of $289.1 million in 2021. The increase was primarily driven by $126.2 million in value-added sales from the HCS-Electronic Materials acquisition and an increase in value-added sales in the semiconductor end market. The impact of these items were partially offset by foreign currency headwinds.

EBITDA for the Electronic Materials segment was $67.8 million in 2022 compared to $44.9 million in 2021. The increase in EBITDA was primarily due to incremental EBITDA from HCS-Electronic Materials.

Precision Optics

(Thousands)	2022	2021	2020
Net sales	**$ 113,682**	$ 131,954	$ 111,212
Value-added sales	**113,580**	131,815	101,878
EBITDA	**13,753**	25,854	2,470

2022 Compared to 2021

Net sales from the Precision Optics segment were $113.7 million in 2022, a decrease of 14% compared to net sales of $132.0 million in 2021. The change was primarily driven by a reduction in sales related to COVID-19 PCR testing programs, the discontinuation of a consumer electronic application and foreign currency headwinds.

Value-added sales of $113.6 million in 2022 decreased 14% compared to value-added sales of $131.8 million in 2021. The decrease in value-added sales was due to the same factors driving the decrease in net sales.

EBITDA for the Precision Optics segment was $13.8 million in 2022 compared to $25.9 million in 2021. The decrease in EBITDA was driven by decreased volumes, the temporary shut down of the Shanghai facility in the first and second quarters of 2022, related unabsorbed costs and restructuring charges incurred during 2022.

Other

(Thousands)	2022	2021	2020
Net sales	**$ —**	$ —	$ —
Value-added sales	**(1,483)**	(1,666)	(2,604)
EBITDA	**(28,345)**	(33,371)	(16,804)

2022 Compared to 2021

The Other reportable segment in total includes unallocated corporate costs. Corporate costs of $28.3 million in 2022 decreased $5.1 million as compared to $33.4 million in 2021. Corporate costs were 2% of total Company value-added sales in 2022 compared to 4% in 2021. The decrease in corporate costs in 2022 compared to 2021 was primarily due to a $7.3 million decrease in general and administrative expense, primarily related to a decrease in merger and acquisition costs, primarily related to the HCS-Electronic Materials acquisition in 2021.

Value-Added Sales - Reconciliation of Non-GAAP Financial Measure

A reconciliation of net sales to value-added sales, a non-GAAP financial measure, for each reportable segment and for the Company in total for 2022, 2021, and 2020 is as follows:

(Thousands)	2022	2021	2020
Net sales			
Performance Materials	**$ 671,525**	$ 511,874	$ 394,195
Electronic Materials	**$ 971,902**	866,816	$ 670,867
Precision Optics	**113,682**	131,954	$ 111,212
Other	**—**	—	—
Total	**$ 1,757,109**	$ 1,510,644	$ 1,176,274
Less: pass-through metal costs			
Performance Materials	**$ 81,938**	$ 71,442	$ 48,860
Electronic Materials	**529,947**	577,697	450,351
Precision Optics	**102**	139	9,334
Other	**1,483**	1,666	2,604
Total	**$ 613,470**	$ 650,944	$ 511,149
Value-added sales			
Performance Materials	**589,587**	440,432	345,335
Electronic Materials	**441,955**	289,119	220,516
Precision Optics	**113,580**	131,815	101,878
Other	**(1,483)**	(1,666)	(2,604)
Total	**$ 1,143,639**	$ 859,700	$ 665,125

The cost of gold, silver, platinum, palladium, copper, ruthenium, iridium, rhodium, rhenium, and osmium can be quite volatile. Our pricing policy is to directly pass the cost of these metals on to the customer in order to mitigate the impact of metal price volatility on our results from operations. Trends and comparisons of net sales are affected by movements in the market prices of these metals, but changes in net sales due to metal price movements may not have a proportionate impact on our profitability.

Internally, management reviews net sales on a value-added basis. Value-added sales is a non-GAAP financial measure that deducts the value of the pass-through metal costs from net sales. Value-added sales allow management to assess the impact of differences in net sales between periods, segments, or markets, and analyze the resulting margins and profitability without the distortion of movements in pass-through metal costs. The dollar amount of gross margin and operating profit is not affected by the value-added sales calculation. We sell other metals and materials that are not considered direct pass-throughs, and these costs are not deducted from net sales when calculating value-added sales.

Our net sales are also affected by changes in the use of customer-supplied metal. When we manufacture a precious metal product, the customer may purchase metal from us or may elect to provide its own metal, in which case we process the metal on a toll basis, and the metal value does not flow through net sales or cost of sales. In either case, we generally earn our margin based upon our fabrication efforts. The relationship of this margin to net sales can change depending upon whether or not the product was made from our metal or the customer's metal. The use of value-added sales removes the potential distortion in the comparison of net sales caused by changes in the level of customer-supplied metal.

By presenting information on net sales and value-added sales, it is our intention to allow users of our financial statements to review our net sales with and without the impact of the pass-through metals.

FINANCIAL POSITION

Cash Flow

A summary of cash flows provided by (used in) operating, investing, and financing activities is as follows:

(Thousands)	2022	2021	2020
Net cash provided by operating activities	**$ 115,958**	$ 90,241	$ 101,057
Net cash (used in) investing activities	**(79,729)**	(494,269)	(194,707)
Net cash provided by (used in) financing activities	**(35,558)**	393,006	(7,091)
Effects of exchange rate changes	**(2,032)**	(394)	1,612
Net change in cash and cash equivalents	**$ (1,361)**	$ (11,416)	$ (99,129)

Net cash provided by operating activities totaled $116.0 million in 2022 versus $90.2 million in 2021. Operating cash flow increased primarily due to net income increase of $13.5 million, despite an increase in depreciation and amortization of $9.3 million, customer prepayments increase of $8.2 million and favorable impact of deferred taxes of $14.7 million compared to the prior year. This was partially offset by an increase in working capital outflow, from $33.7 million in 2021 to $58.6 million in 2022. The increase in working capital outflow was primarily driven by an increase in inventory levels to support higher sales as well as increases in the price of raw materials.

Net cash used in investing activities was $79.7 million in 2022 compared to $494.3 million in 2021. The decrease was due to a $392.2 million payment, net of cash acquired, for the HCS-Electronic Materials acquisition in 2021. In addition, capital expenditures decreased by $25.3 million in 2022, compared to 2021, due to increased investments in new equipment funded in part by customer prepayments in 2021 compared to 2022, primarily related to the precision clad strip project. See Notes B and K to the Consolidated Financial Statements for additional discussion.

Net cash provided by (used in) financing activities decreased $428.6 million from 2021. In 2021, the Company entered into the $300 million term loan and incurred $100 million of incremental borrowings under the revolving credit facility used to fund the acquisition of HCS-Electronic Materials. In 2022, the Company began repaying the incurred debt from 2021 and the net amount due under the revolving credit facility and term loan decreased by $28.3 million.

Dividends per common share increased 4% to $0.495 per share in 2022. Total dividend payments to common shareholders were $10.2 million in 2022 and $9.7 million in 2021. In May 2022, the Board of Directors declared an increase in our quarterly dividend from $0.12 to $0.125 per share. We intend to pay a quarterly dividend on an ongoing basis, subject to a continuing strong capital structure and a determination that the dividend remains in the best interest of our shareholders.

Liquidity

We believe that cash flow from operations plus available borrowing capacity and our current cash balance are adequate to support operating requirements, capital expenditures, projected pension plan contributions, the current dividend and share repurchase programs, environmental remediation projects, and strategic acquisitions for at least the next 12 months and the foreseeable future thereafter. At December 31, 2022, cash and cash equivalents held by our foreign operations totaled $11.7 million. We do not expect restrictions on repatriation of cash held outside of the United States to have a material effect on our overall liquidity, financial condition, or the results of operations for the foreseeable future.

A summary of key data relative to our liquidity, including the outstanding debt, cash balances, and available borrowing capacity, as of December 31, 2022 and December 31, 2021 is as follows:

	December 31,	
(Thousands)	2022	2021
Cash and cash equivalents	**$ 13,101**	$ 14,462
Total outstanding debt	**431,981**	449,747
Net (debt) cash	**(418,880)**	(435,285)
Available borrowing capacity	**$ 185,294**	$ 176,419

Net (debt) cash is a non-GAAP financial measure. We are providing this information because we believe it is more indicative of our overall financial position. It is also a measure our management uses to assess financing and other decisions. We believe that based on our typical cash flow generated from operations, we can support a higher leverage ratio in future periods.

The available borrowing capacity in the table above represents the additional amounts that could be borrowed under our revolving credit facility and other secured lines existing as of the end of each year depicted. The applicable debt covenants have been taken into account when determining the available borrowing capacity, including the covenant that restricts borrowing capacity to a multiple of the twelve-month trailing earnings before interest, income taxes, depreciation and amortization, and other adjustments.

In January 2023, we amended the agreement governing our $375.0 million revolving credit facility (Credit Agreement). Pursuant to the amendment, we transition U.S. dollar denominated borrowings from LIBOR to the Secured Overnight Financial Rate (SOFR) for both the revolving credit agreement and the term loan and increased the cap on precious metals facilities from $600 million to $615 million.

The Company had previously amended and restated the Credit Agreement in connection with the HCS-Electronic Materials acquisition in November 2021. A $300 million delayed draw term loan facility was added to the Credit Agreement and the maturity date of the Credit Agreement was extended from 2024 to 2026. Moreover, the Credit Agreement also provides for an uncommitted incremental facility whereby, under certain conditions, the Company may be able to borrow additional term loans in an aggregate amount not to exceed $150.0 million. The Credit Agreement provides the Company and its subsidiaries with additional capacity to enter into facilities for the consignment of precious metals and copper, and provides enhanced flexibility to finance acquisitions and other strategic initiatives. Borrowings under the Credit Agreement are secured by substantially all of the assets of the Company and its direct subsidiaries, with the exception of non-mining real property, precious metal, copper and certain other assets.

The Credit Agreement allows the Company to borrow money at a premium over SOFR, following the January 2023 amendment, or prime rate and at varying maturities. The premium resets quarterly according to the terms and conditions stipulated in the agreement. The Credit Agreement includes restrictive covenants relating to restrictions on additional indebtedness, acquisitions, dividends, and stock repurchases. In addition, the Credit Agreement includes covenants that limit the Company to a maximum leverage ratio and a minimum interest coverage ratio. We were in compliance with all of our debt covenants as of December 31, 2022 and December 31, 2021. Cash on hand up to $25 million can benefit the covenants and may benefit the borrowing capacity under the Credit Agreement.

In November 2021, we completed the acquisition of HCS-Electronic Materials. The Company financed the purchase price for the HCS-Electronic Materials acquisition with a new $300 million five-year term loan pursuant to its delayed draw term loan facility under the Credit Agreement and $103 million of borrowings under its amended revolving credit facility. The interest rate for the term loan is based on SOFR, following the January 2023 amendment, plus a tiered rate determined by the Company's quarterly leverage ratio.

Portions of our business utilize off-balance sheet consignment arrangements allowing us to use metal owned by precious metal consignors as we manufacture product for our customers. Metal is purchased from the precious metal consignor and sold to our customer at the time of product shipment. Expansion of business volumes and/or higher metal prices can put pressure on the consignment line limitations from time to time. In August 2022, we entered into a precious metals consignment agreement, maturing on August 31, 2025, which replaced the consignment agreements that would have matured on August 27, 2022. The available and unused capacity under the metal consignment agreements expiring in August 2025 totaled approximately $241.9 million as of December 31, 2022, compared to $69.8 million as of December 31, 2021 under the metal consignment agreements that expired on August 27, 2022. The availability is determined by Board approved levels and actual capacity. The availability is determined by Board approved levels and actual capacity.

In January 2014, our Board of Directors approved a plan to repurchase up to $50.0 million of our common stock. The timing of the share repurchases will depend on several factors, including market and business conditions, our cash flow, debt levels, and other investment opportunities. There is no minimum number of common shares required to be repurchased in a given year, and the repurchases may be discontinued at any time. We did not repurchase any shares in 2021 or 2022. Since the approval of the repurchase plan, we have purchased 1,254,264 shares at a total cost of $41.7 million, or an average of $33.23 per share.

Material Future Cash Obligations

The following table summarizes our material future obligations with respect to debt and associated interest as of December 31, 2022. In addition to the amounts below, the Company anticipates incurring costs related to its finance lease obligations and non-cancelable lease payments for operating leases with an initial lease term in excess of one year. These obligations are further detailed in Note L.

(Millions)	2023	2024	2025	2026	2027	There- after	Total
Debt (1)	21.1	30.3	30.3	353.5	0.2	0.3	435.7
Interest payments on debt (2)	17.3	15.9	14.1	10.3	—	—	57.6
Total	$ 38.4	$ 46.2	$ 44.4	$ 363.8	$ 0.2	$ 0.3	$ 493.3

(1) Refer to Note O to the Consolidated Financial Statements.

(2) These amounts represent future interest payments related to our total debt, excluding any interest payments to be made on borrowings under our Credit Agreement.

Off-balance Sheet Obligations

We maintain the majority of the precious metals and copper we use in production on a consignment basis in order to reduce our exposure to metal price movements and to reduce our working capital investment. Refer to Item 7A "Quantitative and Qualitative Disclosures about Market Risk." The notional value of off-balance sheet precious metals and copper was $373.1 million as of December 31, 2022 versus $480.2 million as of December 31, 2021. We were in compliance with all of the covenants contained in the consignment agreements as of December 31, 2022 and December 31, 2021. Refer to Note I for additional information.

ORE RESERVES

The following information concerning our mining properties has been prepared in accordance with the requirements of subpart 1300 of Regulation S-K, which first became applicable to us for the year ended December 31, 2021. These requirements differ significantly from the previously applicable disclosure requirements of SEC Industry Guide 7. Among other differences, subpart 1300 of Regulation S-K requires us to disclose our mineral resources, in addition to our mineral reserves, as of the end of our most recently completed fiscal year.

As used in this Form 10-K, the terms "mineral resource," "measured mineral resource," "indicated mineral resource," "inferred mineral resource," "mineral reserve," "proven mineral reserve" and "probable mineral reserve" are defined and used in accordance with subpart 1300 of Regulation S-K. Under subpart 1300 of Regulation S-K, mineral resources may not be classified as "mineral reserves" unless the determination has been made by a qualified person that the mineral resources can be the basis of an economically viable project. You are specifically cautioned not to assume that any part or all of the mineral resources in these categories will ever be converted into mineral reserves, as defined by the SEC. We rely on estimates of our ore resources and recoverable reserves, which estimation is complex due to geological characteristics of the properties and the number of assumptions made.

You are cautioned that, except for that portion of mineral resources classified as mineral reserves, mineral resources do not have demonstrated economic value. Inferred mineral resources are estimates based on limited geological evidence and sampling and have a too high of a degree of uncertainty as to their existence to apply relevant technical and economic factors likely to influence the prospects of economic extraction in a manner useful for evaluation of economic viability. Estimates of inferred mineral resources may not be converted to a mineral reserve. It cannot be assumed that all or any part of an inferred mineral resource will ever be upgraded to a higher category. A significant amount of additional work must be completed in order to determine whether an inferred mineral resource may be upgraded to a higher category. Therefore, you are cautioned not to assume that all or any part of an inferred mineral resource exists, that it can be the basis of an economically viable project, or that it will ever be upgraded to a higher category. Likewise, you are cautioned not to assume that all or any part of measured or indicated mineral resources will ever be converted to mineral reserves.

The information that follows relating to the Spor Mountain Mine is derived, for the most part, from the TRS, which was prepared in compliance with Item 601(b)(96) and subpart 1300 of Regulation S-K. Portions of the following information are based on assumptions, qualifications and procedures that are not fully described herein. Reference should be made to the full text of the TRS, which is filed as Exhibit 96 to this Form 10-K and is incorporated by reference herein.

Mineral Resources

A mineral resource is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade or quality, and quantity that there are reasonable prospects for economic extraction. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed justifiable technical and economic conditions, is likely to, in whole or part, become economically extractable.

The term "measured mineral resource" is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of conclusive geological evidence and sampling.

The term "indicated resources" means resources for which quantity and grade or quality can be estimated on the basis of adequate geological evidence and sampling.

The term "inferred resources" means resources for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling.

The following represents our indicated and inferred ore mineral resources, exclusive of mineral reserves, as of December 31, 2022 and December 31, 2021:

	Indicated	Inferred
As of December 31, 2022		
Tonnage (in thousands)	**1,504**	**2,630**
Grade (% beryllium)	**0.128 %**	**0.345 %**
Beryllium pounds (in millions)	**38.38**	**18.12**
As of December 31, 2021		
Tonnage (in thousands)	1,504	2,630
Grade (% beryllium)	0.128 %	0.345 %
Beryllium pounds (in millions)	38.38	18.12

Mineral Reserves
A mineral reserve is an estimate of tonnage and grade, or quality, of indicated and measured mineral resources that, in the opinion of a qualified person, can be the basis of an economically viable project. More specifically, it is the economically mineable part of a measured or Indicated mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.

Proven mineral reserves are the economically mineable part of a measured mineral resource and can only result from conversion of a measured mineral resource. Probable mineral reserves are the economically mineable part of an indicated and, in some cases, a measured mineral resource. All mineral reserves are classified as proven or probable and are supported by life-of-mine plans. All mineral reserve estimates were reviewed and validated by the Qualified Persons.

The following represents our ore mineral reserves:

	Proven	Probable	Total
As of December 31, 2022			
Tonnage (in thousands)	**7,678**	**962**	**8,640**
Grade (% beryllium)	**0.245 %**	**0.258 %**	**0.246 %**
Beryllium pounds (in millions)	**37.57**	**4.97**	**42.54**
As of December 31, 2021			
Tonnage (in thousands)	7,739	962	8,701
Grade (% beryllium)	0.245 %	0.258 %	0.246 %
Beryllium pounds (in millions)	37.92	4.97	42.89

Internal Controls Disclosure

Under subpart 1305 of Regulation S-K, management has included information regarding the internal controls that the Company used in determining the mineral resource and reserve estimation efforts. There is no disclosure required regarding exploration procedures as the Company completed development drilling on all areas at the Spor Mountain Mine in 2000, and no future exploration is planned at this time. As it relates to estimating mineral resources and reserves, the Company incorporates the following items into the control process:

a. All samples are tested with a berylometer.
b. The berylometer calibration procedures are verified through comparison with the beryllium production from the mill for the same ores.
c. The lab and field berylometers are calibrated on site each shift.
d. Materion follows industry standard procedures for calibrating its field and laboratory berylometers each shift that they are utilized.
e. Resource models are reconciled to production data regularly.
f. Materion has been producing ore at the Spor Mountain Mine for over 45 years and has mined and processed materials from a range of pits from the property. It is considered that Materion has adequate data to support its milling practices.

The Qualified Persons have assessed that the Company's control procedures, including redundant testing at various operational points, the quality control and quality assurance measures, the calibration measures, the extensive cataloging of sample duplicates, and the reconciliation with recovered beryllium, are sufficient.

Based upon average production levels in recent years and our near-term production forecasts, proven reserves would last a minimum of seventy-five years. The table below details our production of beryllium at our Utah location.

(Thousands of Pounds of Beryllium)	2022	2021	2020
Domestic ore	**382**	386	367
Purchased ore	**—**	—	—
Unyielded total	**382**	386	367
Annual yield	**90 %**	91 %	90 %
Beryllium produced	**344**	353	334
% of mill capacity	**53 %**	55 %	52 %

CRITICAL ACCOUNTING POLICIES

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires the inherent use of estimates and management's judgment in establishing those estimates. The following policies are considered by management to be critical because adherence to these policies relies significantly upon our judgment.

Revenue Recognition

Net sales consist primarily of revenue from the sale of precious and non-precious specialty metals, beryllium and copper-based alloys, beryllium composites, and other products into numerous end markets. The Company requires an agreement with a customer that creates enforceable rights and performance obligations. We recognize revenue, in an amount that reflects the consideration to which the Company expects to be entitled, when we satisfy a performance obligation by transferring control of a product to the customer. The core principle of the Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC) 606 is supported by five steps which are outlined below with management's judgment in applying each.

1) Identify the contract with a customer

A contract with a customer exists when the Company enters into an enforceable contract with a customer that identifies each party's rights regarding the products to be transferred or services to be rendered and the related payment terms, the contract has commercial substance, and the Company determines that collection of substantially all consideration for products that are transferred is probable based on the customer's intent and ability to pay.

Management exercises judgment in its assessment that it is probable that the Company will collect substantially all of the payments attributed to products or services that will be transferred to our customers. We regularly review the creditworthiness of our customers considering such factors as the macroeconomic environment, current market conditions, geographic considerations, historical collection experience, a customer's current credit standing, and the age of outstanding accounts receivable balances that may affect a customer's ability to pay. If, after we have recognized revenue, the collectability of an account receivable becomes doubtful, we establish appropriate allowances and reserves against accounts receivable with respect to the previously recognized revenue that remains uncollected. Allowances and reserves against accounts receivable are maintained for estimated probable losses and are sufficient enough to ensure that accounts receivable are stated at amounts that are considered collectible.

If management forms a judgment that a particular customer's financial condition has deteriorated but decides to deliver products or services to the customer, we will defer recognizing revenue relating to products sold to that customer until it is probable that we will collect substantially all of the consideration to which we are entitled, which typically coincides with the collection of cash.

2) Identify the performance obligations in the contract

Performance obligations promised in a contract are identified based on the products that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the product either on its own or together with other resources that are readily available from third parties or from the Company, and are distinct in the context of the contract, whereby the transfer of the product is separately identifiable from other promises in the contract.

Certain of the Company's contracts with customers may contain multiple performance obligations. As a result, management utilizes judgment to determine the appropriate accounting, including whether multiple promised products or services in a contract should be accounted for separately or as a group, how the consideration should be allocated among the performance obligations, and when to recognize revenue upon satisfaction of the performance obligations.

3) Determine the transaction price

The transaction price is determined based on the consideration to which the Company will be entitled in exchange for transferring products or services to the customer. The vast majority of our contracts contain fixed consideration terms. However, the Company also has contracts with customers that include variable consideration. Volume discounts and rebates are offered as an incentive to encourage additional purchases and customer loyalty. Volume discounts and rebates typically require a customer to purchase a specified quantity of products, after which the price of additional products decreases. These contracts include variable consideration because the total amount to be paid by the customer is not known at contract inception and is affected by the quantity of products ultimately purchased. As a result, management applies judgment to estimate the volume discounts based on experience with similar contracts, customers, and current sales forecasts. Also, the Company has contracts, primarily relating to its precious metal products, where the transaction price includes variable consideration at contract inception because it is calculated based on a commodity index at a specified date. Management exercises judgment to determine the minimum amount to be included in the transaction price. Variable consideration is included in the transaction price if, in the Company's judgment, it is probable that a significant future reversal of cumulative revenue under the contract will not occur.

4) Allocate the transaction price to performance obligations in the contract

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 to each performance obligation based on the relative standalone selling price. The Company typically determines standalone selling price based on the price at which the performance obligation is sold separately. If the standalone selling price is not observable through past transactions, management uses judgment to estimate the standalone selling price taking into account available information such as market conditions and internally approved pricing guidelines related to the performance obligations.

5) Recognize revenue when or as the Company satisfies a performance obligation

Management applies the principle of control to determine whether the customer obtains control of a product as it is created and if revenue should be recognized over time. The vast majority of the Company's performance obligations are satisfied at a point in time when control of the product transfers to the customer. Control of the product is generally transferred to the customer when the Company has a present right to payment, the customer has legal title, the customer has physical possession, the customer has the significant risks and rewards of ownership, and the customer has accepted the product.

However, for certain contracts, particularly relating to the U.S. government and relating to specialized products with no alternative use, we generally recognize revenue over time as we procure the product because of continuous transfer of control to the customer. This continuous transfer of control to the customer is supported by a termination for convenience clause in the contract that allows the customer to unilaterally terminate the contract, pay the Company for costs incurred plus a reasonable profit, and take control of any work in process. We generally use the cost-to-cost measure of progress for these contracts because it best depicts the transfer of control to the customer which occurs as we incur costs on the related contracts. Under the cost-to-cost measure of progress, the extent of progress towards completion is measured based on the ratio of costs incurred to date to the total estimated costs at completion of the performance obligation. Therefore, revenue is recognized proportionally as costs are incurred for these contracts.

The Company recognizes revenue net of reserves for price adjustments, returns, and prompt payment discounts. Management generally estimates these amounts using the expected value method. The Company has sufficient historical experience with our customers that provides predictive value to support that the reserves recorded are appropriate.

Other considerations

We receive payment from customers equal to the invoice price for most of our sales transactions.

Returned products are generally not accepted unless the customer notifies the Company in writing, and we authorize the product return by the customer.

Unearned revenue is recorded cash consideration from customers in advance of the shipment of the goods, which is a liability on our Consolidated Balance Sheets. This contract liability is subsequently reversed and the revenue, cost of sales, and gross margin are recorded when the Company has transferred control of the product to the customer. The related inventory also remains on our balance sheet until the revenue recognition criteria are met. Advanced billings are typically made in association with products with long manufacturing times and/or products relating to contracts with the government. Billings in advance of the shipments allow us to collect cash earlier than billing at the time of the shipment and, therefore, the collected cash can be used to reduce our investment in working capital. Refer to Note D of the Consolidated Financial Statements for additional details on our contract balances.

Pensions

The annual net periodic expense and benefit obligations related to the Company's defined benefit plans are determined on an actuarial basis. This determination requires critical assumptions regarding the discount rate, long-term rate of return on plan assets, increases in compensation levels, and amortization periods for actuarial gains and losses. Assumptions are determined based on Company data and appropriate market indicators and are evaluated each year as of the plans' measurement date. Changes in the assumptions to reflect actual experience, as well as the amortization of actuarial gains and losses, could result in a material change in the annual net periodic expense and benefit obligations reported in the financial statements.

The Company uses a spot-rate approach to estimate the service and interest cost components of net periodic benefit cost for its defined benefit pension plans. The spot-rate approach applies separate discount rates (along the yield curve) for each projected benefit payment in the calculation.

Our pension plan investment strategies are governed by a policy adopted by the Board of Directors. A senior management team oversees a group of outside investment analysts and brokerage firms that implement these strategies. The future return on pension assets is dependent upon the plan's asset allocation, which changes from time to time, and the performance of the underlying investments. Consistent with December 31, 2021, we used an expected rate of return on domestic plan assets assumption of 5.25% at December 31, 2022. This assumption is reflective of management's view of the long-term returns in the marketplace, as well as changes in risk profiles and available investments. Should the assets earn an average return less than the expected return assumption over time, in all likelihood the future pension expense would increase.

The impact of a change in the discount rate or expected rate of return assumption on domestic pension expense can vary from year to year depending upon the undiscounted liability level, the current discount rate, the asset balance, other changes to the plan, and other factors. A 0.25 percentage point decrease to the discount rate would increase the 2023 projected pension expense approximately $0.1 million. A 0.25 percentage point decrease in the expected rate of return assumption would increase the 2023 projected pension expense by approximately $0.4 million.

Refer to Note P of the Consolidated Financial Statements for additional details on our pension and other post-employment benefit plans.

Deferred Taxes

We record deferred tax assets and liabilities based upon the temporary difference between the financial reporting and tax basis of assets and liabilities. If it is more likely than not that some portion or all of the deferred tax assets will not be realized, a valuation allowance is established. All available evidence, both positive and negative, is considered to determine whether a valuation allowance is needed. We review the expiration dates of certain deferred tax assets against projected income levels to determine if a valuation allowance is needed. Certain deferred tax assets do not have an expiration date. We also evaluate deferred tax assets for realizability due to cumulative operating losses by jurisdiction and record a valuation allowance as warranted. A valuation allowance may increase tax expense and reduce net income in the period it is recorded. If a valuation allowance is no longer required, it will reduce tax expense and increase net income in the period in which it is reversed.

We had valuation allowances of $4.9 million and $5.0 million associated with certain federal, state, and foreign deferred tax assets as of year-end 2022 and 2021, respectively, primarily for net operating loss, capital loss carryforwards and state tax credits.

Refer to Note G of the Consolidated Financial Statements for additional deferred tax details.

Precious Metal Physical Inventory Counts

We take and record the results of a physical inventory count of our precious metals on a quarterly basis. Our precious metal operations include a refinery that processes precious metal-containing scrap and other materials from our customers, as well as our own internally generated scrap. We also outsource portions of our refining requirements to other vendors, particularly for those materials with longer processing times. The precious metal content within these various refine streams may be in solutions, sludges, and other non-homogeneous forms and can vary over time based upon the input materials, yield rates, and other process parameters. The determination of the weight of the precious metal content within the refine streams as part of a physical inventory count requires the use of estimates and calculations based upon assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volumes of solutions and other materials within the refinery, data from our refine vendors, and other factors. The resulting calculated weight of the precious metals in our refine operations may differ, in either direction, from what our records indicate that we should have on hand, which would then result in an adjustment to our pre-tax income in the period when the physical inventory was taken, and the related estimates were made.

Goodwill and Other Intangible Assets

We use the acquisition method of accounting to allocate costs of acquired businesses to the assets acquired and liabilities assumed based on their estimated fair values at the dates of acquisition. The excess costs of acquired businesses over the fair values of the assets acquired and liabilities assumed are recognized as goodwill. The valuations of the acquired assets and liabilities will impact the determination of future operating results. Determining the fair value of assets acquired and liabilities assumed requires management's judgment and often involves the use of significant estimates and assumptions, including assumptions with respect to future cash inflows and outflows, revenue growth rates, discount rates, customer attrition rates, royalty rates, asset lives, contributory asset charges, and market multiples, among other items. We determine the fair values of intangible assets acquired generally in consultation with third-party valuation advisors.

Intangible assets other than goodwill are recognized if the benefit of the intangible asset is obtained through contractual or other legal rights, or if the intangible asset can be sold, transferred, licensed or exchanged, regardless of the Company's intent to do so. Goodwill represents the excess purchase price over the fair value of the tangible net assets and intangible assets acquired in a business combination and is reviewed annually for impairment or more frequently if impairment indicators arise. Finite-lived intangible assets are reviewed for impairment if facts and circumstances warrant. There were no indicators during interim periods that required the performance of an interim impairment assessment. The Company conducted its annual impairment assessment as of the first day of the fourth quarter.

Goodwill is assigned to the reporting unit, which is the operating segment level or one level below the operating segment. Goodwill within the Electronic Materials segment totaled $206.7 million as of December 31, 2022. Within the Precision Optics segment, goodwill totaled $86.7 million. The remaining $26.2 million is related to the Performance Materials segment.

For the purpose of the annual goodwill impairment assessment, we have the option to perform a qualitative assessment (commonly referred to as "step zero") to determine whether further quantitative analysis for impairment of goodwill is necessary. In performing step zero for our impairment test, we are required to make assumptions and judgments including, but not limited to, macroeconomic conditions as related to our business, current and future financial performance of our reporting units, industry and market considerations, and cost factors such as changes in raw materials, labor, or other costs. If the step zero analysis indicates that it is more likely than not that the fair value of a reporting unit is less than its respective carrying value including goodwill, then we would perform an additional quantitative analysis. The next step compares the fair value of the reporting unit to its carrying value, including goodwill. An impairment charge is recognized for the amount the carrying value of the reporting unit exceeds its fair value.

The Company notes that reporting units with goodwill due to recent acquisitions are likely to have fair values to the proximity of the carrying value due to the shorter period of time for fair value from the recent acquisition to have changed. The Precision Optics reporting unit includes the 2020 goodwill of $70.6 million related to the Optics Balzers acquisition and the Performance Materials and Electronic Materials segments include $24.3 million and $157.0 million, respectively, of goodwill related to the HCS-Electronic Materials acquisition. As a result of the timing of the recent acquisitions over the past few years, the Company elected to bybass the qualitative assessment and perform a quantitative assessment of the Performance Materials, Electronic Materials and Precision Optics reporting units' goodwill balances.

The quantitative analysis compares estimated fair value of the reporting unit, using an income approach (a discounted cash flow model), as well as a market approach, with its carrying value. The income approach and market approach are weighted in arriving at fair value based on the relative merits of the methods used and the quantity and quality of collected data to arrive at the indicated fair value.

The income approach requires several assumptions including future sales growth, EBITDA margins and capital expenditures. The Company's reporting units each provide their forecast of results for the next five years. These forecasts form the basis for the information used in the discounted cash flow model. The discounted cash flow model also requires the use of a discount rate and a terminal revenue growth rate (the revenue growth rate for the period beyond the five years forecast by the reporting units), as well as projections of future operating margins (for the period beyond the forecast five years). The Company used a discount rate in the mid-teens and a terminal growth rate of low single digits.

The market approach requires several assumptions including sales and EBITDA multiples for comparable companies that operate in the same markets as the reporting unit. During the fourth quarter of 2022, the Company considered sales multiples in the low single digits and EBITDA multiples in the range high single digits to low double digits.

Based on the quantitative assessment performed for the Precision Optics reporting unit, the fair value exceeded the carrying value by less than 10%, but by a sufficient amount to support no indicators of impairment as of October 1, 2022. As of October 1, 2022, based on the quantitative assessments for the other reporting units, the estimated fair value was substantially in excess of the carrying value for the remaining reporting units.

Management believes the future sales growth and EBITDA margins in the long range plan, terminal growth rate and the discount rate used in the valuations requires significant use of judgment. If any of our reporting units do not meet our long range plan estimates or our discount rate increase significantly, we could be required to perform an interim goodwill impairment analysis or recognize charges in future periods. Any impairment charges that the Company may take in the future could be material to its consolidated results of operations and financial condition. The assumptions used for the reporting units and indefinite-lived intangibles with fair values exceeding carrying values of less than 10% are more sensitive to future performance and will be monitored accordingly.

We also compared our market capitalization as of October 1, 2022 to the carrying value of our equity and considering an implied control premium, we noted no impairment indicators or triggering events.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We are exposed to precious metal and commodity price, interest rate, foreign exchange rate, and utility cost differences. While the degree of exposure varies from year to year, our methods and policies designed to manage these exposures have remained fairly consistent over time. Generally, we attempt to minimize the effects of these exposures on our pre-tax income and cash flows through the use of natural hedges, which include pricing strategies, borrowings denominated in the same terms as the exposed asset, off-balance sheet financing arrangements, and other methods. Where we cannot use a natural hedge, we may use derivative financial instruments to minimize the effects of these exposures when practical and cost efficient. The use of off-balance sheet financing arrangements and derivative financial instruments is subject to policies approved by the Audit Committee of the Board of Directors with oversight provided by a group of senior financial managers at our corporate office.

Precious metals. We use gold and other precious metals in manufacturing various products. To reduce the exposure to market price changes, the majority of our precious metal requirements are maintained on a consigned inventory basis. We purchase the metal out of consignment from our suppliers when it is ready to ship to a customer as a finished product. Our purchase price forms the basis for the price charged to the customer for the precious metal content and, therefore, the current cost is matched to the selling price, and the price exposure is minimized.

We are charged a consignment fee by the precious metal consignors that own the precious metals. This fee is a function of the market price of the metal, the quantity of metal we have on hand, and the rate charged by the institution. Because of market forces and competition, the fee can only be charged to customers in a limited case-by-case basis. Should the market price of precious metals that we have on consignment increase by 20% from the prices on December 31, 2022, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately $2.2 million on an annual basis. This calculation assumes no changes in the quantity of metal held on consignment or the underlying fee and that none of the additional fees are charged to customers.

To further limit price and financing rate exposures, under some circumstances, we will require customers to furnish their own metal for processing. Customers may also elect to provide their own material for us to process on a toll basis as opposed to purchasing our material.

The available capacity of our existing consignment lines to consign precious metals is a function of the quantity and price of the metals on hand. As prices increase, a given quantity of metal will utilize a larger proportion of the existing consignment lines. A significant prolonged increase in metal prices could result in our consignment lines being fully utilized, and, absent securing additional consignment line capacity from precious metal consignors, could require us to purchase precious metals rather than consign them, require customers to supply their own metal, and/or force us to turn down additional business opportunities. If we were in a significant precious metal ownership position, we might elect to use derivative financial instruments to hedge the potential price exposure. The cost to finance and potentially hedge the purchased inventory may also be higher than the consignment fee. The financial statement impact of the risk from rising metal prices impacting our consignment availability cannot be estimated at the present time.

In certain circumstances, we may elect to fix the price of precious metals for a customer for a stated quantity over a specified period of time. In those cases, we may secure hedge contracts with terms that match the terms in the agreement with our customer so that the gain or loss on the contract with the customer due to subsequent movements in the precious metal price will generally be offset by a gain or loss on the hedge contract. At December 31, 2022, we did not have a material amount of such hedge contracts outstanding.

Copper. We also use copper in our production processes. When possible, fluctuations in the purchase price of copper are passed on to customers in the form of price adders or reductions. While over time our price exposure to copper is generally in balance, there can be a lag between the change in our cost and the pass-through to our customers, resulting in higher or lower margins in a given period. To mitigate this impact, we hedge a portion of this pricing risk.

We consign the majority of our copper inventory requirements. As with precious metals, the available capacity under the existing lines is a function of the quantity and price of metal on hand. Should the market cost of copper increase by 20% from the price as of December 31, 2022, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately $0.5 million on an annual basis. This calculation assumes no changes in the quantity of inventory or the underlying fee and that none of the additional fees are charged to customers.

Lower of cost or net realizable value. In our manufacturing processes, we use various metals that are not widely used by others or actively traded and, therefore, there is no established efficient market for derivative financial instruments that could be used to effectively hedge the related price exposures. For certain applications, our pricing practice with respect to these metals is to establish the selling price based upon our cost to purchase the material, limiting our price exposure. However, the inventory carrying value may be exposed to market fluctuations. The inventory value is maintained at the lower of cost or net realizable value and if the market value were to drop below the carrying value, the inventory would have to be reduced accordingly and a charge recorded against cost of sales. This risk is mainly associated with long manufacturing lead-time items and with sludges and scrap materials, which generally have longer processing times to be refined or processed into a usable form for further manufacturing and are typically not covered by specific sales orders from customers. We did not record any material lower of cost or net realizable value charges in 2022, 2021, or 2020 as a result of market price fluctuations of metals in our inventories.

Interest rates. We are exposed to changes in interest rates on our cash balances and borrowings under our Credit Agreement. We may manage this interest rate exposure by maintaining a combination of short-term and long-term debt and variable and fixed rate instruments. We may also use interest rate swaps to fix the interest rate on variable rate obligations, as we deem appropriate. As of December 31, 2022 the fair value of our interest rate swap asset was $7.9 million. In February 2023 we amended the terms of the interest rate swap to hedge the change in 1-month USD-SOFR. See Note R for further discussion. Excess cash is typically invested in high quality instruments that mature in 90 days or less. Investments are made in compliance with policies approved by the Board of Directors.

Foreign currencies. Portions of our international operations sell products priced in foreign currencies, mainly the euro and yen, while the majority of these products' costs are incurred in U.S. dollars. We are exposed to currency movements in that if the U.S. dollar strengthens, the translated value of the foreign currency sale and the resulting margin on that sale will be reduced. To minimize this exposure, we may purchase foreign currency forward contracts, options, and collars in compliance with approved policies. If the dollar strengthened, the decline in the translated value of our margins would be at least partially offset by a gain on the hedge contract. A decrease in the value of the dollar would result in larger margins but potentially a loss on the contract, depending upon the method used to hedge the exposure. Our current policy limits our hedges to 80% or less of the forecasted exposure.

The notional value of outstanding currency contracts was $55.8 million as of December 31, 2022. If the dollar weakened 10% against the currencies we have hedged from the December 31, 2022 exchange rates, the reduced gain and/or increased loss on the outstanding contracts as of December 31, 2022 would reduce 2022 pre-tax profits by approximately $2.6 million. This reduction in profits would be primarily offset with the foreign currency gain from the 10% movement in the exchange rates with effective hedges.

Utilities. The cost of natural gas and electricity used in our operations may vary from year to year and from season to season. We attempt to minimize these fluctuations and the exposure to higher costs by utilizing fixed price agreements of set durations, when deemed appropriate, obtaining competitive bidding between regional energy suppliers, and other methods.

Economy. We are exposed to changes in global economic conditions and the potential impact those changes may have on various facets of our business. We have a program in place to closely monitor the credit worthiness and financial condition of our key providers of financial services, including our bank group and insurance carriers, as well as the credit worthiness of customers and vendors, and have various contingency plans in place.

Our bank lines are established with a number of different banks in order to mitigate our exposure to any one financial institution. All of the banks in our bank group had credit in good standing as of December 31, 2022. The financial statement impact from the risk of one or more of the banks in our bank group reducing our lines due to their insolvency or other causes cannot be estimated at the present time.

Item 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Management's Report on Internal Control over Financial Reporting

The management of Materion Corporation and subsidiaries is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rules 13a-15(f) and 15d-15(f). Materion Corporation and subsidiaries' internal control system was designed to provide reasonable assurance to the Company's management and Board of Directors regarding the preparation and fair presentation of published financial statements. All internal control systems, no matter how well designed, have inherent limitations. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation.

Materion Corporation and subsidiaries' management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2022. In making this assessment, it used the framework set forth by the Committee of Sponsoring Organizations of the Treadway Commission (the COSO criteria) in Internal Control - Integrated Framework (2013).

Based on our assessment we believe that, as of December 31, 2022, the Company's internal control over financial reporting is effective.

The effectiveness of our internal control over financial reporting as of December 31, 2022 has been audited by Ernst & Young LLP, an independent registered public accounting firm, as stated in their report.

Report of Independent Registered Public Accounting Firm

To the Shareholders and Board of Directors of Materion Corporation

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Materion Corporation and subsidiaries (the Company) as of December 31, 2022 and 2021, the related consolidated statements of income, comprehensive income, shareholders' equity and cash flows for each of the three years in the period ended December 31, 2022, and the related notes and financial statement schedule listed in the Index at Item 15(a) (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company’s internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated February 16, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audits. We are a public accounting firm registered with the 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 audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the 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 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 financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the financial statements that were communicated or required to be communicated to the audit committee and that: (1) relate to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters 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 matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Reconciliation of Precious Metals Consignment Inventory

Description of the matter

At December 31, 2022, the notional value of the Company's off-balance sheet precious metals was $373.1 million. As discussed in Note I to the consolidated financial statements, the Company uses estimates to measure the precious metal content within various refinement streams which can vary over time based upon the input materials, yield rates, and other process parameters.

Auditing the reconciliation of precious metals consignment inventory is complex due to the highly detailed nature of the inventory reconciliation and the amount of information that is obtained from third parties. A physical inventory is performed by the Company on a quarterly basis to verify the existence of inventory. The precious metals inventory reconciliation includes estimates based on assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volume of solutions and other materials within the refinery, data from refine vendors, and other factors. The reconciliation of precious metals consignment inventory presents the resulting calculated weight of the precious metals generated from these estimates within the Company's refine operations. This calculated weight may differ from what the Company's records indicate should be on hand, which would then result in an adjustment to pre-tax income.

How we addressed the matter in our audit

We obtained an understanding, evaluated the design and tested the operating effectiveness of controls over the Company's reconciliation of the precious metals consignment inventory process. This included controls over management's review of the significant inputs into and underlying the reconciliation.

To test the Company's reconciliation of the precious metals physical consignment inventory, our procedures included, among others, evaluating the significant assumptions and data used to estimate the total value of the precious metal, which was identified through the physical inventory. We observed the physical inventory process, tested inventory activity from the date of observation through December 31, 2022, evaluated the underlying data used in the reconciliation, and confirmed certain consigned inventory held with the third parties. We assessed the historical accuracy of management's estimates, which are based on assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volume of solutions and other materials within the refinery, data from their refine vendors, and other factors and assessed the historical accuracy of management's analysis to evaluate the assumptions that were most significant to the calculated weight of the precious metal inventory.

Precision Optics Goodwill Impairment Evaluation

Description of the matter	At December 31, 2022, the Company had goodwill of $319.5 million, of which, $86.7 million related to the Precision Optics reporting unit. As discussed in Notes A and M to the consolidated financial statements, due to recent acquisitions, the Company elected to perform a quantitative annual impairment assessment of its Precision Optics reporting unit's goodwill as of October 1, 2022, and concluded that there was no impairment, but the estimated fair value of the Precision Optics reporting unit exceeded the carrying value by less than 10%. Auditing the Company's Precision Optics reporting unit's goodwill impairment assessment was complex and highly judgmental due to the significant estimation required in determining the fair value of the reporting unit. In particular, the fair value estimate was sensitive to significant assumptions, such as the discount rate, revenue growth rates, terminal growth rate and EBITDA margins, which are affected by expectations about future market or economic conditions.
How we addressed the matter in our audit	We obtained an understanding, evaluated the design and tested the operating effectiveness of controls over the Company's Precision Optics reporting unit goodwill impairment process, including controls over the significant assumptions discussed above. We also tested management's controls over the completeness and accuracy of the underlying data used in its analysis. To test the estimated fair value of the Company's Precision Optics reporting unit, our audit procedures included, among others, assessing fair value methodologies and testing the significant assumptions discussed above and the underlying data used by the Company in its analysis. For example, we compared the significant assumptions used by management to current industry and economic trends, recent historical performance, and other relevant factors. We also assessed the historical accuracy of management's estimates and performed sensitivity analyses of significant assumptions to evaluate the changes in fair value that would result from changes in the assumptions. In addition, we involved our valuation specialists to assist with our evaluation of the methodology and significant assumptions used by the Company in the determination of the fair value for the Company's Precision Optics reporting unit.

/s/ Ernst & Young LLP

We have served as the Company's auditor since at least 1958, but we are unable to determine the specific year.

Cleveland, Ohio

February 16, 2023

Report of Independent Registered Public Accounting Firm

To the Shareholders and the Board of Directors of Materion Corporation

Opinion on Internal Control over Financial Reporting

We have audited Materion Corporation and subsidiaries' internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, Materion Corporation and subsidiaries (the Company) maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of Materion Corporation and subsidiaries as of December 31, 2022 and 2021, the related consolidated statements of income, comprehensive income, shareholders' equity and cash flows for each of the three years in the period ended December 31, 2022, and the related notes and financial statement schedule listed in the Index at Item 15(a) and our report dated February 16, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible 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 internal control over financial reporting based on our audit. We are a public accounting firm registered with the 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 audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

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.

/s/ Ernst & Young LLP

Cleveland, Ohio

February 16, 2023

Materion Corporation and Subsidiaries
Years Ended December 31, 2022, 2021, & 2020

Consolidated Statements of Income

(Thousands except per share amounts)	**2022**	2021	2020
Net sales	**$ 1,757,109**	$ 1,510,644	$ 1,176,274
Cost of sales	**1,413,229**	1,226,882	983,641
Gross margin	**343,880**	283,762	192,633
Selling, general, and administrative expense	**169,338**	163,777	133,963
Research and development expense	**28,977**	26,575	20,283
Goodwill impairment charges (Note M)	**—**	—	9,053
Asset impairment charges (Note M)	**—**	—	1,419
Restructuring expense (income)	**1,573**	(438)	11,237
Other — net (Note E)	**24,237**	16,737	8,463
Operating profit	**119,755**	77,111	8,215
Other non-operating (income) expense — net (Note O)	**(5,250)**	(5,115)	(3,939)
Interest expense — net (Note F)	**21,905**	4,901	3,879
Income before income taxes	**103,100**	77,325	8,275
Income tax expense (benefit) (Note G)	**17,110**	4,851	(7,187)
Net income	**$ 85,990**	$ 72,474	$ 15,462
Basic earnings per share:			
Net income per share of common stock	**$ 4.19**	$ 3.55	$ 0.76
Diluted earnings per share:			
Net income per share of common stock	**$ 4.14**	$ 3.50	$ 0.75
Weighted-average number of shares of common stock outstanding:			
Basic	**20,511**	20,422	20,338
Diluted	**20,760**	20,689	20,603

The accompanying notes are an integral part of the consolidated financial statements.

Materion Corporation and Subsidiaries
Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Comprehensive Income

(Thousands)	2022	2021	2020
Net income	**$ 85,990**	$ 72,474	$ 15,462
Other comprehensive income:			
Foreign currency translation adjustment	**(5,869)**	(6,904)	9,030
Derivative and hedging activity, net of tax expense (benefit) of $1,387, $482, and $(28), respectively	**4,655**	1,603	(80)
Pension and post-employment benefit adjustment, net of tax expense (benefit) of $518, $1,094 and $(651), respectively	**(526)**	3,771	(2,127)
Other comprehensive income (loss)	**(1,740)**	(1,530)	6,823
Comprehensive income	**$ 84,250**	$ 70,944	$ 22,285

The accompanying notes are an integral part of the consolidated financial statements.

Materion Corporation and Subsidiaries
Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Cash Flows

(Thousands)	2022	2021	2020
Cash flows from operating activities:			
Net income	**$ 85,990**	$ 72,474	$ 15,462
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation, depletion, and amortization	**53,436**	44,137	42,384
Amortization of deferred financing costs in interest expense	**1,734**	967	790
Stock-based compensation expense (non-cash)	**8,813**	6,517	5,528
Amortization of pension and post-retirement costs	**(146)**	437	(151)
Loss (gain) on sale of property, plant, and equipment	**14**	(282)	466
Deferred income tax (benefit) expense	**1,733**	(12,957)	(9,850)
Impairment charges	**—**	—	10,472
Net pension curtailments and settlements	**(551)**	—	94
Changes in assets and liabilities, net of acquired assets and liabilities:			
Decrease (increase) in accounts receivable	**(4,377)**	(30,490)	(707)
Decrease (increase) in inventory	**(63,986)**	(43,458)	(1,288)
Decrease (increase) in prepaid and other current assets	**(1,604)**	(3,855)	2,475
Increase (decrease) in accounts payable and accrued expenses	**12,860**	40,219	(21,877)
Increase (decrease) in unearned revenue	**207**	106	2,935
Increase (decrease) in interest and taxes payable	**154**	(220)	(157)
Increase (decrease) in unearned income due to customer prepayments	**21,942**	13,752	54,103
Other — net	**(261)**	2,894	378
Net cash provided by operating activities	**115,958**	90,241	101,057
Cash flows from investing activities:			
Payments for acquisition, net of cash acquired	**(2,971)**	(392,240)	(130,715)
Payments for purchase of property, plant, and equipment	**(77,608)**	(102,910)	(67,274)
Proceeds from settlement of currency exchange contract	**—**	—	3,249
Proceeds from sale of property, plant, and equipment	**850**	881	33
Net cash used in investing activities	**(79,729)**	(494,269)	(194,707)
Cash flows from financing activities:			
Proceeds from (repayments of) borrowings under revolving credit agreement, net	**(9,046)**	118,297	34,000
Proceeds from issuance of debt	**9,276**	300,000	—
Repayment of debt	**(19,299)**	(2,054)	(20,634)
Principal payments under finance lease obligations	**(2,736)**	(2,819)	(2,213)
Cash dividends paid	**(10,160)**	(9,697)	(9,257)
Deferred financing costs	**—**	(7,403)	—
Repurchase of common stock	**—**	—	(6,766)
Payments of withholding taxes for stock-based compensation awards	**(3,593)**	(3,318)	(2,221)
Net cash provided by (used in) financing activities	**(35,558)**	393,006	(7,091)
Effects of exchange rate changes	**(2,032)**	(394)	1,612
Net change in cash and cash equivalents	**(1,361)**	(11,416)	(99,129)
Cash and cash equivalents at beginning of period	**14,462**	25,878	125,007
Cash and cash equivalents at end of period	**$ 13,101**	$ 14,462	$ 25,878

The accompanying notes are an integral part of the consolidated financial statements.

Materion Corporation and Subsidiaries
December 31, 2022 and 2021

Consolidated Balance Sheets

(Thousands)	**2022**	2021
Assets		
Current assets		
Cash and cash equivalents (Note A)	**$ 13,101**	$ 14,462
Accounts receivable (Note A)	**215,211**	213,819
Inventories, net (Notes A and I)	**423,080**	361,115
Prepaid and other current assets	**39,056**	37,856
Total current assets	**690,448**	627,252
Deferred income taxes (Notes A and G)	**3,265**	5,431
Property, plant, and equipment (Notes A and J)	**1,209,205**	1,132,223
Less allowances for depreciation, depletion, and amortization	**(760,440)**	(723,248)
Property, plant, and equipment — net	**448,765**	408,975
Operating lease, right-of-use asset (Note L)	**64,249**	63,096
Intangible assets (Notes A and M)	**143,219**	156,736
Other assets (Note O)	**22,535**	27,369
Goodwill (Notes A and M)	**319,498**	318,620
Total Assets	**$ 1,691,979**	$ 1,607,479
Liabilities and Shareholders' Equity		
Current liabilities		
Short-term debt (Note N)	**$ 21,105**	$ 15,359
Accounts payable	**107,899**	86,243
Salaries and wages	**35,543**	37,544
Other liabilities and accrued items	**54,993**	53,388
Income taxes (Notes A and G)	**3,928**	4,205
Unearned revenue (Note D)	**15,496**	7,770
Total current liabilities	**238,964**	204,509
Other long-term liabilities	**12,181**	14,954
Operating lease liabilities (Note L)	**59,055**	57,099
Finance lease liabilities (Note L)	**13,876**	16,327
Retirement and post-employment benefits (Note O)	**20,422**	33,394
Unearned income (Notes A and K)	**107,736**	97,962
Long-term income taxes (Notes A and G)	**665**	1,190
Deferred income taxes (Notes A and G)	**28,214**	27,216
Long-term debt (Note N)	**410,876**	434,388
Shareholders' equity		
Serial preferred stock (no par value; 5,000 authorized shares, none issued)	**—**	—
Common stock (no par value; 60,000 authorized shares, issued shares of 27,148 for both 2022 and 2021)	**288,100**	271,978
Retained earnings	**769,418**	693,756
Common stock in treasury (6,605 shares for 2022 and 6,700 shares for 2021)	**(220,864)**	(209,920)
Accumulated other comprehensive loss (Note P)	**(41,909)**	(40,169)
Other equity	**5,245**	4,795
Total shareholders' equity	**799,990**	720,440
Total Liabilities and Shareholders' Equity	**$ 1,691,979**	$ 1,607,479

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The accompanying notes are an integral part of the consolidated financial statements.

Materion Corporation and Subsidiaries
Years Ended December 31, 2022, 2021, and 2020

Consolidated Statements of Shareholders' Equity

(Thousands)	Common Shares: Common Shares	Common Shares: Common Shares Held in Treasury	Shareholders' Equity: Common Stock	Shareholders' Equity: Retained Earnings	Shareholders' Equity: Common Stock In Treasury	Shareholders' Equity: Accumulated Other Comprehensive Income (Loss)	Shareholders' Equity: Other Equity	Shareholders' Equity: Total
Balance at December 31, 2019	**20,404**	**6,744**	**$ 249,674**	**$ 624,954**	**$(186,845)**	**$ (45,462)**	**$ 3,422**	**$ 645,743**
Net income	—	—	—	15,462	—	—	—	15,462
Other comprehensive income	—	—	—	—	—	6,729	—	6,729
Net pension curtailments and settlements	—	—	—	—	—	94	—	94
Cumulative effect of accounting change	—	—	—	—	—	—	—	—
Cash dividends declared ($0.455 per share)	—	—	—	(9,257)	—	—	—	(9,257)
Stock-based compensation activity	117	(117)	8,867	(101)	(3,147)	—	—	5,619
Payments for withholding taxes for stock-based compensation awards	(39)	39	—	—	(2,221)	—	—	(2,221)
Repurchase of shares	(158)	158	—	—	(6,766)	—	—	(6,766)
Directors' deferred compensation	4	(4)	101	—	(208)	—	334	227
Balance at December 31, 2020	**20,328**	**6,820**	**$ 258,642**	**$ 631,058**	**$(199,187)**	**$ (38,639)**	**$ 3,756**	**$ 655,630**
Net income	—	—	—	72,474	—	—	—	72,474
Other comprehensive income	—	—	—	—	—	(1,530)	—	(1,530)
Cash dividends declared ($0.475 per share)	—	—	—	(9,697)	—	—	—	(9,697)
Stock-based compensation activity	164	(164)	13,142	(79)	(6,546)	—	—	6,517
Payments for withholding taxes for stock-based compensation awards	(49)	49	—	—	(3,318)	—	—	(3,318)
Directors' deferred compensation	5	(5)	194	—	(869)	—	1,039	364
Balance at December 31, 2021	**20,448**	**6,700**	**$ 271,978**	**$ 693,756**	**$(209,920)**	**$ (40,169)**	**$ 4,795**	**$ 720,440**
Net income	—	—	—	85,990	—	—	—	85,990
Other comprehensive income	—	—	—	—	—	(1,740)	—	(1,740)
Cash dividends declared ($0.495 per share)	—	—	—	(10,160)	—	—	—	(10,160)
Stock-based compensation activity	135	(135)	15,977	(168)	(6,996)	—	—	8,813
Payments for withholding taxes for stock-based compensation awards	(43)	43	—	—	(3,593)	—	—	(3,593)
Directors' deferred compensation	3	(3)	145	—	(355)	—	450	240
Balance at December 31, 2022	**20,543**	**6,605**	**$ 288,100**	**$ 769,418**	**$(220,864)**	**$ (41,909)**	**$ 5,245**	**$ 799,990**

The accompanying notes are an integral part of the consolidated financial statements.

Note A — Significant Accounting Policies

Organization: Materion Corporation (the Company) is a holding company with subsidiaries that have operations in the United States, Europe, and Asia. These operations manufacture advanced engineered materials used in a variety of end markets, including semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center. The Company has four reportable segments: Performance Materials, Electronic Materials, Precision Optics, and Other. Other includes unallocated corporate costs.

Refer to Note C for additional segment details. The Company distributes its products through a combination of company-owned facilities and independent distributors and agents.

Business Combinations: The Company records assets acquired and liabilities assumed at the date of acquisition at their respective fair values. Intangible assets acquired in a business combination are recognized and reported apart from goodwill. Goodwill represents the excess purchase price over the fair value of the tangible net assets and intangible assets acquired in a business combination. Acquisition-related expenses are recognized separately from the business combination and are expensed as incurred.

See Note B for further discussion of the acquisition of HCS-Electronic Materials which was completed on November 1, 2021.

Use of Estimates: The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying notes. Actual results may differ from those estimates.

Consolidation: The Consolidated Financial Statements include the accounts of Materion Corporation and its subsidiaries. All of the Company's subsidiaries were wholly owned as of December 31, 2022. Intercompany accounts and transactions are eliminated in consolidation.

Cash Equivalents: All highly liquid investments with a maturity of three months or less when purchased are considered to be cash equivalents.

Accounts Receivable: An allowance for doubtful accounts is maintained for the expected losses resulting from the inability of customers to pay amounts due. The Company considers the current market conditions and credit losses related to the Company's trade receivables based on the macroeconomic environment, geographic considerations, and other expected market trends. Additionally, the allowance is based upon identified delinquent accounts, customer payment patterns, and other analyses of historical data and trends. Accounts receivable were net of an allowance for credit losses of $0.6 million and $0.5 million at December 31, 2022 and December 31, 2021, respectively. The change in the allowance for credit losses includes expense and net write-offs, neither of which were material. The Company extends credit to customers based upon their financial condition, and collateral is not generally required.

Inventories: Inventories are stated at net realizable value. The associated inventory reserve was $0.4 million and $0.3 million at December 31, 2022 and 2021, respectively. All of the Company's inventories, except for its bertrandite ore mine which values inventory using a weighted average cost method, including raw materials, manufacturing supplies inventory as well as international (outside the U.S.) inventories, have been valued using the first-in, first-out (FIFO) method as of December 31, 2022 and 2021.

Property, Plant, and Equipment: Property, plant, and equipment is stated on the basis of cost. Depreciation is computed principally by the straight-line method, except certain assets for which depreciation may be computed by the units-of-production method. The depreciable lives that are used in computing the annual provision for depreciation by class of asset are primarily as follows:

	Years
Land improvements	10 to 20
Buildings	20 to 40
Leasehold improvements	Life of lease
Machinery and equipment	3 to 15
Furniture and fixtures	4 to 10
Automobiles and trucks	3 to 8
Research equipment	3 to 10
Computer hardware	3 to 10
Computer software	3 to 10

An asset acquired under a finance lease will be recorded at the lesser of the present value of the projected lease payments or the fair value of the asset and will be depreciated in accordance with the above schedule. Leasehold improvements will be depreciated over the life of the improvement if it is shorter than the life of the lease. Repair and maintenance costs are expensed as incurred.

Mineral Resources and Mine Development: Property acquisition costs are capitalized as mineral resources on the balance sheet and are depleted using the units-of-production method based upon total estimated recoverable proven reserves of the beryllium-bearing bertrandite ore body. The Company uses beryllium pounds as the unit of accounting measure, and depletion expense is recorded on a pro-rata basis based upon the amount of beryllium pounds extracted as a percentage of total estimated beryllium pounds contained in the ore body.

Mine development costs at our open pit surface mines include drilling, infrastructure, other related costs to delineate an ore body and the removal of overburden to initially expose an ore body. Costs incurred before mineralization is classified as proven and probable reserves are expensed and classified as exploration expense. Capitalization of mine development project costs, that meet the definition of an asset, begins once mineralization is classified as proven and probable reserves.

In 2020, the Company expanded a mine to further develop an ore body. Since the pre-production phase ended when ore was first extracted from this mine, the Company recognized approximately $12.9 million of mine development costs in 2020 as a component of cost of sales. This expansion is expected to benefit future periods.

The cost of removing overburden and waste materials to access the ore body at an open-pit mine prior to the production phase is capitalized during the development of an open-pit mine and are capitalized at each pit. These costs are amortized as the ore is extracted using the units-of-production method based upon total estimated recoverable proven reserves for the individual pit. The Company uses beryllium pounds as the unit of accounting measure for recording amortization.

To the extent that the aforementioned costs benefit an entire ore body, the costs are amortized over the estimated useful life of the ore body. Costs incurred to access specific ore blocks or areas that only provide benefit over the life of that area are amortized over the estimated life of that specific ore block area.

Drilling costs incurred during the production phase for operational ore control are allocated to inventory costs and then included as a component of costs applicable to sales. All other drilling and related costs are expensed as incurred.

Goodwill and Other Intangible Assets: Goodwill is reviewed annually for impairment or more frequently if impairment indicators arise. The Company conducts its annual goodwill impairment assessment as of the first day of the fourth quarter, or more frequently under certain circumstances. For the purpose of the goodwill impairment assessment, the Company has the option to perform a qualitative assessment (commonly referred to as "step zero") to determine whether further quantitative analysis of impairment of goodwill is necessary or a quantitative assessment ("step one") where the Company estimates the fair value of each reporting unit using a discounted cash flow method (income approach). Goodwill is assigned to the reporting unit, which is the operating segment level or one level below the operating segment. Intangible assets with finite lives are amortized using the straight-line method or effective interest method, as applicable, over the periods estimated to be benefited, which is generally 20 years or less. Finite-lived intangible assets are also reviewed for impairment if facts and circumstances warrant.

Long-Lived Asset Impairment: Management performs impairment tests of long-lived assets, including property and equipment, whenever an event occurs or circumstances change that indicate that the carrying value may not be recoverable or the useful life of the asset has changed. Upon indications of impairment, assets and liabilities are grouped at the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities. The asset group would be considered impaired when the estimated future undiscounted cash flows generated by the asset group are less than its carrying value. If such undiscounted cash flows indicate that the carrying value of the asset group is not recoverable, impairment losses are measured by comparing the estimated fair value of the asset group to its carrying amount.

Derivatives: The Company recognizes all derivatives on the balance sheet at fair value. If the derivative is designated and effective as a cash flow hedge, changes in the fair value of the derivative are recognized in other comprehensive income, a component of shareholders' equity, until the hedged item is recognized in earnings. If the derivative is designated as a fair value hedge, changes in fair value are offset against the change in the fair value of the hedged asset, liability, or commitment through earnings. The ineffective portion of a derivative's change in fair value, if any, is recognized in earnings immediately. If a derivative is not a hedge, changes in its fair value are adjusted through the income statement.

Asset Retirement Obligation: The Company records a liability to recognize the legal obligation to remove an asset at the time the asset is acquired or when the legal liability arises. The liability is recorded for the present value of the ultimate obligation by discounting the estimated future cash flows using a credit-adjusted risk-free interest rate. The liability is accreted over time, with the accretion charged to expense. An asset equal to the fair value of the liability is recorded concurrent with the liability and depreciated over the life of the underlying asset.

Unearned Income: Expenditures for capital equipment to be reimbursed under government contracts are recorded in property, plant, and equipment, while the reimbursements for those expenditures are recorded in unearned income, a liability on the balance sheet. When the assets subject to reimbursement are placed in service, the total cost is depreciated over the useful lives, and the unearned income liability is reduced and credited to cost of sales on the Consolidated Statements of Income ratably with the annual depreciation expense.

Also included in Unearned Income as of December 31, 2022 and 2021, are $85.9 million and $72.6 million, respectively, of customer prepayments. See Note K for additional discussion.

Advertising Costs: The Company expenses all advertising costs as incurred. Advertising costs were $0.3 million in 2022, 2021, and 2020.

Stock-based Compensation: The Company recognizes stock-based compensation expense based on the grant date fair value of the award over the period during which an employee is required to provide service in exchange for the award. Stock-based awards include performance-based restricted stock units (PRSUs), restricted stock units (RSUs), and stock appreciation rights (SARs). The fair value of PRSUs and RSUs is primarily based on the closing market price of a share of the Company's common stock on the date of grant, modified as appropriate to take into account the features of such grants. SARs are granted with an exercise price equal to the closing price of the Company's common shares on the date of grant. The fair value of SARs is determined using a Black-Scholes option-pricing model, which incorporates assumptions regarding the expected volatility, the expected option life, the risk-free interest rate, and the expected dividend yield. The portion of the PRSU awards that are valued based on the Company's total shareholder return as compared to peers is valued using Monte Carlo simulations, which incorporates assumptions regarding the expected volatility, the expected correlation, and the risk-free interest rate. See Note Q for additional information about stock-based compensation.

Capitalized Interest: Interest expense associated with active capital asset construction and mine development projects is capitalized and amortized over the future useful lives of the related assets.

Income Taxes: The Company uses the liability method in measuring the provision for income taxes and recognizing deferred tax assets and liabilities on the balance sheet. The Company will record a valuation allowance to reduce the deferred tax assets to the amount that is more likely than not to be realized, as warranted by current facts and circumstances. The Company applies a more-likely-than-not recognition threshold for all tax uncertainties and will record a liability for those tax benefits that have a less than 50% likelihood of being sustained upon examination by the taxing authorities.

Net Income Per Share: Basic earnings per share (EPS) is computed by dividing income available to common stockholders by the weighted-average number of common shares outstanding for the period. Diluted EPS reflects the assumed conversion of all dilutive common stock equivalents as appropriate using the treasury stock method.

New Pronouncements Adopted:
In October 2021, the FASB issued ASU 2021-08, *Business Combinations (Topic 805): Accounting for Contract Assets and Contract Liabilities from Contracts with Customers*. This guidance requires companies to apply ASC 606 on the acquisition date to recognize and measure contract assets and contract liabilities from contracts with customers acquired in a business combination. This is an exception to the recognition and measurement principle in ASC 805 which generally requires an acquirer to recognize and measure the assets it acquires and the liabilities it assumes at fair value on the acquisition date. For

public entities, the guidance is effective for fiscal years beginning after December 15, 2022, and early adoption is permitted. The Company has early adopted this guidance and has applied it to the accounting for contract assets and contract liabilities acquired as part of the HCS-Electronic Materials (as defined in Note B) acquisition.

In March 2020, the FASB issued ASU 2020-04, *Reference Rate Reform (Topic 848): Facilitation of the Effects of Reference Rate Reform on Financial Reporting*. This guidance is intended to provide temporary optional expedients and exceptions to the U.S. GAAP guidance on contract modifications and hedge accounting to ease the financial reporting burden related to the expected market transition from the London Interbank Offered Rate (LIBOR) and other interbank offered rates to alternative reference rates. The guidance is available immediately and the Company has applied this guidance in accounting for the interest rate swap as discussed in Note R. Any additional reference rate reform impacts will be accounted for in accordance with ASU 2020-04.

No other recently issued or effective ASUs had, or are expected to have, a material effect on the Company's results of operations, financial condition, or liquidity.

Reclassifications

Certain items previously reported in specific financial statement captions have been reclassified to conform to the current presentation. These reclassifications had no impact on the Company's financial position, results of operations, or cash flows.

Note B — Acquisition

On November 1, 2021, the Company acquired the industry-leading electronic materials business of H.C. Starck Group GmbH (HCS-Electronic Materials) for a cash purchase price of approximately $398.9 million, on a cash-free, debt-free basis, subject to a customary purchase price adjustment mechanism. In 2022, acquisition-related inventory step-up expense was $7.5 million and classified in Cost of Sales and transaction and integration costs were $4.2 million and classified in Selling, General and Administrative expenses in the accompanying consolidated statements of income. The Company financed the purchase price for the HCS-Electronic Materials acquisition with a new $300 million five-year term loan pursuant to a delayed draw term loan facility entered during October 2021 and $103 million of borrowings under its amended revolving credit facility, which was also extended to expire five years in October 2026. This acquired business operates within the Performance Materials and Electronic Materials segments, and the results of operations are included as of the date of acquisition. The combination of Materion and HCS-Electronic Materials enhances the Company's position as the leading supplier to the high growth semiconductor industry.

During the period subsequent to the HCS-Electronic Materials acquisition, we made certain measurement period adjustments to the acquired assets and liabilities assumed due to clarification of information utilized to determine fair value during the measurement period. Additionally, we paid a working capital true-up of approximately $3.0 million during the second quarter of 2022, which increased the total purchase price. As of November 1 2022, the purchase price allocation was final. The following table sets forth cumulative measurement period changes since the acquisition date, as well as the initial allocation of the estimated fair value of the identifiable tangible and intangible assets acquired and liabilities assumed of HCS-Electronic Materials, with the excess recorded to goodwill:

(Thousands)	Initial Allocation of Consideration	Measurement Period Adjustments	Final Allocation
Assets:			
Cash and cash equivalents	$ 3,685	$ —	$ 3,685
Accounts receivable	28,352	35	28,387
Inventories	70,681	—	70,681
Prepaid and other current assets	660	(450)	210
Property, plant, and equipment	44,681	355	45,036
Operating lease, right-of-use assets	6,120	—	6,120
Intangible assets	107,800	—	107,800
Other long-term assets	4,528	—	4,528
Goodwill	178,181	3,144	181,325
Total assets acquired	$ 444,688	$ 3,084	$ 447,772
Liabilities:			
Accounts payable	$ 12,139	$ (240)	$ 11,899
Salaries and wages	2,516	$ 625	3,141
Other liabilities and accrued items	28	$ —	28
Income taxes	2,183	$ (457)	1,726
Other long-term liabilities	5,543	$ 215	5,758
Operating lease liabilities	6,042	$ —	6,042
Deferred income taxes	20,300	$ (30)	20,270
Total liabilities assumed	$ 48,751	$ 113	$ 48,864
Net assets acquired	$ 395,937	$ 2,971	$ 398,908

Assets acquired and liabilities assumed are recognized at their respective fair values as of the acquisition date. The Company engaged specialists to assist in the valuation of inventories, property, plant, and equipment, and intangible assets.

In determining the fair value of the amounts above, inventory is fair valued based on the comparative sales method for work in process and finished goods at the selling price less cost to dispose and remaining manufacturing effort. The remaining working capital accounts' carrying values approximate fair value. For property, plant and equipment and intangible asset values, the Company utilized various forms of the income, cost and market approaches depending on the asset being valued. The Company used a relief from royalty method under the income approach to value its trade names and developed technology and the multi-period excess earnings method under the income approach to value customer relationships. The significant assumptions used to estimate the fair value of these intangible assets included the discount rate and certain assumptions that form the basis of future cash flows (including revenue growth rates, royalty rates for trade names and developed technology, and attrition rates for customer relationships). Inputs were generally determined by taking into account independent appraisals and historical data, supplemented by current and anticipated market conditions and are considered Level 3 assets as the assumptions are unobservable inputs developed by the Company.

As part of the acquisition, the Company recorded approximately $181.3 million of goodwill allocated between its Electronic Materials and Performance Materials segments based on the relative fair values. Goodwill was calculated as the excess of the purchase price over the estimated fair values of the tangible net assets and intangible assets acquired and primarily attributable to the synergies expected to arise after the acquisition dates. The goodwill is not expected to be deductible for U.S. tax purposes.

The following table reports the intangible assets by asset category as of the closing date:

(Thousands)	Value at Acquisition	Useful Life
Customer relationships	$ 50,200	13 years
Technology	35,300	13 years
Trade name	22,300	15 years
Total	$ 107,800	

Had the HCS-Electronic Materials acquisition occurred as of the beginning of fiscal 2020, the Company's sales and income (loss) before taxes would have been as follows:

	(Unaudited) Year Ended December 31,			
	2021		2020	
Net Sales	$	1,659,620	$	1,308,300
Profit income (loss) before taxes	$	91,551	$	(17,761)

The unaudited pro forma financial information has been calculated after applying our accounting policies and adjusting the historical results with pro forma adjustments that assume the acquisition occurred on January 1, 2020. These unaudited pro forma results do not represent financial results realized, nor are they intended to be a projection of future results. The transaction accounting adjustments and other adjustments are based on available information and assumptions that the Company’s management believes are reasonable. Such adjustments are estimates and actual experience may differ from expectations. The amortization of inventory step-up from the preliminary purchase price allocation of approximately $15 million of expense is reflected in the 2020 unaudited pro forma income (loss) before taxes above. Additionally, the 2020 pro forma income (loss) before taxes includes approximately $10 million of additional interest expense related to committed financing to fund the acquisition, annual acquisition-related intangible asset amortization expense of $8.2 million, and transaction expenses of $5.5 million as if it occurred on January 1, 2020.

Note C — Segment Reporting and Geographic Information

The Company changed two segment names during the first quarter of 2022: Performance Alloys and Composites became Performance Materials, and Advanced Materials became Electronic Materials. The Company believes these names better represent the markets served and the advanced next-generation product solutions provided to our customers. Other than the name changes, there were no changes in the composition or structure of the Company's reportable segments in 2022.

The Company has the following operating segments: Performance Materials, Electronic Materials, Precision Optics, and Other. The Company’s operating segments represent components of the Company for which separate financial information is available that is utilized on a regular basis by the Chief Executive Officer, the Company's Chief Operating Decision Maker, in determining how to allocate the Company’s resources and evaluate performance. The segments are determined based on several factors, including the availability of discrete financial information and the Company’s organizational and management structure.

Performance Materials provides advanced engineered solutions comprised of beryllium and non-beryllium containing alloy systems and custom engineered parts in strip, bulk, rod, plate, bar, tube, and other customized shapes.

Electronic Materials produces advanced chemicals, microelectronics packaging, precious metal, non-precious metal, and specialty metal products, including vapor deposition targets, frame lid assemblies, clad and precious metal preforms, high temperature braze materials, and ultra-fine wire.

Precision Optics produces thin film coatings, optical filter materials, sputter-coated, and precision-converted thin film materials.

The Other reportable segment includes unallocated corporate costs and assets.

Beginning with the first quarter of 2022, the Company began using earnings before interest, taxes, depreciation, depletion and amortization (EBITDA) as the main operating income metric used by management to measure the financial performance of the Company and each segment. The Company made this change because recent acquisitions have resulted in increased purchase accounting amortization expense, which in turn has affected the comparability of results across periods and when compared to other companies. Management believes EBITDA is useful to investors as it better represents the Company's performance, excluding the effect of the recent acquisition of significant intangible assets that are now being amortized. EBITDA is not a measurement of financial performance under U.S. GAAP. Although the Company uses EBITDA to assess the performance of its business and for various other purposes, the use of this non-GAAP financial measure as an analytical tool has limitations, and it should not be considered in isolation or as a substitute for analysis of the Company’s results of operations as reported in accordance with U.S. GAAP.

The below table presents financial information for each segment and a reconciliation of EBITDA to Net Income (the most directly comparable GAAP financial measure) for 2022 and 2021:

(Thousands)	2022	2021
Net sales:		
Performance Materials[1]	**$ 671,525**	$ 511,874
Electronic Materials[1]	**$ 971,902**	866,816
Precision Optics	**113,682**	131,954
Other	**—**	—
Net sales	**1,757,109**	1,510,644
Segment EBITDA:		
Performance Materials	**$ 125,227**	89,028
Electronic Materials	**67,806**	$ 44,852
Precision Optics	**13,753**	25,854
Other	**(28,345)**	(33,371)
Total Segment EBITDA	**178,441**	126,363
Income tax expense	**17,110**	4,851
Interest expense - net	**21,905**	4,901
Depreciation, depletion and amortization	**53,436**	44,137
Net income	**$ 85,990**	$ 72,474

(1) Excludes inter-segment sales of $0.7 million for Performance Materials and $14.0 million for Electronic Materials for 2022 and $0.2 million for Performance Materials and $13.9 million for Electronic Materials for 2021. Inter-segment sales are eliminated in consolidation.

Other geographic information includes the following:

(Thousands)	2022	2021	2020
Net sales			
United States	**$ 867,053**	$ 794,862	$ 641,727
Asia	**519,395**	426,303	329,968
Europe	**355,691**	270,213	189,281
All other	**14,970**	19,266	15,298
Total	**$ 1,757,109**	$ 1,510,644	$ 1,176,274
Property, plant, and equipment, net by country deployed			
United States	**$ 372,779**	$ 327,969	$ 223,340
All other	**75,986**	81,006	86,346
Total	**$ 448,765**	$ 408,975	$ 309,686

International sales include sales from international operations and direct exports from our U.S. operations. No individual country, other than the United States, or customer accounted for 10% or more of the Company's net sales for the years presented.

The following table disaggregates revenue for each segment by end market for 2022 and 2021:

(Thousands)	Performance Materials	Electronic Materials	Precision Optics	Other	Total
2022					
End Market					
Semiconductor	**$ 8,666**	**$ 784,517**	**$ 5,107**	**$ —**	**$ 798,290**
Industrial	**168,012**	**47,407**	**31,948**	**—**	**247,367**
Aerospace and Defense	**110,884**	**5,882**	**16,988**	**—**	**133,754**
Consumer Electronics	**49,859**	**1,144**	**22,666**	**—**	**73,669**
Automotive	**93,581**	**7,590**	**9,922**	**—**	**111,093**
Energy	**50,021**	**98,844**	**—**	**—**	**148,865**
Telecom and Data Center	**65,230**	**149**	**—**	**—**	**65,379**
Other	**125,272**	**26,369**	**27,051**	**—**	**178,692**
Total	**$ 671,525**	**$ 971,902**	**$ 113,682**	**$ —**	**$ 1,757,109**
2021					
End Market					
Semiconductor	$ 8,481	$ 683,085	$ 2,572	$ —	$ 694,138
Industrial	123,337	45,025	32,779	—	201,141
Aerospace and Defense	86,046	5,509	23,622	—	115,177
Consumer Electronics	41,694	1,184	32,485	—	75,363
Automotive	105,466	7,321	8,356	—	121,143
Energy	23,913	99,330	—	—	123,243
Telecom and Data Center	53,510	173	—	—	53,683
Other	69,427	25,189	32,140	—	126,756
Total	$ 511,874	$ 866,816	$ 131,954	$ —	$ 1,510,644

Note D — Revenue Recognition

Net sales consist primarily of revenue from the sale of precious and non-precious specialty metals, beryllium and copper-based alloys, beryllium composites, and other products into numerous end markets. The Company requires an agreement with a customer that creates enforceable rights and performance obligations. The Company generally recognizes revenue, in an amount that reflects the consideration to which it expects to be entitled, upon satisfaction of a performance obligation by transferring control over a product to the customer. Control over the product is generally transferred to the customer when the Company has a present right to payment, the customer has legal title, the customer has physical possession, the customer has the significant risks and rewards of ownership, and/or the customer has accepted the product.

Shipping and Handling Costs: The Company accounts for shipping and handling activities related to contracts with customers as costs to fulfill its promise to transfer the associated products. Accordingly, customer payments for shipping and handling costs are recorded as a component of net sales, and related costs are recorded as a component of cost of sales.

Taxes Collected from Customers and Remitted to Governmental Authorities*:* Revenue is recorded net of taxes collected from customers that are remitted to governmental authorities, with the collected taxes recorded as current liabilities until remitted to the relevant government authority.

Product Warranty: Substantially all of the Company's customer contracts contain a warranty that provides assurance that the purchased product will function as expected and in accordance with certain specifications. The warranty is intended to safeguard the customer against existing defects and does not provide any incremental service to the customer.

Transaction Price Allocated to Future Performance Obligations: ASC 606 requires that the Company disclose the aggregate amount of transaction price that is allocated to performance obligations that have not yet been satisfied at December 31, 2022. Remaining performance obligations include non-cancelable purchase orders and customer contracts. The guidance provides certain practical expedients that limit this requirement. As such, the Company does not disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less. After considering the practical expedient, at December 31, 2022, the aggregate amount of the transaction price allocated to remaining performance obligations was approximately $63.9 million.

Contract Costs: The Company recognizes the incremental costs of obtaining contracts as an expense when incurred if the amortization period of the assets that the Company otherwise would have recognized is one year or less. These costs primarily relate to sales commissions, which are included in selling, general, and administrative expenses.

Contract Balances: The timing of revenue recognition, billings, and cash collections resulted in the following contract assets and contract liabilities:

(Thousands)	**December 31, 2022**	December 31, 2021	$ change	% change
Accounts receivable, trade	**$ 215,726**	$ 213,584	$ 2,142	1 %
Unbilled receivables	**10,765**	7,961	2,804	35 %
Unearned revenue	**15,496**	7,770	7,726	99 %

Accounts receivable, trade represents payments due from customers relating to the transfer of the Company's products and services. The Company believes that its receivables are collectible and appropriate allowances for doubtful accounts have been recorded. Impairment losses (bad debt) incurred relating to our receivables were immaterial during 2022.

Unbilled receivables represent expenditures on contracts, plus applicable profit margin, not yet billed. Unbilled receivables are normally billed and collected within one year. Billings made on contracts are recorded as a reduction of unbilled receivables.

Unearned revenue is recorded for consideration received from customers in advance of satisfaction of the related performance obligations. The Company recognized approximately $7.1 million of the December 31, 2021 unearned amounts as revenue during 2022. The Company recognized approximately $6.8 million of the December 31, 2020 unearned amounts as revenue during 2021.

As a practical expedient, the Company does not adjust the promised amount of consideration for the effects of a significant financing component because the period between the transfer of a product or service to a customer and when the customer pays for that product or service will be one year or less. The Company does not include extended payment terms in its contracts with customers.

Note E — Other-net

Other-net is summarized for 2022, 2021, and 2020 as follows:

	(Income) Expense		
(Thousands)	**2022**	**2021**	**2020**
Metal consignment fees	**$ 12,212**	$ 9,305	$ 8,587
Amortization of intangible assets	**12,400**	5,973	2,377
Foreign currency loss (gain)	**(679)**	1,573	(2,569)
Net (gain) loss on disposal of fixed assets	**14**	(282)	466
Other items	**290**	168	(398)
Total other-net	**$ 24,237**	$ 16,737	$ 8,463

Note F — Interest Expense-net

The following chart summarizes the interest incurred, capitalized, and paid in 2022, 2021, and 2020:

(Thousands)	**2022**	**2021**	**2020**
Interest incurred, net	**$ 23,014**	$ 5,277	$ 3,889
Less: Capitalized interest	**1,109**	376	10
Total net expense	**$ 21,905**	$ 4,901	$ 3,879
Interest paid	**$ 21,190**	$ 3,652	$ 3,442

The increase in interest expense in 2022 versus 2021 was driven by increased borrowings under our revolving credit facility and new term loan during 2021 primarily to finance the acquisition of HCS-Electronic Materials. Amortization of deferred financing costs within interest expense was $1.7 million in 2022, $1.0 million in 2021, and $0.8 million in 2020.

Note G — Income Taxes

On August 9, 2022, President Biden signed the CHIPS and Science Act (CHIPS Act) into law. The CHIPS Act provides incentives, beginning in 2023, for manufacturing semiconductors and certain tooling equipment used in the semiconductor manufacturing process. On August 16, 2022, President Biden also signed the Inflation Reduction Act of 2022 (IRA) into law. The IRA, among other provisions, includes a new corporate alternative minimum tax on certain large corporations, an excise tax on stock buybacks, and tax credits for certain critical minerals. The Company does not expect to be an applicable corporation subject to the alternative minimum tax based on our reported GAAP earnings the past three years. The CHIPS Act and the IRA did not have an impact to our consolidated financial statements for the year ended December 31, 2022. We continue to examine the impacts the CHIPS Act and the IRA may have on the Company in 2023 and subsequent years.

Income (loss) before income taxes and income tax expense (benefit) are comprised of the following:

(Thousands)	2022	2021	2020
Income (loss) before income taxes:			
Domestic	**$ 90,403**	$ 54,684	$ (1,153)
Foreign	**12,697**	22,641	9,428
Total income (loss) before income taxes	**$ 103,100**	$ 77,325	$ 8,275
Income tax expense:			
Current income tax expense (benefit):			
Domestic	**$ 12,571**	$ 14,603	$ 812
Foreign	**2,806**	3,205	1,851
Total current	**$ 15,377**	$ 17,808	$ 2,663
Deferred income tax (benefit) expense:			
Domestic	**$ 588**	$ (7,953)	$ (5,641)
Foreign	**1,145**	(5,004)	(4,209)
Total deferred	**$ 1,733**	$ (12,957)	$ (9,850)
Total income tax expense (benefit)	**$ 17,110**	$ 4,851	$ (7,187)

A reconciliation of the U.S. federal statutory income tax rate to the Company's effective income tax rate is as follows:

	2022	2021	2020
U.S. federal statutory rate	**21.0 %**	21.0 %	21.0 %
State and local income taxes, net of federal tax effect	**1.7**	(0.3)	(10.0)
Effect of excess of percentage depletion over cost depletion	**(3.1)**	(3.4)	(43.0)
Foreign derived intangible income deduction	**(1.7)**	(2.3)	(1.8)
Non-deductible goodwill impairment	**—**	—	7.1
Research and development tax credit	**(2.0)**	(1.2)	(16.4)
Impact of foreign operations	**0.6**	0.3	(5.3)
Non-deductible transaction costs	**—**	1.6	6.9
Interest from tax authorities	**—**	—	(3.8)
Adjustment to unrecognized tax benefits	**(0.5)**	(1.9)	1.8
Equity compensation	**(0.9)**	(0.5)	(5.3)
Non-deductible officers' compensation	**1.2**	1.4	6.8
Valuation allowance	**0.6**	(8.5)	(45.5)
Other items	**(0.3)**	0.1	0.6
Effective tax rate	**16.6 %**	6.3 %	(86.9)%

Deferred tax assets and (liabilities) are determined based on temporary differences between the financial reporting and tax basis of assets and liabilities. Deferred tax assets and (liabilities) recorded in the Consolidated Balance Sheets consist of the following:

(Thousands)	December 31, 2022	December 31, 2021
Asset (liability)		
Post-employment benefits other than pensions	**$ 1,230**	$ 1,714
Other reserves	**1,831**	1,901
Deferred compensation	**3,850**	3,263
Environmental reserves	**1,321**	1,358
Inventory	**6,118**	—
Research expenditures	**7,069**	—
Revenue recognition	**7,878**	5,027
Lease liabilities	**12,651**	11,639
Interest expense carryforward	**12,470**	14,163
Pensions	**—**	1,393
Accrued compensation expense	**5,477**	6,410
Net operating loss and credit carryforwards	**9,915**	11,423
Subtotal	**69,810**	58,291
Valuation allowance	**(4,935)**	(4,957)
Total deferred tax assets	**64,875**	53,334
Depreciation	**(42,481)**	(24,484)
Lease assets	**(12,078)**	(11,184)
Inventory	**—**	(2,329)
Amortization	**(32,925)**	(35,542)
Mine development	**—**	(917)
Pensions	**(400)**	—
Unrealized gains	**(1,940)**	(663)
Total deferred tax liabilities	**(89,824)**	(75,119)
Net deferred tax liabilities	**$ (24,949)**	$ (21,785)

The Company had deferred income tax assets offset with a valuation allowance for certain foreign and state net operating losses, a domestic capital loss carryforward, state investment and research and development tax credit carryforwards, and deferred tax assets that are not likely to be realized for certain of the Company's controlled foreign corporations. The Company intends to maintain a valuation allowance on these deferred tax assets until a realization event occurs to support reversal of all or a portion of the allowance.

At December 31, 2022, for income tax purposes, the Company had foreign net operating loss carryforwards of $21.2 million that do not expire, and $3.2 million that expire in calendar years 2023 through 2027. The Company had state net operating loss carryforwards of $16.3 million that expire in calendar years 2023 through 2040 and state tax credits of $4.1 million that expire in calendar years 2023 through 2037. The Company also had a capital loss carryforward of $7.4 million that expires in 2026. A valuation allowance of $4.9 million has been provided against certain foreign and state net operating loss carryforwards, a U.S. capital loss carryforward, and state tax credits due to uncertainty of their realization.

The Company files income tax returns in the U.S. federal jurisdiction, and in various state, local, and foreign jurisdictions. With limited exceptions, the Company is no longer subject to U.S. federal examinations for years before 2019, state and local examinations for years before 2018, and foreign examinations for tax years before 2017.

We operate under a tax holiday in Malaysia, which was extended and is effective through July 31, 2027. The tax holiday is conditional upon our meeting certain employment, sales, and investment thresholds. The impact of this holiday decreased foreign taxes by $3.0 million in 2022.

A reconciliation of the Company’s unrecognized tax benefits for the year-to-date periods ended December 31, 2022 and 2021 is as follows:

(Thousands)	2022	2021
Balance at January 1	**$ 1,142**	$ 2,360
Additions to tax provisions related to the current year	**—**	431
Additions to tax positions related to prior years	**—**	—
Reduction to tax positions related to prior years	**(8)**	(45)
Lapses on statutes of limitations	**(482)**	(1,604)
Balance at December 31	**$ 652**	$ 1,142

Included in the balance of unrecognized tax benefits, including interest and penalties, as of December 31, 2022 and December 31, 2021 are $0.7 million and $1.2 million, respectively, of tax benefits that would affect the Company’s effective tax rate if recognized. It is reasonably possible that the amount of unrecognized tax benefits will change in the next twelve months; however, we do not expect the change to have a material impact on the Consolidated Statements of Income or the Consolidated Balance Sheets.

The Company recognizes interest and penalties related to unrecognized tax benefits on the income tax expense line in the accompanying Consolidated Statements of Income. Accrued interest and penalties are included on the related tax liability line in the Consolidated Balance Sheets. The amount of interest and penalties, net of the related tax benefit, recognized in earnings was immaterial during 2022, 2021, and 2020. As of December 31, 2022 and 2021, accrued interest and penalties, net of the related tax benefit, were immaterial.

Income taxes paid during 2022, 2021, and 2020, were approximately $14.5 million, $21.8 million, and $3.9 million, respectively.

No additional income taxes have been provided for any remaining undistributed foreign earnings not subject to the transition tax, or any additional outside basis difference inherent in these entities, as these amounts continue to be indefinitely reinvested in foreign operations as of December 31, 2022. The amount of such unrepatriated earnings totaled $105.4 million as of December 31, 2022. It is not practicable to estimate the additional income taxes and applicable withholding taxes that would be payable on the remittance of such undistributed earnings.

Note H — Earnings Per Share

The following table sets forth the computation of basic and diluted EPS:

(Thousands except per share amounts)	2022	2021	2020
Numerator for basic and diluted EPS:			
Net income	**$ 85,990**	$ 72,474	$ 15,462
Denominator:			
Denominator for basic EPS:			
Weighted-average shares outstanding	**20,511**	20,422	20,338
Effect of dilutive securities:			
Stock appreciation rights	**81**	78	39
Restricted stock units	**102**	124	102
Performance-based restricted stock units	**66**	65	124
Diluted potential common shares	**249**	267	265
Denominator for diluted EPS:			
Adjusted weighted-average shares outstanding	**20,760**	20,689	20,603
Basic EPS	**$ 4.19**	$ 3.55	$ 0.76
Diluted EPS	**$ 4.14**	$ 3.50	$ 0.75

Equity awards covering shares of common stock totaling 56,636 in 2022, 55,598 in 2021, and 166,255 in 2020 were excluded from the diluted EPS calculation as their effect would have been anti-dilutive.

Note I — Inventories, net

Inventories in the Consolidated Balance Sheets are summarized as follows:

	December 31,	
(Thousands)	2022	2021
Raw materials and supplies	$ 113,694	$ 93,518
Work in process	249,105	221,638
Finished goods	60,281	45,959
Inventories, net	423,080	361,115

Inventory balances are presented net of an excess and obsolete reserve totaling $19.8 million and $23.9 million at December 31, 2022 and December 31, 2021, respectively.

The Company takes and records the results of a physical inventory count of its precious metals on a quarterly basis. The Company's precious metal operations include a refinery that processes precious metal-containing scrap and other materials from its customers, as well as its own internally generated scrap. The Company also outsources portions of its refining requirements to other vendors, particularly those materials with longer processing times. The precious metal content within these various refine streams may be in solutions, sludges, and other non-homogeneous forms and can vary over time based upon the input materials, yield rates, and other process parameters. The determination of the weight of the precious metal content within the refine streams as part of a physical inventory count requires the use of estimates and calculations based upon assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volumes of solutions and other materials within the refinery, data from the Company's refine vendors, and other factors. The resulting calculated weight of the precious metals in the Company's refine operations may differ, in either direction, from what its records indicate that the Company should have on hand, which would then result in an adjustment to its pre-tax income in the period when the physical inventory was taken, and the related estimates were made.

The Company maintains the majority of the precious metals and copper used in production on a consignment basis in order to reduce our exposure to metal price movements and to reduce our working capital investment. The notional value of off-balance sheet precious metals and copper was $373.1 million as of December 31, 2022 versus $480.2 million as of December 31, 2021.

Note J — Property, Plant, and Equipment

Property, plant, and equipment on the Consolidated Balance Sheets is summarized as follows:

	December 31,	
(Thousands)	2022	2021
Land	$ 26,579	$ 26,627
Buildings	200,223	173,907
Machinery and equipment	770,628	687,502
Software	44,886	45,445
Construction in progress	100,188	130,838
Allowances for depreciation	(720,455)	(690,166)
Subtotal	422,049	374,153
Finance leases	31,662	32,865
Allowances for depreciation	(7,395)	(6,193)
Subtotal	24,267	26,672
Mineral resources	4,980	4,980
Mine development	30,059	30,059
Allowances for amortization and depletion	(32,590)	(26,889)
Subtotal	2,449	8,150
Property, plant, and equipment — net	$ 448,765	$ 408,975

The Company received $63.5 million from the U.S. Department of Defense (DoD), in previous periods, for reimbursement of the DoD's share of the cost of equipment. This amount was recorded in property, plant, and equipment and the reimbursements are reflected in Unearned income on the Consolidated Balance Sheets. The equipment was placed in service during 2012, and its full cost is being depreciated in accordance with Company policy. The unearned income liability is being reduced ratably with the depreciation expense recorded over the life of the equipment. Unearned income was reduced by $4.4 million in 2022 and $4.3 million in both 2021 and 2020 and credited to cost of sales in the Consolidated Statements of Income, offsetting the impact of the depreciation expense on the associated equipment on the Company's cost of sales and gross margin. The unamortized unearned income balance was $15.3 million and $19.7 million at December 31, 2022 and December 31, 2021, respectively.

We recorded depreciation and depletion expense of $35.2 million in 2022, $31.4 million in 2021, and $30.9 million in 2020. Depreciation, depletion, and amortization as shown on the Consolidated Statement of Cash Flows is net of the reduction in the unearned income liability in 2022, 2021, and 2020. The net carrying value of capitalized software was $4.6 million and $5.4 million at December 31, 2022 and December 31, 2021, respectively. Depreciation expense related to software was $1.8 million in 2022, 2021, and 2020, respectively.

As of December 31, 2022 and December 31, 2021 capital expenditures in accounts payable was $12.1 million and $2.1 million, respectively.

Note K — Customer Prepayments

In 2020, the Company entered into an investment agreement and a master supply agreement with a customer to procure equipment to manufacture product for the customer. The customer provided prepayments to the Company to fund the necessary infrastructure improvements and procure the equipment necessary to supply the customer with the desired product. The Company owns, operates and maintains the equipment that is being used to manufacture product for the customer.

Revenue will be recognized as the Company fulfills purchase orders and ships the commercial product to the customer, as product delivery is considered the satisfaction of the performance obligation.

Additionally, during the second quarter of 2022, the Company entered into an amendment to the investment agreement with the same customer to procure additional equipment to manufacture product for the customer. As of December 31, 2022, the Company has received approximately $21.9 million in prepayments under the terms of this amended agreement.

As of December 31, 2022 and 2021, $85.9 million and $72.6 million, respectively, of prepayments are classified as Unearned income on the Consolidated Balance Sheet. The prepayments will remain in Unearned income until commercial purchase orders are received for product serviced out of the equipment, at which time a portion of the purchase order value related to prepayments will be reclassified to Unearned revenue. As of December 31, 2022 $4.5 million of the prepayments are classified as Unearned revenue. No amounts of the prepayments were classified as short-term unearned revenue as of December 31, 2021

Note L — Leasing Arrangements

The Company leases warehouse and manufacturing real estate, and manufacturing and computer equipment under operating leases with lease terms ranging up to 25 years. Several operating lease agreements contain options to extend the lease term and/or options for early termination. The lease term consists of the non-cancelable period of the lease, periods covered by options to extend the lease if the Company is reasonably certain to exercise the option, and periods covered by an option to terminate the lease if the Company is reasonably certain not to exercise the option. As of December 31, 2022, we had no material leases that had yet to commence.

The discount rate implicit within the leases is generally not determinable, and, therefore, the Company determines the discount rate based on its incremental borrowing rate. The incremental borrowing rate for leases is determined based on the lease term over which lease payments are made, adjusted for the impact of collateral.

The components of operating and finance lease cost for 2022 and 2021 were as follows:

(Thousands)	2022	2021
Components of lease expense		
Operating lease cost	**$ 13,381**	$ 11,825
Finance lease cost		
Amortization of right-of-use assets	**1,202**	1,989
Interest on lease liabilities	**819**	1,009
Total lease cost	**$ 15,402**	$ 14,823

The Company straight-lines its expense of fixed payments for operating leases over the lease term and expenses the variable lease payments in the period incurred. These variable lease payments are not included in the calculation of right-of-use assets or lease liabilities.

Supplemental balance sheet information related to the Company's operating and finance leases as of December 31, 2022 and 2021 is as follows:

(Thousands, except lease term and discount rate)	2022	2021
Supplemental balance sheet information		
Operating Leases		
Operating lease right-of-use assets	**$ 64,249**	$ 63,096
Other liabilities and accrued items	**8,401**	7,906
Operating lease liabilities	**59,055**	57,099
Finance Leases		
Property, plant, and equipment	**$ 31,662**	$ 32,865
Allowances for depreciation, depletion, and amortization	**(7,395)**	(6,193)
Finance lease assets, net	**$ 24,267**	$ 26,672
Other liabilities and accrued items	**$ 1,485**	$ 2,800
Finance lease liabilities	**13,876**	16,327
Total principal payable on finance leases	**$ 15,361**	$ 19,127
Weighted Average Remaining Lease Term		
Operating leases	**11.78**	11.47
Finance leases	**17.98**	16.96
Weighted Average Discount Rate		
Operating leases	**6.08%**	6.19%
Finance leases	**5.11%**	4.99%

Future maturities of the Company's lease liabilities as of December 31, 2022 are as follows:

(Thousands)	Finance Leases	Operating Leases
2023	$ 2,216	$ 12,338
2024	1,385	9,642
2025	1,230	8,743
2026	1,204	7,355
2027	1,204	5,913
2028 and thereafter	16,579	51,574
Total lease payments	23,818	95,565
Less amount of lease payment representing interest	8,457	28,109
Total present value of lease payments	$ 15,361	$ 67,456

Supplemental cash flow information related to leases was as follows:

(Thousands)	2022	2021
Supplemental cash flow information		
Cash paid for amounts included in the measurement of lease liabilities:		
Operating cash flows from operating leases	**$ 19,653**	$ 17,580
Operating cash flows from finance leases	**818**	1,009
Financing cash flows from finance leases	**2,736**	2,819
Right-of-use assets obtained in exchange for lease obligations:		
Operating leases	**9,967**	9,191
Finance leases	**—**	—

Note M — Intangible Assets and Goodwill

Intangible Assets

The cost and accumulated amortization of intangible assets subject to amortization as of December 31, 2022 and 2021, is as follows:

	2022			2021		
(Thousands)	Gross Carrying Amount	Accumulated Amortization	Net	Gross Carrying Amount	Accumulated Amortization	Net
Customer relationships	**$ 110,347**	**$ (28,950)**	**$ 81,397**	$ 111,220	$ (22,777)	$ 88,443
Technology	**44,886**	**(10,420)**	**34,466**	45,014	(6,917)	38,097
Licenses and other	**34,300**	**(10,562)**	**23,738**	34,468	(7,879)	26,589
Total	**$ 189,533**	**$ (49,932)**	**$ 139,601**	$ 190,702	$ (37,573)	$ 153,129

During 2021, the Company acquired $50.2 million in customer relationships with a useful life of 13 years and $35.3 million in technology with a useful life of 13 years, as well as a $22.3 million trade name with a useful life of 15 years related to the HCS-Electronic Materials acquisition.

During 2020, the Company accelerated amortization on $26.2 million of intangible assets for its LAC business that was shut down on December 31, 2020. These assets were fully amortized as of December 31, 2020 and fully written off in 2021 with no impact to the Consolidated Statements of Income in 2021.

Amortization expense for 2022, 2021, and 2020 was $12.4 million, $6.0 million, and $2.4 million, respectively.

Estimated amortization expense for each of the five succeeding years is as follows:

(Thousands)	Amortization Expense
2023	12,473
2024	12,473
2025	11,851
2026	10,626
2027	10,471

Intangible assets also includes deferred costs relating to the Company's revolving credit and consignments lines of $3.6 million and $3.6 million at December 31, 2022 and 2021, respectively.

Goodwill

In 2021, the Company acquired HCS-Electronic Materials for a total purchase price of $398.9 million, and recorded goodwill of $181.3 million. Goodwill of $157.0 million and $24.3 million associated with the HCS-Electronic Materials acquisition was allocated to the Electronic Materials and Performance Materials segments, respectively.

The balance of goodwill at December 31, 2022 and 2021 was $319.5 million and $318.6 million, respectively.

A summary of changes in goodwill by reportable segment is as follows:

(Thousands)	Performance Materials	Electronic Materials	Precision Optics	Total
Balance at December 31, 2020	$ 1,899	$ 50,527	$ 92,490	$ 144,916
Acquisition	23,904	154,277	—	178,181
Impairment charge	—	—	—	—
Other	—	(284)	(4,193)	(4,477)
Balance at December 31, 2021	$ 25,803	$ 204,520	$ 88,297	$ 318,620
Acquisition			—	—
Impairment charge	—	—	—	—
Other	354	2,150	(1,626)	878
Balance at December 31, 2022	**$ 26,157**	**206,670**	**$ 86,671**	**$ 319,498**

Due to recent acquisitions, the Company elected to perform a quantitative annual impairment assessment of its reporting units' goodwill as of October 1, 2022 and determined that the estimated fair values for each of its reporting units exceeded their carrying values, therefore no impairment charges were necessary. The estimated fair value of the Company's Precision Optics reporting unit exceeded the carrying value by less than 10%.

Management believes the future sales growth and EBITDA margins in the long range plan, terminal growth rate and the discount rate used in the valuations requires significant use of judgment. If any of our reporting units do not meet our long range plan estimates or our discount rate increase significantly, we could be required to perform an interim goodwill impairment analysis or recognize charges in future periods. Any impairment charges that the Company may take in the future could be material to its consolidated results of operations and financial condition. The assumptions used for the reporting units with fair values exceeding carrying values of less than 10% are more sensitive to future performance and will be monitored accordingly.

The results of the Company's 2022 and 2021 annual goodwill impairment assessments indicated that no goodwill impairment existed.

The Company's accumulated goodwill impairment losses were $20.6 million as of December 31, 2022, 2021 and 2020. Accumulated impairment losses were from the closure of the LAC reporting unit which was closed as of December 31, 2020.

Note N — Debt

Long-term debt in the Consolidated Balance Sheets is summarized as follows:

	December 31,	
(Thousands)	2022	2021
Borrowings under Credit Agreement with average interest rate of 6.08% at December 31, 2022 and 2.12% at December 31, 2021	$ 143,250	$ 152,296
Borrowings under the Term Loan Facility	285,000	300,000
Foreign debt	7,541	2,252
Total long-term debt outstanding	435,791	454,548
Current portion of long-term debt	(21,105)	(15,359)
Gross long-term debt	$ 414,686	$ 439,189
Unamortized deferred financing fees	(3,810)	(4,801)
Long-term debt	$ 410,876	$ 434,388

Maturities on long-term debt instruments as of December 31, 2022 are as follows:

(Thousands)	
2023	21,105
2024	30,337
2025	30,337
2026	353,543
2027	204
2028 and thereafter	265
Total	$ 435,791

In 2021, the Company amended and restated our $375.0 million revolving credit facility (Credit Agreement) in connection with the HCS-Electronic Materials acquisition. A $300 million delayed draw term loan facility was added to the Credit Agreement and the maturity date of the Credit Agreement was extended from 2024 to 2026. Moreover, the Credit Agreement also provides for an uncommitted incremental facility whereby, under certain conditions, the Company may be able to borrow additional term loans in an aggregate amount not to exceed $150.0 million. On November 1, 2021, Materion borrowed the full $300 million available under the delayed draw term loan facility and used the proceeds to pay a portion of the purchase price of the HCS-Electronic Materials acquisition.

The Credit Agreement provides the Company and its subsidiaries with additional capacity to enter into facilities for the consignment of precious metals and copper, and provides enhanced flexibility to finance acquisitions and other strategic initiatives. Borrowings under the Credit Agreement are secured by substantially all of the assets of the Company and its direct subsidiaries, with the exception of non-mining real property, precious metals, copper and certain other assets.

In January 2023, we amended the Credit Agreement to transition U.S. dollar denominated borrowings from LIBOR to the Secured Overnight Financial Rate (SOFR) for both the revolving credit agreement and the term loan and to increase the cap on precious metals facilities from $600 million to $615 million.

The Credit Agreement allows the Company to borrow money at a premium over SOFR, following the January 2023 amendment, or prime rate and at varying maturities. The premium resets quarterly according to the terms and conditions available under the agreement. The Credit Agreement includes restrictive covenants relating to restrictions on additional indebtedness, acquisitions, dividends, and stock repurchases. In addition, the Credit Agreement includes covenants subject to a maximum leverage ratio and a minimum interest coverage ratio. We were in compliance with all of our debt covenants as of December 31, 2022 and December 31, 2021. Cash on hand up to $25 million can benefit the covenants and may benefit the borrowing capacity under the Credit Agreement. At December 31, 2022 and 2021, there was $428.3 million and $452.3 million outstanding under the Credit Agreement, respectively.

At December 31, 2022 and 2021 there was $46.5 million and $46.3 million letters of credit outstanding against the credit sub-facility, respectively. The Company pays a variable commitment fee that may reset quarterly (0.28% as of December 31, 2022) on the available and unborrowed amounts under the revolving credit line.

The available borrowings under the individual existing credit lines totaled $185.3 million as of December 31, 2022.

Note O — Pensions and Other Post-Employment Benefits

The obligation and funded status of the Company's pension and other post-employment benefit plans are shown below. The Pension Benefits column aggregates defined benefit pension plans in the U.S., Germany, Liechtenstein, England, and the U.S. supplemental retirement plans. The Other Benefits column includes the domestic retiree medical and life insurance plan.

	Pension Benefits		Other Benefits	
(Thousands)	**2022**	**2021**	**2022**	**2021**
Change in benefit obligation				
Benefit obligation at beginning of year	**$ 235,779**	$ 246,107	**$ 7,514**	$ 8,190
Service cost	**1,231**	1,722	**78**	80
Interest cost	**4,874**	4,186	**156**	116
Net pension curtailments and settlements	**(3,104)**	—	**—**	—
Acquisition	**—**	—	**—**	—
Plan amendments	**—**	—	**—**	—
Actuarial (gain) loss	**(61,819)**	(8,448)	**(1,800)**	(112)
Benefit payments	**(5,821)**	(4,927)	**(443)**	(742)
Foreign currency exchange rate changes and other	**(3,108)**	(2,861)	**—**	(18)
Benefit obligation at end of year	**168,032**	235,779	**5,505**	7,514
Change in plan assets				
Fair value of plan assets at beginning of year	**227,340**	226,176	**—**	—
Plan settlements	**(3,104)**	—	**—**	—
Acquisition	**—**	—	**—**	—
Actual return on plan assets	**(53,283)**	5,769	**—**	—
Employer contributions	**831**	955	**—**	—
Employee contributions	**786**	878	**—**	—
Benefit payments from fund	**(6,175)**	(5,399)	**—**	—
Foreign currency exchange rate changes and other	**(1,799)**	(1,039)	**—**	—
Fair value of plan assets at end of year	**164,596**	227,340	**—**	—
Funded status at end of year	**$ (3,436)**	$ (8,439)	**$ (5,505)**	$ (7,514)
Amounts recognized in the Consolidated Balance Sheets consist of:				
Other assets	**$ 11,761**	$ 18,566	**$ —**	$ —
Other liabilities and accrued items	**(536)**	(1,662)	**(754)**	(754)
Retirement and post-employment benefits	**(14,661)**	(25,343)	**(4,751)**	(6,760)
Net amount recognized	**$ (3,436)**	$ (8,439)	**$ (5,505)**	$ (7,514)

The benefit obligation decreased in 2022 due to actuarial gains that were driven by increases in the discount rate.

The following amounts are included within accumulated other comprehensive loss at December 31, 2022:

	Pension Benefits		Other Benefits	
(Thousands)	**2022**	**2021**	**2022**	**2021**
Amounts recognized in other comprehensive income (before tax) consist of:				
Net actuarial loss (gain)	**$ 43,039**	$ 42,440	**$ (5,573)**	$ (4,044)
Net prior service cost (credit)	**(617)**	(695)	**(556)**	(2,054)
Net transition obligation/(asset)	**—**	637	**—**	—
Net amount recognized	**$ 42,422**	$ 42,382	**$ (6,129)**	$ (6,098)

The following table provides information regarding the accumulated benefit obligation:

	Pension Benefits		Other Benefits	
(Thousands)	**2022**	**2021**	**2022**	**2021**
Additional information				
Accumulated benefit obligation for all defined benefit pension plans	**$ 167,366**	$ 233,717	**$ —**	$ —
For defined benefit pension plans with benefit obligations in excess of plan assets:				
Aggregate benefit obligation	**18,490**	58,052	**—**	—
Aggregate fair value of plan assets	**3,279**	33,148	**—**	—
For defined benefit pension plans with accumulated benefit obligations in excess of plan assets:				
Aggregate accumulated benefit obligation	**17,833**	56,043	**—**	—
Aggregate fair value of plan assets	**3,279**	33,148	**—**	—

The following table summarizes components of net benefit cost:

	Pension Benefits			Other Benefits		
(Thousands)	**2022**	**2021**	**2020**	**2022**	**2021**	**2020**
Net benefit cost						
Service cost	**$ 1,231**	$ 1,722	$ 1,403	**$ 78**	$ 80	$ 59
Interest cost	**4,874**	4,186	5,234	**156**	116	213
Expected return on plan assets	**(9,570)**	(9,881)	(9,333)	**—**	—	—
Amortization of prior service credit	**(78)**	(82)	—	**(1,497)**	(1,497)	(1,497)
Recognized net actuarial loss (gain)	**1,701**	2,344	1,678	**(272)**	(275)	(332)
Net periodic benefit (credit) cost	**(1,842)**	(1,711)	(1,018)	**(1,535)**	(1,576)	(1,557)
Net pension curtailments and settlements	**(551)**	—	94	**—**	—	—
Total net benefit (credit) cost	**$ (2,393)**	$ (1,711)	$ (924)	**$ (1,535)**	$ (1,576)	$ (1,557)

Components of net periodic benefit cost, other than service cost, are included in Other non-operating (income) expense in the Consolidated Statements of Income. Additionally, Pension Benefit Guaranty Corporation premiums are reported within expected return on plan assets.

The following table summarizes amounts recognized in other comprehensive income (OCI):

	Pension Benefits			Other Benefits		
(Thousands)	**2022**	**2021**	**2020**	**2022**	**2021**	**2020**
Change in other comprehensive income						
OCI at beginning of year	**$ 42,382**	$ 48,673	$ 48,073	**$ (6,098)**	$ (7,525)	$ (9,578)
Increase (decrease) in OCI:						
Recognized during year — prior service cost (credit)	**78**	82	—	**1,497**	1,497	1,497
Recognized during year — net actuarial (losses) gains	**(1,701)**	(2,344)	(1,678)	**272**	275	332
Occurring during year — prior service cost	**—**	—	(799)	**—**	—	—
Occurring during year — net actuarial losses (gains)	**1,112**	(4,553)	3,146	**(1,800)**	(345)	224
Other adjustments	**551**	—	(94)	**—**	—	—
Foreign currency exchange rate changes		524	25	**—**	—	—
OCI at end of year	**$ 42,422**	$ 42,382	$ 48,673	**$ (6,129)**	$ (6,098)	$ (7,525)

In determining the projected benefit obligation and the net benefit cost, as of a December 31 measurement date, the Company used the following assumptions:

	Pension Benefits			Other Benefits		
	2022	**2021**	**2020**	**2022**	**2021**	**2020**
Assumptions used to determine benefit obligations at fiscal year end						
Discount rate	**2.16% - 5.54%**	0.22% - 3.02%	0.03% - 2.76%	**5.52 %**	2.90 %	2.45 %
Rate of compensation increase	**1.75% - 3.00%**	1.50% - 3.00%	1.50% - 3.00%	**3.50 %**	3.00 %	3.00 %
Assumptions used to determine net cost for the fiscal year						
Discount rate	**0.22% - 3.02%**	0.03% - 2.76%	0.21% - 3.48%	**2.90 %**	2.45 %	3.20 %
Expected long-term return on plan assets	**1.20% - 5.25%**	1.20% - 5.75%	1.80% - 6.00%	**N/A**	N/A	N/A
Rate of compensation increase	**1.50% - 3.00%**	1.50% - 3.00%	1.50% - 3.00%	**3.00 %**	3.00 %	3.00 %

Discount Rate. The discount rate used to determine the present value of the projected and accumulated benefit obligation at the end of each year is established based upon the available market rates for high quality, fixed income investments whose maturities match the plan's projected cash flows.

The Company uses a spot-rate approach to estimate the service and interest cost components of net periodic benefit cost for its defined benefit pension plans. The spot-rate approach applies separate discount rates for each projected benefit payment in the calculation.

Expected Long-Term Return on Plan Assets. Management establishes the domestic expected long-term rate of return assumption by reviewing historical trends and analyzing the current and projected market conditions in relation to the plan's asset allocation and risk management objectives. Consideration is given to both recent plan asset performance as well as plan asset performance over various long-term periods of time, with an emphasis on the assumption being a prospective, long-term rate of return. Management consults with and considers the opinions of its outside investment advisers and actuaries when establishing the rate and reviews assumptions with the Audit Committee of the Board of Directors.

Rate of Compensation Increase. The rate of compensation increase assumption is no longer applicable for the domestic defined benefit due to the Company freezing the plan effective January 1, 2020. The rate of compensation assumption to determine the benefit obligation and net cost for the domestic retiree medical plan was 3.5% in 2022 and 3.0% in both 2022 and 2021.

Assumptions for the defined benefit pension plans in Germany, Liechtenstein, and England are determined separately from the U.S. plan assumptions, based on historical trends and current and projected market conditions in each respective country. One plan in Germany is unfunded.

Assumed health care trend rates at fiscal year end	**2022**	2021
Health care trend rate assumed for next year	**6.00%**	6.00%
Rate that the trend rate gradually declines to (ultimate trend rate)	**5.00%**	5.00%
Year that the rate reaches the ultimate trend rate	**2032**	2028

Plan Assets

The following tables present the fair values of the Company's defined benefit pension plan assets as of December 31, 2022 and 2021 by asset category. The Company has some investments that are valued using net asset value (NAV) as the practical expedient and have not been classified in the fair value hierarchy. Refer to Note R for definitions of the fair value hierarchy.

(Thousands)	December 31, 2022 Total	Level 1	Level 2	Level 3
Cash	**$ 1,058**	**$ 1,058**	**$ —**	**$ —**
Equity securities (a)	**37,083**	**37,083**	**—**	**—**
Fixed-income securities (b)	**13,314**	**13,314**	**—**	**—**
Other types of investments:				
Real estate fund (c)	**3,115**	**3,115**	**—**	**—**
Total	**54,570**	**54,570**	**—**	**—**
Investments measured at NAV: (d)				
Pooled investment fund (e)	**103,142**			
Multi-strategy hedge funds (f)	**6,812**			
Private equity funds	**72**			
Total assets at fair value	**$ 164,596**			

(Thousands)	December 31, 2021 Total	Level 1	Level 2	Level 3
Cash	$ 4,777	$ 4,777	$ —	$ —
Equity securities (a)	49,618	49,618	—	—
Fixed-income securities (b)	14,344	14,344	—	—
Other types of investments:				
Real estate fund (c)	3,258	3,258	—	—
Total	71,997	71,997	—	—
Investments measured at NAV: (d)				
Pooled investment fund (e)	147,832			
Multi-strategy hedge funds (f)	7,438			
Private equity funds	73			
Total assets at fair value	$ 227,340			

(a) Equity securities are primarily comprised of corporate stock and mutual funds directly held by the plans. Equity securities are valued using the closing price reported on the active market on which the individual securities are traded.
(b) Fixed income securities are primarily comprised of governmental and corporate bonds directly held by the plans. Governmental and corporate bonds are valued using both market observable inputs for similar assets that are traded on an active market and the closing price on the active market on which the individual securities are traded.
(c) Includes a mutual fund that typically invests at least 80% of its assets in equity and debt securities of companies in the real estate industry or related industries or in companies which own significant real estate assets at the time of investment.
(d) Certain assets that are measured at fair value using the NAV practical expedient have not been classified in the fair value hierarchy.
(e) Pooled investment fund consists of various investment types including equity investments covering a range of geographies and including investment managers that hold long and short positions, property investments, and other multi-strategy funds which combine a range of different credit, equity, and macro-orientated ideas and dynamically allocate funds across asset classes.
(f) Includes a fund that invests in a broad portfolio of hedge funds.

The Company's domestic defined benefit pension plan investment strategy, as approved by the Governance and Organization Committee of the Board of Directors, is to employ an allocation of investments that will generate returns equal to or better than the projected long-term growth of pension liabilities so that the plan will be self-funding. The return objective is to maximize investment return to achieve and maintain a 100% funded status over time, taking into consideration required cash contributions. The allocation of investments is designed to maximize the advantages of diversification while mitigating the risk and overall portfolio volatility to achieve the return objective. Risk is defined as the annual variability in value and is measured in terms of the standard deviation of investment return. Under the Company's investment policies, allowable investments include domestic equities, international equities, fixed income securities, cash equivalents, and alternative securities (which include real estate, private venture capital investments, hedge funds, and tactical asset allocation). Ranges, in terms of a percentage of the total assets, are established for each allowable class of security. Derivatives may be used to hedge an existing security or as a risk reduction strategy. Current asset allocation guidelines are to invest 0% to 40% in equity securities, 60% to

90% in fixed income securities and cash, and up to 20% in alternative securities. Management reviews the asset allocation on a quarterly or more frequent basis and makes revisions as deemed necessary.

None of the plan assets noted above are invested in the Company's common stock.

Cash Flows

Employer Contributions. The Company does not expect to contribute to its domestic defined benefit pension plan in 2023.

All plan participants with an accrued benefit may elect an immediate payout in lieu of their future monthly annuity if the lump sum amount does not exceed $100,000.

Estimated Future Benefit Payments. The following benefit payments, which reflect expected future service, as appropriate, are expected to be paid:

		Other Benefits	
(Thousands)	Pension Benefits	Gross Benefit Payment	Net of Medicare Part D Subsidy
2023	7,565	767	767
2024	8,174	679	679
2025	8,880	608	608
2026	9,773	518	518
2027	10,638	478	478
2028 through 2032	56,634	1,815	1,815

Other Benefit Plans

In addition to the plans shown above, the Company also has certain foreign subsidiaries with accrued unfunded pension and other post-employment arrangements. The liability for these arrangements was $0.5 million at December 31, 2022 and $1.1 million at December 31, 2021, and was included in retirement and post-employment benefits on the Consolidated Balance Sheets.

The Company also sponsors defined contribution plans available to substantially all U.S. employees. The Company's annual defined contribution expense, including the expense for the enhanced defined contribution plan, was $13.1 million in 2022, $9.9 million in 2021, and $9.8 million in 2020.

Note P — Accumulated Other Comprehensive (Loss) Income

Changes in the components of accumulated other comprehensive (loss) income, including amounts reclassified out, for 2022, 2021, and 2020, and the balances in accumulated other comprehensive (loss) income as of December 31, 2022, 2021, and 2020 are as follows:

	Gains and Losses On Cash Flow Hedges							
(Thousands)	Foreign Currency	Interest Rate	Precious Metals	Copper	Total	Pension and Post-Employment Benefits	Foreign Currency Translation	Total
Balance at December 31, 2019	$ 1,324	$ —	$ (452)	$ 25	$ 897	$ (41,346)	$ (5,013)	$ (45,462)
Other comprehensive income (loss) before reclassifications	(1,268)	—	(1,675)	218	$ (2,725)	(2,721)	9,030	3,584
Amounts reclassified from accumulated other comprehensive income	222	—	2,041	354	2,617	(57)	—	2,560
Other comprehensive income (loss) before tax	(1,046)	—	366	572	(108)	(2,778)	9,030	6,144
Deferred taxes on current period activity	(241)	—	84	129	(28)	(651)	—	(679)
Other comprehensive income (loss) after tax	(805)	—	282	443	(80)	(2,127)	9,030	6,823
Balance at December 31, 2020	$ 519	$ —	$ (170)	$ 468	$ 817	$ (43,473)	$ 4,017	$ (38,639)
Balance at December 31, 2020	$ 519	$ —	$ (170)	$ 468	$ 817	$ (43,473)	$ 4,017	$ (38,639)
Other comprehensive income (loss) before reclassifications	2,252	—	508	2,444	5,204	4,428	(6,904)	2,728
Amounts reclassified from accumulated other comprehensive income	123	—	(193)	(3,049)	(3,119)	437	—	(2,682)
Other comprehensive income (loss) before tax	2,375	—	315	(605)	2,085	4,865	(6,904)	46
Deferred taxes on current period activity	546	—	73	(137)	482	1,094	—	1,576
Other comprehensive income (loss) after tax	1,829	—	242	(468)	1,603	3,771	(6,904)	(1,530)
Balance at December 31, 2021	$ 2,348	$ —	$ 72	$ —	$ 2,420	$ (39,702)	$ (2,887)	$ (40,169)
Balance at December 31, 2021	$ 2,348	$ —	$ 72	$ —	$ 2,420	$ (39,702)	$ (2,887)	$ (40,169)
Other comprehensive income (loss) before reclassifications	(1,260)	8,113	(259)	—	6,594	(394)	(5,869)	331
Amounts reclassified from accumulated other comprehensive income	(176)	(250)	(126)	—	(552)	386	—	(166)
Other comprehensive income (loss) before tax	(1,436)	7,863	(385)	—	6,042	(8)	(5,869)	165
Deferred taxes on current period activity	(331)	1,808	(90)	—	1,387	518	—	1,905
Other comprehensive income (loss) after tax	(1,105)	6,055	(295)	—	4,655	(526)	(5,869)	(1,740)
Balance at December 31, 2022	$ 1,243	$ 6,055	$ (223)	$ —	$ 7,075	$ (40,228)	$ (8,756)	$ (41,909)

Reclassifications of gains and losses on foreign currency cash flow hedges from accumulated other comprehensive income are recorded in Net sales in the Consolidated Statements of Income while gains and losses on precious metal cash flow hedges are recorded in Cost of sales in the Consolidated Statements of Income. Refer to Note R for additional details on cash flow hedges.

Reclassifications from accumulated other comprehensive income for pension and post-employment benefits are included in the computation of the net periodic pension and post-employment benefit expense. Refer to Note O for additional details on pension and other post-employment expenses.

Note Q — Stock-based Compensation

The Company maintains two stock incentive plans (the 2006 Stock Incentive Plan and the 2006 Non-employee Director Equity Plan) that have been approved by its shareholders. These plans authorize the granting of option rights, stock appreciation rights (SARs), performance-restricted shares, performance shares, performance units, restricted shares, and restricted stock units (RSUs).

Stock-based compensation expense, which includes awards settled in shares and in cash and is recognized as a component of selling, general, and administrative (SG&A) expenses, was $9.0 million, $7.3 million, and $5.7 million in 2022, 2021, and 2020, respectively. The Company derives a tax deduction measured by the excess of the market value over the grant price at the date stock-based awards vest or are exercised. The Company recognized $1.0 million, $0.9 million, and $0.5 million of tax benefits in 2022, 2021, and 2020, respectively, relating to the issuance of common stock for the exercise/vesting of equity awards.

The following sections provide information on awards settled in shares.

SARs. The Company grants SARs to certain employees. Upon exercise of vested SARs, the participant will receive a number of shares of common stock equal to the spread (the difference between the market price of the Company's common shares at the time of exercise and the strike price established on the grant date) divided by the common share price. The strike price of the SARs is equal to the market value of the Company's common shares on the day of the grant. The number of SARs available to be issued is established by plans approved by the shareholders. The vesting period and the life of the SARs are established at the time of grant. The exercise of the SARs is generally satisfied by the issuance of treasury shares. SARs vest in equal installments annually over three years. SARs expire in seven years.

The following table summarizes the Company's SARs activity during 2022:

(Shares in thousands)	Number of SARs	Weighted-average Exercise Price Per Share	Aggregate Intrinsic Value (thousands)	Weighted-average Remaining Term (Years)
Outstanding at December 31, 2021	260	$ 51.55		
Granted	45	80.85		
Exercised	(49)	42.83		
Cancelled	—	—		
Outstanding at December 31, 2022	256	58.38	$ 7,448	3.8
Vested and expected to vest as of December 31, 2022	256	58.38	7,448	3.8
Exercisable at December 31, 2022	160	50.56	5,928	2.8

A summary of the status and changes of shares subject to SARs and the related average price per share follows:

(Shares in thousands)	Number of SARs	Weighted-average Grant Date Fair Value
Nonvested as of December 31, 2021	100	$ 17.98
Granted	45	25.87
Vested	(50)	17.47
Cancelled	—	—
Nonvested as of December 31, 2022	95	$ 21.97

As of December 31, 2022, $1.3 million of expense with respect to non-vested SARs has yet to be recognized as expense over a weighted-average period of approximately 22 months. The total fair value of shares vested during 2022, 2021, and 2020 was $0.9 million, $0.8 million, and $1.5 million, respectively.

The weighted-average grant date fair value for 2022, 2021, and 2020 was $25.87, $20.66, and $13.67, respectively. The fair value will be amortized to compensation cost on a straight-line basis over the vesting period of three years, or earlier if the employee is retirement eligible and continued vesting is approved by the Board of Directors as defined in the Plan. Stock-based compensation expense relating to SARs was $0.9 million in each of the last three years.

The total intrinsic value of stock options exercised during 2022, 2021 and 2020 was $2.1 million, $1.6 million and $0.5 million, respectively.

The fair value of the SARs was estimated on the grant date using the Black-Scholes pricing model with the following assumptions:

	2022	2021	2020
Risk-free interest rate	**1.56 %**	0.57 %	1.41 %
Dividend yield	**0.6 %**	0.7 %	0.9 %
Volatility	**38.5 %**	37.6 %	31.8 %
Expected lives (in years)	**4.4**	4.6	4.8

The risk-free rate of return was based on U.S. Treasury yields with a maturity equal to the expected life of the award. The dividend yield was based on the Company's historical dividend rate and stock price. The expected volatility of stock was derived by referring to changes in the Company's historical common stock prices over a time-frame similar to the expected life of the award. In addition to considering the vesting period and contractual term of the award for the expected life assumption, the Company analyzes actual historical exercise experience for previously granted awards.

Restricted Stock Units (RSUs) - Employees. The Company may grant RSUs to employees of the Company. These units constitute an agreement to deliver shares of common stock to the participant at the end of the vesting period, which is defined at the date of the grant, and are forfeited should the holder's employment terminate during the restriction period. The fair market value of the RSUs is determined on the date of the grant and is amortized over the vesting period. With the exception of the 2022 annual employee grant, the vesting period is typically three years unless the recipient is retirement eligible and continued vesting is approved by the Board of Directors. The 2022 annual employee grant vests in three equal annual installments on the anniversary of the grant date.

The fair value of RSUs settled in stock is based on the closing stock price on the date of grant. The weighted-average grant date fair value for 2022, 2021, and 2020 was $80.96, $68.62, and $51.55, respectively. Cash-settled RSUs are accounted for as liability-based compensation awards and adjusted based on the closing price of Materion's common stock over the vesting period of three years.

Stock-based compensation expense relating to stock-settled RSUs was $3.5 million in 2022, $3.5 million in 2021, and $2.7 million in 2020. The unamortized compensation cost on the outstanding RSUs was $5.5 million as of December 31, 2022 and is expected to be recognized over a weighted-average period of 23 months. The total fair value of shares that vested during 2022 was $2.8 million, compared to $2.0 million in 2021 and $1.2 million in 2020.

The following table summarizes the stock-settled RSU activity during 2022:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2021	162	$ 59.23
Granted	61	80.96
Vested	(49)	58.29
Forfeited	(9)	64.91
Outstanding at December 31, 2022	165	$ 67.31

RSUs - Non-Employee Directors. In 2022, 2021, and 2020, 11,120, 9,904, and 15,976 RSUs, with a one year vesting period, were granted to certain non-employee members of the Board of Directors. The weighted-average grant date fair value of these RSUs was $81.59, $75.77, and $48.42 in 2022, 2021, and 2020, respectively. The Company recognized $0.9 million of expense related to these awards in 2022, compared to $0.8 million of expense in 2021 and $0.7 million of expense in 2020. At December 31, 2022, $0.3 million of expense with respect to non-vested RSU awards granted to the Board of Directors has yet to be recognized and will be amortized into expense over a weighted-average period of approximately four months.

Long-term Incentive Plans. Under the long-term incentive compensation plans, executive officers and selected other employees receive restricted stock unit awards based upon the Company's performance over the defined period, typically three years. Total units earned for grants made in 2022, 2021, and 2020, may vary between 0% and 200% of the units granted based on the attainment of performance targets during the related three-year period. All grants will be settled in Materion common shares and are equity classified. Vesting of performance-based awards is contingent upon the attainment of threshold performance objectives.

The following table summarizes the activity related to performance-based RSUs during 2022:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2021	119	$ 70.77
Granted	38	95.44
Vested	(43)	69.84
Forfeited	(3)	79.01
Outstanding at December 31, 2022	111	$ 79.31

Compensation expense is based upon the performance projections for the plan period of three years, the percentage of requisite service rendered, and the fair market value of the Company's common shares on the date of grant. The offset to the compensation expense for the portion of the award to be settled in shares is recorded within shareholders' equity and was $3.6 million for 2022, $2.2 million for 2021, and $2.0 million for 2020.

Directors' Deferred Compensation. Non-employee directors may defer all or part of their compensation into the Company's common stock. The fair value of the deferred shares is determined at the share acquisition date and is recorded within shareholders' equity. At December 31, 2022, shareholders' equity included 0.1 million shares related to this plan.

Note R — Fair Value Information and Derivative Financial Instruments

The Company measures and records financial instruments at fair value. A hierarchy is used for those instruments measured at fair value that distinguishes between assumptions based upon market data (observable inputs) and the Company's assumptions (unobservable inputs). The hierarchy consists of three levels:

Level 1 — Quoted market prices in active markets for identical assets and liabilities;

Level 2 — Inputs other than Level 1 inputs that are either directly or indirectly observable; and

Level 3 — Unobservable inputs developed using estimates and assumptions developed by the Company, which reflect those that a market participant would use.

The following table summarizes the financial instruments measured at fair value on the Consolidated Balance Sheets at December 31, 2022 and 2021:

(Thousands)	Total	Fair Value Measurements Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Observable Inputs (Level 2)	Other Significant Unobservable Inputs (Level 3)
December 31, 2022				
Financial Assets				
Deferred compensation investments	**$ 3,001**	**$ 3,001**	**$ —**	**$ —**
Foreign currency forward contracts	**1,291**	**—**	**1,291**	**—**
Interest rate swap	**7,863**		**7,863**	
Precious metal swaps	**118**	**—**	**118**	**—**
Total	**$ 12,273**	**$ 3,001**	**$ 9,272**	**$ —**
Financial Liabilities				
Deferred compensation liability	**$ 3,001**	**$ 3,001**	**$ —**	**$ —**
Foreign currency forward contracts	**1,757**	**—**	**1,757**	**—**
Interest rate swap	**—**		**—**	
Precious metal swaps	**411**	**—**	**411**	**—**
Total	**$ 5,169**	**$ 3,001**	**$ 2,168**	**$ —**
December 31, 2021				
Financial Assets				
Deferred compensation investments	$ 4,246	$ 4,246	$ —	$ —
Foreign currency forward contracts	3,368	—	3,368	—
Precious metal swaps	116	—	116	—
Total	$ 7,730	$ 4,246	$ 3,484	$ —
Financial Liabilities				
Deferred compensation liability	$ 4,246	$ 4,246	$ —	$ —
Foreign currency forward contracts	136	—	136	—
Precious metal swaps	24	—	24	—
Total	$ 4,406	$ 4,246	$ 160	$ —

The Company uses a market approach to value the assets and liabilities for financial instruments in the table above. Outstanding contracts are valued through models that utilize market observable inputs, including both spot and forward prices, for the same underlying currencies and metals. The Company's deferred compensation investments and liabilities are based on the fair value of the investments corresponding to the employees’ investment selections, primarily in mutual funds, based on quoted prices in active markets for identical assets. Deferred compensation investments are primarily presented in Other assets. Deferred compensation liabilities are primarily presented in Other long-term liabilities.

Due to the nature of fair value calculations for variable-rate debt, the carrying value of the Company's long-term variable-rate debt is a reasonable estimate of its fair value. As noted in Note R, the Company entered into a $100.0 million interest rate swap to hedge the interest rate risk on the fixed rate portion of the Credit Agreement. The fair value of the interest rate swap asset was $7.9 million as of December 31, 2022, and was determined using level 2 inputs. The total of the outstanding amount on the fixed rate debt and the fair value of the interest rate swap approximates the total fair value of the fixed rate debt as of December 31, 2022.

The carrying values of the other working capital items in the Consolidated Balance Sheets approximate fair values at December 31, 2022 and 2021.

The Company uses derivative contracts to hedge portions of its foreign currency exposures and may also use derivatives to hedge a portion of its precious metal and interest expense fluctuations. The objectives and strategies for using derivatives in these areas are as follows:

Interest Rate. On March 4, 2022, the Company entered into a $100.0 million interest rate swap to hedge the interest rate risk on the Credit Agreement described in Note P. The swap hedges the change in 1-month LIBOR from March 4, 2022 to November 2, 2026. In February 2023 we amended the terms of the interest rate swap to hedge the change in 1-month

USD-SOFR. The purpose of this hedge is to manage the risk of changes in the monthly interest payments attributable to changes in the benchmark interest rate.

Foreign Currency. The Company sells a portion of its products to overseas customers in their local currencies, primarily in euro and yen. The Company secures foreign currency derivatives, mainly forward contracts and options, to hedge these anticipated sales transactions. The purpose of the hedge program is to protect against the reduction in the dollar value of foreign currency sales from adverse exchange rate movements. Should the dollar strengthen significantly, the decrease in the translated value of the foreign currency sales should be partially offset by gains on the hedge contracts. Depending upon the methods used, the hedge contracts may limit the benefits from a weakening U.S. dollar.

The use of forward contracts locks in a firm rate and eliminates any downside risk from an adverse rate movement as well as any benefit from a favorable rate movement. The Company may from time to time choose to hedge with options or a tandem of options known as a collar. These hedging techniques can limit or eliminate the downside risk but can allow for some or all of the benefit from a favorable rate movement to be realized. Unlike a forward contract, a premium is paid for an option; collars, which are a combination of a put and call option, may have a net premium but can be structured to be cash neutral. The Company will primarily hedge with forward contracts due to the relationship between the cash outlay and the level of risk.

Precious Metals. The Company maintains the majority of its precious metal production requirements on consignment in order to reduce its working capital investment and the exposure to metal price movements. When a product containing precious metal is fabricated and delivered to the customer, the metal content is purchased out of consignment based on the current market price. The price paid by the Company for the precious metal forms the basis for the price charged to the customer for the metal content in the product. This methodology allows for changes in either direction in the market prices of the precious metals used by the Company to be passed through to the customer and reduces the impact that changes in prices could have on the Company's margins and operating profit. The consigned metal is owned by precious metal consignors that charge the Company consignment fees based upon the value of the metal as it fluctuates while on consignment. Each precious metal consignor retains title to its consigned precious metal until it is purchased by the Company, and it is the Company’s typical practice to purchase metal out of consignment only after a product containing that metal has been purchased by one of our customers.

In certain instances, a customer may want to fix the price for the precious metal at the time the sales order is placed rather than at the time of shipment. Setting the sales price at a different date than when the material would be purchased out of consignment potentially creates an exposure to movements in the market price of the metal. Therefore, in these limited situations, the Company may elect to enter into a forward contract to purchase precious metal. The forward contract allows the Company to purchase metal at a fixed price on a specific future date. The price in the forward contract serves as the basis for the price to be charged to the customer. By doing so, the selling price and purchase price are matched, and the Company's price exposure is reduced.

The Company refines precious metal-containing materials for its customers and typically will purchase the refined metal from the customer at current market prices. In limited circumstances, the customer may want to fix the price to be paid at the time of the order as opposed to when the material is refined. The customer may also want to fix the price for a set period of time. The Company may then elect to enter into a hedge contract, either a forward contract or a swap, to fix the price for the estimated quantity of metal to be refined and purchased, thereby reducing the exposure to adverse movements in the price of the metal. The Company may also enter into hedges to mitigate the risk relating to the prices of the metals that we process or refine.

In certain circumstances, the Company also refines metal from the customer and may retain a portion of the refined metal as payment. The Company may elect to enter into a forward contract to sell precious metal to reduce the Company's price exposure in these instances.

The Company may from time to time elect to purchase precious metal and hold in inventory rather than on consignment due to potential consignment line limitations or other factors. These purchases are infrequent and, when made are typically held for a short duration. A forward contract will be secured at the time of the purchase to fix the price to be paid when the metal is transferred back to the consignment line, thereby limiting any price exposure during the time when the metal was owned by the Company.

Copper. The Company also uses copper in its production processes. When possible, fluctuations in the purchase price of copper are passed on to customers in the form of price adders or reductions. While over time the Company's price exposure to copper is generally in balance, there can be a lag between the change in the Company's cost and the pass-through to its customers, resulting in higher or lower margins in a given period. To mitigate this impact, the Company hedges a portion of this pricing risk.

A team consisting of senior financial managers reviews the estimated exposure levels, as defined by budgets, forecasts, and other internal data, and determines the timing, amounts, and instruments to use to hedge exposures. Management analyzes the effective hedged rates and the actual and projected gains and losses on the hedging transactions against the program objectives, targeted rates, and levels of risk assumed. Foreign currency contracts are typically layered in at different times for a specified exposure period in order to minimize the impact of market rate movements.

The use of derivatives is governed by policies adopted by the Audit and Risk Committee of the Board of Directors. The Company will only enter into a derivative contract if there is an underlying identified exposure. Contracts are typically held to maturity. The Company does not engage in derivative trading activities and does not use derivatives for speculative purposes. The Company only uses hedge contracts that are denominated in the same currency or metal as the underlying exposure.

All derivatives are recorded on the balance sheet at fair value. If the derivative is designated and effective as a cash flow hedge, changes in the fair value of the derivative are recognized in OCI until the hedged item is recognized in earnings. The ineffective portion of a derivative's fair value, if any, is recognized in earnings immediately. If a derivative is not a hedge, changes in the fair value are adjusted through income. The fair values of the outstanding derivatives are recorded on the balance sheet as assets (if the derivatives are in a gain position) or liabilities (if the derivatives are in a loss position). The fair values will also be classified as short-term or long-term depending upon their maturity dates.

The following table summarizes the notional amount and the fair value of the Company's outstanding derivatives not designated as hedging instruments (on a gross basis) and balance sheet classification as of December 31, 2022 and 2021:

	December 31, 2022		December 31, 2021	
(Thousands)	**Notional Amount**	**Fair Value**	**Notional Amount**	**Fair Value**
Foreign currency forward contracts				
Prepaid expenses	**$ 12,242**	**$ 791**	$ 55,063	$ 2,132
Other liabilities and accrued items	**17,061**	**1,048**	9,425	128

These outstanding foreign currency derivatives were related to balance sheet hedges and intercompany loans. Other-net included foreign currency gains related to these derivatives of $0.2 million in 2022, compared to $1.2 million of foreign currency gains in 2021.

The following table summarizes the notional amount and the fair value of the Company's outstanding derivatives designated as cash flow hedges (on a gross basis) and balance sheet classification at December 31, 2022 and 2021:

	December 31, 2022				
		Fair Value			
(Thousands)	**Notional Amount**	**Prepaid and other current assets**	**Other assets**	**Other liabilities and accrued items**	**Other long-term liabilities**
Foreign currency forward contracts - yen	**$ 2,985**	**$ 145**	**$ —**	**$ 74**	**$ 26**
Foreign currency forward contracts - euro	**25,712**	**355**	**—**	**472**	**137**
Precious metal swaps	**8,758**	**118**	**—**	**411**	**—**
Interest rate swap	**100,000**	**3,114**	**4,749**	**—**	**—**
Total	**$ 137,455**	**$ 3,732**	**$ 4,749**	**$ 957**	**$ 163**

	December 31, 2021				
		Fair Value			
	Notional Amount	**Prepaid and other current assets**	**Other assets**	**Other liabilities and accrued items**	**Other long-term liabilities**
Foreign currency forward contracts - yen	$ 3,907	$ 131	$ 2	$ —	$ —
Foreign currency forward contracts - euro	28,412	1,102	—	—	8
Precious metal swaps	6,256	116	—	24	
Total	$ 38,575	$ 1,349	$ 2	$ 24	$ 8

All of these contracts were designated and effective as cash flow hedges. No ineffectiveness expense was recorded in 2022, 2021, or 2020.

The fair value of derivative contracts recorded in accumulated other comprehensive income (loss) totaled $7.4 million and $1.3 million as of December 31, 2022 and December 31, 2021, respectively. Deferred gains of $3.9 million at December 31, 2022 are expected to be reclassified to earnings within the next 18-month period.

The following table summarizes the pre-tax amounts reclassified from accumulated other comprehensive income relating to the hedging relationship of the Company's outstanding derivatives designated as cash flow hedges and income statement classification for years ended December 31, 2022 and 2021:

(Thousands)		2022	2021
Hedging relationship	**Line item**		
Foreign currency forward contracts	Net sales	**$ (176)**	$ 123
Precious metal swaps	Cost of sales	**(126)**	(193)
Interest rate swap	Interest expense - net	**(250)**	—
Copper swaps	Cost of sales	**—**	(3,049)
Total		**$ (552)**	$ (3,119)

The derivative activity in the table above is reflected in cash flows from operating activities.

Note S — Contingencies and Commitments

Beryllium Cases

The Company is a defendant from time to time in proceedings in various state and federal courts brought by plaintiffs alleging that they have contracted, or have been placed at risk of contracting, beryllium sensitization or Chronic Beryllium Disease (CBD) or related ailments as a result of exposure to beryllium. Plaintiffs in beryllium cases seek recovery under theories of negligence and various other legal theories and seek compensatory and punitive damages, in many cases of an unspecified sum. Spouses, if any, often claim loss of consortium.

Employee cases, in which plaintiffs have a high burden of proof, have historically involved relatively small losses to the Company. Third-party plaintiffs (typically employees of customers) face a lower burden of proof than do the Company's employees, but these cases have generally been covered by varying levels of insurance. Management has vigorously contested the beryllium cases brought against the Company.

Non-employee beryllium cases are covered by insurance, subject to certain limitations. The insurance covers defense costs and indemnity payments (resulting from settlements or court verdicts) and is subject to various levels of deductibles. Defense and indemnity costs were less than or equal to the deductible in both 2022 and 2021.

As of December 31, 2022, the Company was a defendant in one beryllium litigation cases, which was also outstanding as of December 31, 2021. The Company does not expect the resolution of this case to have a material impact on its consolidated financial statements. During 2022, one beryllium litigation case was resolved.

Although it is not possible to predict the outcome of any pending litigation, the Company provides for costs related to litigation matters when a loss is probable, and the amount is reasonably estimable. Litigation is subject to many uncertainties, and it is possible that some of the actions could be decided unfavorably in amounts exceeding the Company's reserves. An unfavorable outcome or settlement of a beryllium case or adverse media coverage could encourage the commencement of additional similar litigation. The Company is unable to estimate its potential exposure to unasserted claims.

Based upon currently known facts and assuming collectability of insurance, the Company does not believe that resolution of the current or any potential future beryllium proceedings will have a material adverse effect on the financial condition or cash flow of the Company. However, the Company's results of operations could be materially affected by unfavorable results in one or more cases.

Environmental Proceedings

The Company has an active program for environmental compliance that includes the identification of environmental projects and estimating the impact on the Company's financial performance and available resources. Environmental expenditures that relate to current operations, such as wastewater treatment and control of airborne emissions, are either expensed or capitalized as appropriate. The Company records reserves for the probable costs for identified environmental remediation projects. The Company's environmental engineers perform routine ongoing analyses of the remediation sites and will use outside consultants to assist in their analyses from time to time. Reserve accruals are based upon their analyses and are established based on the reasonably estimable loss or range of loss. The accruals are revised for the results of ongoing studies, changes in strategies, inflation, and for differences between actual and projected costs. The accruals may also be affected by rulings and negotiations with regulatory agencies. The timing of payments often lags the accrual, as environmental projects typically require a number of years to complete.

The environmental reserves recorded represent the Company's best estimate of what is reasonably possible and cover existing or currently foreseen projects based upon current facts and circumstances. For sites where the investigative work and work plan development are substantially complete, the Company does not believe that it is reasonably possible that the cost to resolve environmental matters will be materially different than what has been accrued. For sites that are in the preliminary stages of investigation, the ultimate loss contingencies cannot be reasonably determined at the present time. As facts and circumstances change, the ultimate cost may be revised, and the recording of additional costs may be material in the period in which the additional costs are accrued. The Company does not believe that the ultimate liability for environmental matters will have a material impact on its financial condition or liquidity due to the nature of known environmental matters and the extended period of time over which environmental remediation normally takes place.

The undiscounted reserve balance at the beginning of the year, the amounts expensed and paid, and the balance at December 31, 2022 and 2021 are as follows:

(Thousands)		2022		2021
Reserve balance at beginning of year	$	4,770	$	5,476
Expensed		180		185
Paid		(480)		(891)
Reserve balance at end of year	$	4,470	$	4,770
Ending balance recorded in:				
Other liabilities and accrued items	$	440	$	539
Other long-term liabilities		4,030		4,231

The majority of expenses in both 2022 and 2021 was for various remediation projects at the Elmore, Ohio plant site.

Asset Retirement Obligations

The Company has asset retirement obligations related to its mine in Utah, as well as for certain leased facilities where the Company is contractually obligated to restore the facility back to its original condition at the end of the lease. The following represents a roll forward of the Company's asset retirement obligation liabilities for the years ended December 31, 2022 and 2021:

(Thousands)		2022		2021
Asset retirement obligation at beginning of period	$	2,231	$	1,765
Accretion expense		198		134
Change in liability		—		332
Asset retirement obligation at end of period	$	2,429	$	2,231

These obligations are reflected in Other long-term liabilities on the Consolidated Balance Sheet.

Other

The Company is subject to various legal or other proceedings that relate to the ordinary course of its business. The Company believes that the resolution of these proceedings, individually or in the aggregate, will not have a material adverse impact upon the Company's consolidated financial statements.

On October 14, 2020, Garett Lucyk, et al. v. Materion Brush Inc., et. al., case number 20CV0234, a wage and hour purported collective and class action, was filed in the Northern District of Ohio against the Company and its subsidiary, Materion Brush Inc. (collectively, the Company). Plaintiff, a former hourly production employee at the Company's Elmore, Ohio facility, alleges that he and other similarly situated employees are not paid for all time they spend donning and doffing personal protective equipment in violation of the Fair Labor Standards Act and Ohio law. Plaintiff filed a motion for conditional certification, which the Company opposed. On August 2, 2022, the Court conditionally certified a class of employees at the Company’s Elmore facility only and rejected certification of a class across the Company’s other facilities. In November 2022, the parties reached a settlement for an immaterial amount. The settlement is pending court approval.

At December 31, 2022, the Company had outstanding letters of credit totaling $46.5 million related to workers’ compensation, consigned precious metal guarantees, environmental remediation issues, and other matters. The majority of the Company's outstanding letters of credit expire in 2023 and are expected to be renewed.

Item 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

Item 9A. CONTROLS AND PROCEDURES

a) Evaluation of Disclosure Controls and Procedures

The Company carried out an evaluation under the supervision and with participation of the Company's management, including the chief executive officer and chief financial officer, of the effectiveness of the design and operation of disclosure controls and procedures as of December 31, 2022 pursuant to Rules 13a-15(b) and 15d-15(b) under the Securities Exchange Act of 1934, as amended (Exchange Act). Based on that evaluation, management, including the chief executive officer and chief financial officer, concluded that disclosure controls and procedures are effective as of December 31, 2022.

b) Management's Report on Internal Control over Financial Reporting

The Report of Management on Internal Control over Financial Reporting and the Report of Independent Registered Public Accounting Firm thereon are set forth in Item 8 of this Form 10-K and are incorporated herein by reference.

c) Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting identified in connection with the evaluation required by Rules 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the three months ended December 31, 2022 that have materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting.

Item 9B. OTHER INFORMATION

None.

Item 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information under “Election of Directors” in Materion Corporation's Proxy Statement for the 2023 Annual Meeting of Shareholders (Proxy Statement), to be filed with the Securities and Exchange Commission pursuant to Regulation 14A, is incorporated herein by reference.

A listing of executive officers, their ages, positions, and offices held over the past five years, is as follows:

Name	Age	Positions and Offices Held
Jugal K. Vijayvargiya	54	President and Chief Executive Officer (March 2017-Present); President Delphi Electronics and Safety, a global technology solutions provider to the automotive and transportation sectors (prior to March 2017)
Shelly M. Chadwick	51	Vice President, Finance and Chief Financial Officer (November 2020-Present); Vice President Finance and Chief Accounting Officer at The Timken Company, a world leader in engineered bearings and power transmission products (November 2016-November 2020)
Gregory R. Chemnitz	65	Vice President, General Counsel and Secretary

The information required by Item 10 with respect to directors, the Audit and Risk Committee of the Board of Directors, and Audit and Risk Committee financial experts is incorporated herein by reference from the section entitled “Corporate Governance; Committees of the Board of Directors — Audit and Risk Committee” and “Audit and Risk Committee Expert, Financial Literacy and Independence” in the Proxy Statement.

We have adopted a Policy Statement on Significant Corporate Governance Issues and a Code of Conduct Policy that applies to our chief executive officer and senior financial officers, including the principal financial and accounting officer, controller, and other persons performing similar functions, in compliance with applicable New York Stock Exchange and Securities and Exchange Commission requirements. The aforementioned materials and any amendments thereto, along with the charters of the Audit and Risk, Nominating, Governance, and Corporate Social Responsibility, and Compensation and Human Capital Committees of our Board of Directors, which also comply with applicable requirements, are available on our website at http://materion.com, and copies are also available upon request by any shareholder to Secretary, Materion Corporation, 6070 Parkland Boulevard, Mayfield Heights, Ohio 44124.

Item 11. EXECUTIVE COMPENSATION

Incorporated by reference from the sections of the Proxy Statement entitled “Executive Compensation” and “2022 Compensation of Non-Employee Directors."

Item 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Incorporated by reference from the sections of the Proxy Statement entitled “Related Party Transactions” and “Corporate Governance; Committees of the Board of Directors — Director Independence.”

Item 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required under Item 12 regarding security ownership is incorporated by reference from the section of the Proxy Statement entitled “Security Ownership of Certain Beneficial Owners and Management." The information required by Item 12 regarding securities authorized for issuance under equity compensation plans is incorporated by reference from the section of the Proxy Statement entitled "Equity Compensation Plan Information."

Item 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

Incorporated by reference from the section of the Proxy Statement entitled “Ratification of Independent Registered Public Accounting Firm.”

PART IV

Item 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) 1. Financial Statements and Supplemental Information

See Index to Consolidated Financial Statements in Item 8 of this Form 10-K.

(a) 2. Financial Statement Schedules

The following consolidated financial information for the years ended December 31, 2022, 2021, and 2020 is submitted herewith:

Schedule II — Valuation and qualifying accounts.

All other schedules for which provision is made in the applicable accounting regulations of the Securities and Exchange Commission are not required under the related instructions or are inapplicable, and therefore have been omitted.

(a) 3. Exhibits

All documents referenced below were filed pursuant to the Exchange Act by Materion Corporation, file number 001-15885, unless otherwise noted.

2.1	Share Purchase Agreement, dated as of September 19, 2021, by and among Materion Corporation, HCST Hungary Holding Vagyonkezelő Korlátolt Felelősségű Társaság, H.C. Starck Group GmbH and Opus HoldCo S.à r.l. (filed as Exhibit 2.1 to Materion's Form 8-K filed on November 1, 2021), incorporated herein by reference
3.1	Amended and Restated Articles of Incorporation of Materion Corporation (filed as Exhibit 3.2 to the Company's Quarterly Report on Form 10-Q for the period ended on June 27, 2014), incorporated herein by reference.
3.2	Amended and Restated Code of Regulations (filed as Exhibit 3.1 to the Company's Quarterly Report on Form 10-Q for the period ended June 27, 2014), incorporated herein by reference.
4.1	Description of Materion Corporation Common Stock (filed as Exhibit 4.1 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019), incorporated herein by reference.
4.2	Amendment No. 1, dated September 30, 2021, to Third Amended and Restated Credit Agreement, dated September 24, 2019, by and among Materion, Materion's subsidiary, Materion Netherlands B.V., Materion's other foreign subsidiaries party thereto from time to time, the financial institutions party thereto from time to time as lenders, JPMorgan Chase Bank, N.A., as administrative agent, Wells Fargo Bank National Association and Bank of America, N.A., as co-syndication agents, and KeyBank National Association, as documentation agent (filed as Exhibit 4.2 to the Company's Annual Report on Form 10-K for the year ended December 31, 2021), incorporated herein by reference.
4.3	Fourth Amended and Restated Credit Agreement, by and among Materion Corporation, Materion Netherlands B.V., the other foreign borrowers party thereto from time to time, the financial institutions party thereto from time to time as lenders, JPMorgan Chase Bank, N.A., as administrative agent, Wells Fargo Bank, National Association and Bank of America, N.A., as co-syndication agents, KeyBank National Association, as documentation agent, and JPMorgan Chase Bank, N.A., Wells Fargo Securities, LLC and BofA Securities, Inc., as joint bookrunners and joint lead arrangers (filed as Exhibit 10.1 to the Company's 8-K filed on November 1, 2021), incorporated herein by reference.
4.4#	Amendment No. 1 dated as of January 13, 2023 to Fourth Amended and Restated Credit Agreement dated as of October 27, 2021, by and among Materion Corporation (the "Company"), Materion Netherlands B.V. (the "Dutch Borrower" and, together with the Company, the "Borrowers"), the financial institutions listed on the signature pages hereof and JPMorgan Chase Bank, N.A., as Administrative Agent (the "Administrative Agent"), under that certain Fourth Amended and Restated Credit Agreement dated as of October 27, 2021 by and among the Company, the Dutch Borrower, the other Foreign Subsidiary Borrowers from time to time party thereto.
10.1	Metals Consignment Agreement, dated as of August 12, 2022, among Materion Corporation, certain of its subsidiaries and Bank of Montreal (filed as Exhibit 10.1 to the Company's Form 8-K Filed on August 15, 2022), incorporated herein by reference.
10.2	The Bank of Nova Scotia Consignment Agreement with Materion Advanced Materials Germany GMBH dated as of February 28, 2017 (filed as Exhibit 99.1 to the Company's Form 8-K filed on March 1, 2017), incorporated herein by reference.
10.3	Form of Indemnification Agreement entered into by the Company and its executive officers (filed as Exhibit 10a to the Company's Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.

10.4	Form of Indemnification Agreement entered into by the Company and its directors (filed as Exhibit 10b to the Company’s Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.
10.5*	Amended and Restated Form of Severance Agreement for Executive Officers (filed as Exhibit 10.2 to the Company’s Quarterly Report on Form 10-Q for the period ended June 27, 2008), incorporated herein by reference.
10.6*	Amendment No. 1 to Amended and Restated Severance Agreement, dated May 4, 2011 (filed as Exhibit 10.2 to the Company’s Quarterly Report on Form 10-Q for the period ended July 1, 2011), incorporated herein by reference.
10.7*	Amended and Restated Form of Severance Agreement for Key Employees (filed as Exhibit 10.1 to the Company’s Quarterly Report on Form 10-Q for the period ended June 27, 2008), incorporated herein by reference.
10.8*	Form of Severance Agreement for Key Employees (filed as Exhibit 10f to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference.
10.9*	Severance Agreement for Jugal Vijayvargiya dated as of March 3, 2017 (filed as Exhibit 10.2 to the Company's Form 8-K filed on March 3, 2017), incorporated herein by reference.
10.10*	CEO Offer Letter for Jugal Vijayvargiya dated as of March 1, 2017 (filed as Exhibit 10.1 to the Company's Form 8-K filed on March 3, 2017), incorporated herein by reference.
10.11*	Severance Agreement for Shelly M. Chadwick dated as of December 15, 2020 (filed as Exhibit 10.11 to the Company's Form 10-K for the year ended December 31, 2020), incorporated herein by reference.
10.12*	CFO Offer Letter for Shelly M. Chadwick dated as of October 24, 2020 (filed as Exhibit 10.12 to the Company's Form 10-K for the year ended December 31, 2020), incorporated herein by reference.
10.13*	Form of Trust Agreement between the Company and Key Trust Company of Ohio, N.A. (formerly Ameritrust Company National Association) on behalf of the Company’s executive officers (filed as Exhibit 10e to the Company’s Annual Report on Form 10-K for the year ended December 31, 1994), incorporated herein by reference.
10.14*	2022 Management Incentive Plan (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended April 1, 2022), incorporated herein by reference.
10.15*	Materion and Subsidiaries Management Incentive Plan for the 2020 Plan Year (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended March 27, 2020), incorporated herein by reference.
10.16*	Materion and Subsidiaries Management Incentive Plan for the 2021 Plan Year (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended April 2, 2021), incorporated herein by reference.
10.17*	Materion Corporation 2006 Stock Incentive Plan (as Amended and Restated as of May 3, 2017) (filed as Exhibit 4.3 to the Registration Statement on Form S-8 (Registration No. 333-217633), incorporated herein by reference.
10.18*	Form of 2022 Restricted Stock Unit Agreement (Stock-Settled) under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2022 (filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the period ended April 1, 2022), incorporated herein by reference.
10.19*	Form of 2020 Restricted Stock Unit Agreement (Stock-Settled) under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2020 (filed as Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the period ended March 27, 2020), incorporated herein by reference.
10.20*	Form of 2021 Restricted Stock Unit Agreement (Stock-Settled) under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2021 (filed as Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the period ended April 2, 2021), incorporated herein by reference.
10.21*	Form of 2022 Performance-Based Restricted Stock Unit Agreement under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2022 (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended April 1, 2022), incorporated herein by reference.
10.22*	Form of 2020 Performance-Based Restricted Stock Units Agreement under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2020 (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended March 27, 2020), incorporated herein by reference.

10.23*	Form of 2021 Performance-Based Restricted Stock Units Agreement under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2021 (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended April 2, 2021), incorporated herein by reference.
10.24*	Form of 2010 Stock Appreciation Rights Agreement (filed as Exhibit 10.34 to the Company's Annual Report on Form 10-K for the year ended December 31, 2009), incorporated herein by reference.
10.25*	Form of 2016 Stock Appreciation Rights Agreement (filed as Exhibit 10ad to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference.
10.26*	Form of 2020 Appreciation Rights Agreement under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2020 (filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the period ended March 27, 2020), incorporated herein by reference.
10.27*	Form of 2021 Appreciation Rights Agreement under the Materion Corporation 2006 Stock Incentive Plan (As Amended and Restated as of May 3, 2017), covering grants made in 2021 (filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the period ended April 2, 2021), incorporated herein by reference.
10.28*	Materion Corporation Supplemental Retirement Benefit Plan (filed as Exhibit 10.1 to the Company's Form 8-K filed on September 19, 2011), incorporated herein by reference.
10.29*	Amendment No. 1 to the Supplemental Retirement Benefit Plan (filed as Exhibit 10al to the Company's Annual Report on Form 10-K for the year ended December 31, 2012), incorporated herein by reference.
10.30*	Amendment No. 2 to the Supplemental Retirement Benefit Plan (filed as Exhibit 10ah to the Company's Annual Report on Form 10-K for the year ended December 31, 2013), incorporated herein by reference.
10.31*	Materion Corporation 2006 Non-employee Director Equity Plan (as Amended and Restated as of May 3, 2017) (filed as Exhibit 4.3 to the Registration Statement on Form S-8 (Registration No. 333-217618), incorporated herein by reference.
10.32*	Form of 2020 Non-Employee Directors Restricted Stock Unit Agreement (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended June 26, 2020), incorporated herein by reference.
10.33*	Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended March 28, 2008), incorporated herein by reference.
10.34*	Amendment No. 1 to the Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10bf to the Company's Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.
10.35*	Amendment No. 2 to the Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended July 3, 2009), incorporated herein by reference.
10.36*	Amendment No. 3 to the Amended and Restated Executive Deferred Compensation Plan II, dated July 6, 2011 (filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the period ended July 1, 2011), incorporated herein by reference.
10.37*	Materion Corporation Restoration & Deferred Compensation Plan, dated March 4, 2015 (filed as Exhibit 10.1 to the Company's Form 8-K filed on March 10, 2015), incorporated herein by reference.
10.38*	Trust Agreement between the Company and Fidelity Investments dated September 26, 2006 for certain deferred compensation plans for Non-employee Directors of the Company (filed as Exhibit 99.4 to the Current Report on Form 8-K filed by the Company on September 29, 2006), incorporated herein by reference.
10.39*	Trust Agreement between the Company and Fidelity Management Trust Company, dated June 25, 2009 relating to the Executive Deferred Compensation Plan II (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended July 3, 2009), incorporated herein by reference.
(21)#	Subsidiaries of the Registrant.
(23.1)#	Consent of Ernst & Young LLP.
(24)#	Powers of Attorney.
(31.1)#	Certification of Chief Executive Officer required by Rule 13a-14(a) or 15d-14(a).
(31.2)#	Certification of Chief Financial Officer required by Rule 13a-14(a) or 15d-14(a).
(32)#	Certifications of Chief Executive Officer and Chief Financial Officer required by 18 U.S.C. Section 1350.
(95)#	Mine Safety Disclosure Pursuant to Section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act for the Fiscal Year Ended December 31, 2022.

(101.INS)#	Inline 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.
(101.SCH)#	Inline XBRL Taxonomy Extension Schema Document.
(101.CAL)#	Inline XBRL Taxonomy Extension Calculation Linkbase Document.
(101.DEF)#	Inline XBRL Taxonomy Extension Definition Linkbase Document.
(101.LAB)#	Inline XBRL Taxonomy Extension Label Linkbase Document.
(101.PRE)#	Inline XBRL Taxonomy Extension Presentation Linkbase Document.
(104)#	Cover Page Interactive Data File (formatted in Inline XBRL and contained in the Exhibit 101 attachments)
*	Denotes a compensatory plan or arrangement.
#	Filed or furnished herewith.

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.

MATERION CORPORATION

By: /s/ Jugal K. Vijayvargiya
Jugal K. Vijayvargiya
President and Chief Executive Officer

Date: February 16, 2023

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 and on the dates indicated.

/s/ Jugal K. Vijayvargiya Jugal K. Vijayvargiya	President and Chief Executive Officer and Director (Principal Executive Officer)	February 16, 2023
/s/ Shelly M. Chadwick Shelly M. Chadwick	Vice President, Finance and Chief Financial Officer (Principal Financial Officer)	February 16, 2023
/s/ John M. Zaranec John M. Zaranec	Chief Accounting Officer	February 16, 2023
* Vinod M. Khilnani	Director	February 16, 2023
* Emily M. Liggett	Director	February 16, 2023
* Robert J. Phillippy	Director	February 16, 2023
* Patrick Prevost	Director	February 16, 2023
* N. Mohan Reddy	Director	February 16, 2023
* Craig S. Shular	Director	February 16, 2023
* Darlene J. S. Solomon	Director	February 16, 2023
* Robert B. Toth	Director	February 16, 2023

* Shelly M. Chadwick, by signing her name hereto, does sign and execute this report on behalf of each of the above-named officers and directors of Materion Corporation, pursuant to Powers of Attorney executed by each such officer and director filed with the Securities and Exchange Commission.

By: /s/ Shelly M. Chadwick
Shelly M. Chadwick
Attorney-in-Fact

February 16, 2023

Materion Corporation and Subsidiaries

Schedule II—Valuation and Qualifying Accounts

(Thousands)

Valuation allowance on deferred tax assets:	**2022**	**2021**	2020
Balance at Beginning of Period	**$ 4,957**	$ 14,134	$ 17,676
Additions:			
Charged to Costs and Expenses (1)	**373**	497	884
Charged to Other Accounts(3)	**—**	1,019	—
Deductions (2)	**$ (395)**	$ (10,693)	$ (4,426)
Balance at End of Period	**$ 4,935**	$ 4,957	$ 14,134

(1) Increase in valuation allowance is recorded as a component of the provision for income taxes.
(2) 2021 includes a $6.9 million valuation allowance reversal in the fourth quarter of 2021 and a $3.8 million balance sheet impact to deferred taxes.
(3) Change in foreign currency exchange rates and acquired reserves. See acquisition footnote B for acquisition details.

CORPORATE DATA

ANNUAL MEETING

The Annual Meeting of Shareholders will be held on Wednesday, May 17, 2023, at 8:00 a.m. EDT at the Boston Marriott Newton hotel in Newton, Massachusetts.

INVESTOR INFORMATION

Materion Corporation maintains an active program of communication with shareholders, securities analysts, and other members of the investment community. Upon written request, Materion Corporation will provide, without charge, a copy of Materion's annual report on Form 10-K for the year ended December 31, 2022, as well as any Securities and Exchange Commission (SEC) filings.

For such documents, please contact:
Kyle Kelleher
Manager, Investor Relations
(216) 383-4931

AUDITORS

Ernst & Young LLP
950 Main Avenue, Suite 1800
Cleveland, Ohio 44113

TRANSFER AGENT AND REGISTRAR

Equiniti Trust Company
P. O. Box 64854
St. Paul, Minnesota 55164-0854
For shareholder inquiries, call: (800) 468-9716
www.shareowneronline.com

STOCK LISTING

New York Stock Exchange/Symbol: MTRN

CORPORATE HEADQUARTERS

Materion Corporation
6070 Parkland Boulevard
Mayfield Heights, Ohio 44124
(216) 486-4200
Facsimile: (216) 383-4091

WEBSITE

Materion Corporation's website offers financial and investor information, news and facts about the Company, its businesses, markets, and products.

GOVERNANCE

The Company has adopted corporate governance guidelines and a Code of Conduct Policy, in compliance with applicable New York Stock Exchange and SEC requirements. These materials, along with the charters of the Audit and Risk Committee, Compensation and Human Capital Committee, and Nominating, Governance and Corporate Responsibility Committee of the Company's Board of Directors, which also comply with applicable requirements, are available on the Company's website.

DIRECTORS AND EXECUTIVE OFFICERS

BOARD OF DIRECTORS AND COMMITTEES OF THE BOARD

Vinod M. Khilnani 2, 3, 4
Non-Executive Chairman of the Board
Retired Executive Chairman
CTS Corporation

Emily M. Liggett 2, 4
Chief Executive Officer
Liggett Advisors

Robert J. Phillippy 1, 4
Former Chief Executive Officer
Newport Corporation

Patrick Prevost 2, 4
Former Chief Executive Officer
Cabot Corporation

N. Mohan Reddy, Ph.D. 1, 3, 4
B. Charles Ames Professor of Management
Case Western Reserve University

Craig S. Shular 1, 3, 4
Former Executive
Chairman of the Board
GrafTech International Ltd.

Darlene J. S. Soloman , Ph.D. 1, 4
Senior Vice President and Chief Technology Officer
Agilent Technologies, Inc.

Robert B. Toth 2, 4
Former Managing Director
CCMP Capital Advisors, LLC

Jugal K. Vijayvargiya 3
President and Chief Executive Officer
Materion Corporation

1 Audit and Risk Committee
2 Compensation and Human Capital Committee
3 Executive Committee
4 Nominating, Governance and Corporate Responsibility Committee

EXECUTIVE OFFICERS

Jugal K. Vijayvargiya
President and Chief Executive Officer

Shelly M. Chadwick
Vice President, Finance and Chief Financial Officer

Gregory R. Chemnitz
Vice President, General Counsel and Secretary

MATERION