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: 000-24085

AXT, INC.

(Exact name of registrant as specified in its charter)

Delaware	**94-3031310**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
4281 Technology Drive, Fremont, California	**94538**
(Address of principal executive offices)	(Zip Code)

Registrant's telephone number, including area code: **(510) 438-4700**

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

Title of each class:	Trading Symbol	Name of each exchange on which registered:
Common Stock, $0.001 par value	AXTI	The NASDAQ Stock Market LLC

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

None

Indicate by checkmark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act ☐ Yes ☒ No

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

Indicate by checkmark 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 ☒	Non-accelerated filer ☐	Smaller reporting company ☒
			Emerging growth 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).

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

The aggregate market value of the voting stock held by non-affiliates of the registrant, based upon the closing sale price of $5.86 for the common stock on June 30, 2022 as reported on the Nasdaq Global Select Market, was approximately $195,138,094. Shares of common stock held by each officer, director and by each person who owns 10% or more of the outstanding common stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not a conclusive determination for other purposes.

As of March 1, 2023, 43,568,708 shares, $0.001 par value, of the registrant's common stock were outstanding.

TABLE OF CONTENTS

PART I

This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Statements relating to our expectations regarding results of operations, market and customer demand for our products, customer qualifications of our products, our ability to expand our markets or increase sales, emerging applications using chips or devices fabricated on our substrates, the development and adoption of new products, applications, enhancements or technologies, the life cycles of our products and applications, product yields and gross margins, expense levels, the impact of the adoption of certain accounting pronouncements, our investments in capital projects, ramping production at our new sites, potential severance costs with respect to the relocation of our gallium arsenide production lines, our ability to have customers re-qualify substrates from our new manufacturing location in Dingxing, China, our ability to utilize or increase our manufacturing capacity, and our belief that we have adequate cash and investments to meet our needs over the next 12 months are forward-looking statements. Additionally, statements regarding completing steps in connection with the proposed listing of shares of our wafer manufacturing company, Beijing Tongmei Xtal Technology Co., Ltd. (“Tongmei”), on the Shanghai Stock Exchange’s Sci-Tech innovAtion boaRd (the “STAR Market”), being accepted to list shares of Tongmei on the STAR Market, the timing and completion of such listing of shares of Tongmei on the STAR Market are forward looking statements. Words such as “expects,” “anticipates,” “intends,” “plans,” “believes,” “seeks,” “estimates,” “goals,” “should,” “continues,” “would,” “could” and similar expressions or variations of such words are intended to identify forward-looking statements, but are not the exclusive means of identifying forward-looking statements in this annual report. Additionally, statements concerning future matters such as our strategy and plans, industry trends and the impact of trends, tariffs and trade wars, the potential or expected impact of the COVID-19 pandemic on our business, results of operations and financial condition, mandatory factory shutdowns in China, changes in policies and regulations in China and economic cycles on our business are forward-looking statements.

Our forward-looking statements are based upon assumptions that are subject to uncertainties and factors relating to the company’s operations and business environment, which could cause actual results to differ materially from those expressed or implied in the forward-looking statements contained in this report. These uncertainties and factors include, but are not limited to: the withdrawal, cancellations or requests for redemptions by private equity funds in China of their investments in Tongmei, the administrative challenges in satisfying the requirements of various government agencies in China in connection with the investments in Tongmei and the listing of shares of Tongmei on the STAR Market, continued open access to companies to list shares on the STAR Market, investor enthusiasm for new listings of shares on the STAR Market and geopolitical tensions between China and the United States. Additional uncertainties and factors include, but are not limited to: the timing and receipt of significant orders; the cancellation of orders and return of product; emerging applications using chips or devices fabricated on our substrates; end-user acceptance of products containing chips or devices fabricated on our substrates; our ability to bring new products to market; product announcements by our competitors; the ability to control costs and improve efficiency; the ability to utilize our manufacturing capacity; product yields and their impact on gross margins; the relocation of manufacturing lines and ramping of production; possible factory shutdowns as a result of air pollution in China; COVID-19 or other outbreaks of a contagious disease; the availability of COVID-19 vaccines; tariffs and other trade war issues; the financial performance of our partially owned supply chain companies; policies and regulations in China; and other factors as set forth in this Annual Report on Form 10-K, including those set forth under the section entitled “Risk Factors” in Item 1A below. All forward-looking statements are based upon management’s views as of the date of this annual report and are subject to risks and uncertainties that could cause actual results to differ materially from historical results or those anticipated in such forward-looking statements. Such risks and uncertainties include those set forth under the section entitled “Risk Factors” in Item 1A below, as well as those discussed elsewhere in this annual report, and identify important factors that could disrupt or injure our business or cause actual results to differ materially from those predicted in any such forward-looking statements.

These forward-looking statements are not guarantees of future performance. Readers are cautioned not to place undue reliance on these forward-looking statements, which speak only as of the date hereof. Readers are urged to carefully review and consider the various disclosures made in this report, which attempt to advise interested parties of the risks and factors that may affect our business, financial condition, results of operations and prospects. We undertake no obligation to revise or update any forward-looking statements in order to reflect any development, event or circumstance that may arise after the date of this report.

Item 1. ***Business***

AXT, Inc. (“AXT”, “the Company”, “we,” “us,” and “our” refer to AXT, Inc. and its consolidated subsidiaries) is a materials science company that develops and produces high-performance compound and single element semiconductor substrates, also known as wafers. Two of our consolidated subsidiaries produce and sell certain raw materials some of which are used in our substrate manufacturing process and some of which are sold to other companies.

Our substrate wafers are used when a typical silicon substrate wafer cannot meet the performance requirements of a semiconductor or optoelectronic device. The dominant substrates used in producing semiconductor chips and other electronic circuits are made from silicon. However, certain chips may become too hot or perform their function too slowly if silicon is used as the base material. In addition, optoelectronic applications, such as LED lighting and chip-based lasers, do not use silicon substrates because they require a wave form frequency that cannot be achieved using silicon. Alternative or specialty materials are used to replace silicon as the preferred base in these situations. Our wafers provide such alternative or specialty materials. We do not design or manufacture the chips. We add value by researching, developing and producing the specialty material wafers. We have two product lines: specialty material substrates and raw materials integral to these substrates. Our compound substrates combine indium with phosphorous (indium phosphide: InP) or gallium with arsenic (gallium arsenide: GaAs). Our single element substrates are made from germanium (Ge).

InP is a high-performance semiconductor wafer substrate used in broadband and fiber optic applications, 5G infrastructure and data center connectivity. More recently, InP substrates are being used in certain consumer products, including biometric wearables and other health monitoring applications. In recent years, InP demand has increased. Semi-insulating GaAs substrates are used to create various high-speed microwave components, including power amplifier chips used in cell phones, satellite communications and broadcast television applications. Semi-conducting GaAs substrates are used to create opto-electronic products, including high brightness light emitting diodes (HBLEDs) that are often used to backlight wireless handsets and liquid crystal display (LCD) TVs and also used for automotive panels, signage, display and lighting applications. GaAs wafers could also be used for making vertical cavity surface emitting lasers (VCSELs) and micro-LEDs targeting improved screen technology. Ge substrates are used in applications such as solar cells for space and terrestrial photovoltaic applications.

Our supply chain strategy includes several consolidated raw material companies. One of these consolidated companies produces pyrolytic boron nitride (pBN) crucibles used in the high temperature (typically in the range 500 C to 1,500 C) growth process of single crystal ingots, effusion rings when growing OLED (Organic Light Emitting Diode) tools, epitaxial layer growth in MOCVD (Metal-Organic Chemical Vapor Deposition) reactors and MBE (Molecular Beam Epitaxy) reactors. We use these pBN crucibles in our own ingot growth processes and they are also sold in the open market to other companies. The second consolidated company converts raw gallium to purified gallium. We use purified gallium in producing our GaAs substrates and it is also sold in the open market to other companies for use in producing magnetic materials, high temperature thermometers, single crystal ingots, including gallium arsenide, gallium nitride, gallium antimonite and gallium phosphide ingots, and other materials and alloys. In addition to purified gallium, the second consolidated company also produces InP base material which we then use to grow single crystal ingots. Our substrate product group generated 79%, 75% and 79% of our consolidated revenue and our raw materials product group generated 21%, 25% and 21% for 2022, 2021 and 2020, respectively.

The following chart shows our substrate products and their materials, diameters and illustrative applications and shows our raw materials group primary products and their illustrative uses and applications.

Products

Substrate Group and Wafer Diameter	Sample of Applications
Indium Phosphide (InP) 2”, 3”, 4”	• Data center connectivity using light/lasers • 5G communications • Fiber optic lasers and detectors • Consumer devices • Passive Optical Networks (PONs) • Silicon photonics • Photonic Integrated circuits (PICs) • High efficiency terrestrial solar cells (CPV) • RF amplifier and switching (military wireless & 5G) • Infrared light-emitting diode (LEDs) motion control • Lidar for robotics and autonomous vehicles • Infrared thermal imaging
Gallium Arsenide (GaAs - semi-insulating) 1”, 2”, 3”, 4”, 5”, 6”	• Wi-Fi devices • IoT devices • High-performance transistors • Direct broadcast television • Power amplifiers for wireless devices • Satellite communications • High efficiency solar cells for drones and automobiles • Solar cells
Gallium Arsenide (GaAs - semi-conducting) 1”, 2”, 3”, 4”, 5", 6” ***(8” in sample quantities)***	• High brightness LEDs • Screen displays using micro-LEDs • Printer head lasers and LEDs • 3-D sensing using VCSELs • Data center communication using VCSELs • Sensors for industrial robotics/Near-infrared sensors • Laser machining, cutting and drilling • Optical couplers • High efficiency solar cells for drones and automobiles • Other lasers • Night vision goggles • Lidar for robotics and autonomous vehicles • Solar cells
Germanium (Ge) 2”, 4”, 6”	• Multi-junction solar cells for satellites • Optical sensors and detectors • Terrestrial concentrated photo voltaic (CPV) cells • Infrared detectors • Carrier wafer for LED
Raw Materials Group	
6N+ and 7N+ purified gallium	• Key material in single crystal ingots such as: - Gallium Arsenide (GaAs) - Gallium Nitride (GaN) - Gallium Antimonite (GaSb) - Gallium Phosphide (GaP)
Boron trioxide (B2O3) ***Gallium-Magnesium alloy***	• Encapsulant in the ingot growth of III-V compound semiconductors • Used for the synthesis of organo-gallium compounds in epitaxial growth on semiconductor wafers
pyrolytic boron nitride (pBN) crucibles ***pBN insulating parts***	• Used when growing single-crystal compound semiconductor ingots • Used as effusion rings growing OLED tools • Used in MOCVD reactors • Used when growing epitaxial layers in Molecular Beam Epitaxy (MBE) reactors

All of our products are manufactured in the People's Republic of China (PRC or China) by our PRC subsidiaries and PRC joint ventures. The PRC generally has favorable costs for facilities and labor compared with comparable facilities in the United States, Europe or Japan. Our supply chain includes partial ownership of raw material companies in China (subsidiaries/joint ventures). We believe this supply chain arrangement provides us with pricing advantages, reliable supply, market trend visibility and better sourcing lead-times for key raw materials central to manufacturing our substrates. In the event of industry-wide supply shortages we believe our vertically integrated supply chain strategy will be even more advantageous. Our raw material companies produce materials, including raw gallium (4N Ga), high purity gallium (6N and 7N Ga), starting material for InP, arsenic, germanium, germanium dioxide, pyrolytic boron nitride (pBN) crucibles and boron oxide (B2O3). We have board representation in all of these raw material companies. We consolidate the companies in which we have either a controlling financial interest, or majority financial interest combined with the ability to exercise substantive control over the operations, or financial decisions, of such companies. We use the equity method to account for companies in which we have noncontrolling financial interest and have the ability to exercise significant influence, but not control, over such companies. We purchase portions of the materials produced by these companies for our own use and they sell the remainder of their production to third parties.

The Beijing city government is moving its offices into the district where our original manufacturing facility is currently located and is in the process of moving thousands of government employees into this district. The government has constructed showcase tower buildings and overseen the establishment of new apartment complexes, retail stores and restaurants. A large park, named Green Heart City Park, was built across the street from our facility and Universal Studios has developed an amusement park within a few miles of our facility. To create room and upgrade the district, the city instructed virtually all existing manufacturing companies, including AXT, to relocate all or some of their manufacturing lines. We were instructed to relocate our gallium arsenide manufacturing lines. For reasons of manufacturing efficiency, we elected to also move part of our germanium manufacturing line. Our indium phosphide manufacturing line, as well as various administrative and sales functions, will remain primarily at our original site.

Begun in 2017, the relocation of our gallium arsenide production lines is now completed. Our PRC subsidiary, Baoding Tongmei Xtal Technology Co., Ltd. ("Baoding Tongmei"), entered into volume production in 2020. To mitigate our risks and maintain our production schedule, we moved our gallium arsenide equipment in stages. By December 31, 2019, we had ceased all crystal growth for gallium arsenide in our original manufacturing facility in Beijing and transferred 100% of our ingot production to the new manufacturing facility of our PRC subsidiary, ChaoYang Tongmei Xtal Technology Co., Ltd., ("ChaoYang Tongmei"), in Kazuo, a city approximately 250 miles from Beijing. We transferred our wafer processing equipment for gallium arsenide to Baoding Tongmei's new manufacturing facility in Dingxing, a city approximately 75 miles from Beijing. Most of our larger, more sophisticated customers have qualified gallium arsenide wafers from the new sites. A few customers, as well as prospective customers, are still in the qualification process. These new facilities enabled us to expand capacity and upgrade some of the equipment. In 2021 and 2022, we added additional equipment, including certain more advanced equipment. We have also invested in additional buildings to complement the initial construction and add capacity as needed. Our PRC subsidiaries also acquired sufficient land to enable them to add facilities, if needed in the future. We believe our ability to add capacity gives us a competitive advantage. In addition, a new level of technological sophistication in our manufacturing capabilities will enable us to support the major trends that we believe are likely to drive demand for our products in the years ahead.

Customer qualifications and expanding capacity as needed require us to continue to diligently address the many details that arise at each of our sites. A failure to properly accomplish this could result in disruption to our production and have a material adverse impact on our revenue, our results of operations and our financial condition. If we fail to meet the product qualification and volume requirements of a customer, we may lose sales to that customer. Our reputation may also be damaged. Any loss of sales could have a material adverse effect on our revenue, our results of operations and our financial condition.

On November 16, 2020, we announced a strategic initiative to access China's capital markets by beginning a process to list shares of Tongmei in an initial public offering (the "IPO") on the STAR Market, an exchange intended to support innovative companies in China. We formed and founded Tongmei in 1998 and believe Tongmei has grown into a company that will be an attractive offering on the STAR Market. To qualify for a STAR Market listing, the first major step in the process was to engage private equity firms in China ("Investors") to invest funds in Tongmei. By December

31, 2020, Investors, which consist of 10 private equity funds, had entered into two sets of definitive transaction documents, each consisting of a capital increase agreement along with certain supplemental agreements in substantially the same form (collectively, the “Capital Investment Agreements”), with Tongmei for a total investment of approximately $48.1 million. (The currency used in the investment transactions was the Chinese renminbi, which has been converted to approximate U.S. dollars for this report.) The remaining investment of approximately $1.5 million of new capital was funded in January 2021. Under China regulations, these investments must be formally approved by the appropriate government agency and are not deemed to be dilutive until such approval is granted. The government approved the approximately $49 million investment in its entirety on January 25, 2021. In exchange for an investment of approximately $49 million, the Investors received a 7.28% redeemable noncontrolling interest in Tongmei.

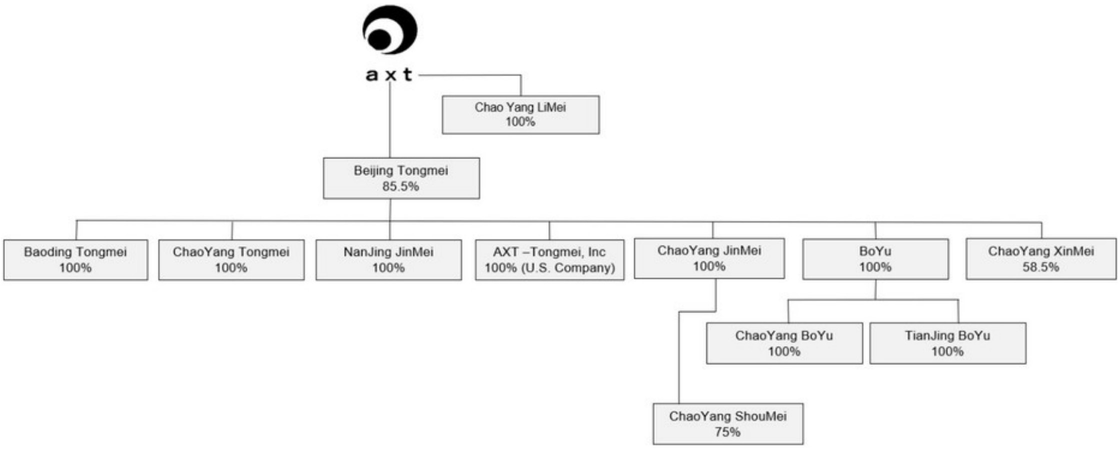
Pursuant to the Capital Investment Agreements with the Investors, each Investor has the right to require AXT to redeem any or all Tongmei shares held by such Investor at the original purchase price paid by such Investor, without interest, in the event the IPO fails to pass the audit of the Shanghai Stock Exchange, is not approved by the Chinese Securities Regulatory Commission (“CSRC”) or Tongmei cancels the IPO application. The aggregate redemption amount is approximately $49 million, subject to the foreign exchange rate variable at time of redemption.

Tongmei submitted its IPO application to the Shanghai Stock Exchange in December 2021 and it was formally accepted for review on January 10, 2022. The Shanghai Stock Exchange approved the IPO application on July 12, 2022. On August 1, 2022, the CSRC accepted for review Tongmei’s IPO application. The STAR Market IPO remains subject to review and approval by the CSRC and other authorities. The process of going public on the STAR Market includes several periods of review and, therefore, is a lengthy process. Further, the timing of the completion of the Star Market IPO is subject to numerous factors outside Tongmei’s control. The listing of Tongmei on the STAR Market will not change the status of AXT as a U.S. public company.

An early step in the STAR Market IPO process involved certain entity reorganizations and alignment of assets under Tongmei. In this regard our two consolidated raw material companies, Nanjing JinMei Gallium Co., Ltd. (“JinMei”) and Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd. (“BoYu”) and its subsidiaries were assigned to Tongmei in December 2020. As of June 30, 2021, AXT-Tongmei, Inc., a wholly owned subsidiary of AXT, was assigned to Tongmei. The assignment to Tongmei of JinMei, BoYu and its subsidiaries, and AXT-Tongmei, Inc. will increase the number of customers and employees attributable to Tongmei as well as increase Tongmei’s consolidated revenue.

We are neither a PRC operating company nor do we conduct our operations in China through the use of variable interest entities (“VIEs”). Recent statements and regulatory actions by China’s government on the use of VIEs and data security or anti-monopoly concerns have not impacted our ability to conduct our business or continue to list our common stock on the Nasdaq Global Select Market.

The following organization chart depicts the consolidated structure as of December 31, 2022.



The businesses of our PRC subsidiaries and PRC joint ventures are subject to complex and rapidly evolving laws and regulations in the PRC, which can change quickly with little advance notice. The PRC government is a single party form of government with virtually unlimited authority and power to intervene in or influence commercial operations in China. In the past, we have experienced such intervention or influence by the PRC government and a change in the rules and regulations in China when we were instructed by the Beijing municipal government to relocate our manufacturing facility in Beijing and expect that such intervention or influence or change in the rules and regulations in China could occur in the future.

In the ordinary course of business, our PRC subsidiaries and PRC joint ventures require permits and licenses to operate in the PRC. Such permits and licenses include permits to use hazardous materials in manufacturing operations. From time to time, the PRC government issues new regulations, which may require additional actions on the part of our PRC subsidiaries and PRC joint ventures to comply. For example, on February 27, 2015, the China State Administration of Work Safety updated its list of hazardous substances. The previous list, which was published in 2002, did not restrict the materials that we use in our wafers. The new list added gallium arsenide. As a result of the newly published list, we were required to seek additional permits. In the ordinary course of business, our PRC subsidiaries and PRC joint ventures apply for permits as required. Any such intervention or influence or change in the rules and regulations in China could result in a material change in our PRC operations and/or the value of our common stock or cause the value of such securities to significantly decline or be worthless.

In September 2018, the Trump Administration announced a list of thousands of categories of goods that became subject to tariffs when imported into the United States. This pronouncement imposed tariffs on the wafer substrates we imported into the United States. The initial tariff rate was 10% and subsequently was increased to 25%. Approximately 14% of our revenue derives from importing our wafers into the United States and we expect the volume to increase. In 2022, 2021 and 2020, we paid approximately \$3.3 million, \$1.3 million and \$1.3 million, respectively, in tariffs. The future impact of tariffs and trade wars is uncertain.

We have created a vertically-integrated supply chain and transfer cash through our corporate structure in three ways. First, we capitalize our investments in our PRC subsidiaries. We license to our PRC subsidiaries intellectual property and receive from our PRC subsidiaries royalty payments. Second, we use transfer pricing arrangements to buy from our PRC subsidiaries and PRC joint ventures wafers and raw materials. We also sell to our PRC subsidiaries capital equipment that we purchase at the request of our PRC subsidiaries and for which we are reimbursed by the applicable PRC subsidiary. We review the terms of the transfer pricing arrangements annually with our independent registered public accounting firm. Third, our PRC subsidiaries and PRC joint ventures have paid dividends to entities within the Company's corporate structure. For the years ended December 31, 2022 and 2021, the aggregate dividends paid to the

Company, directly or to an intermediate entity within our corporate structure, by our PRC subsidiaries and PRC raw material joint ventures were approximately $2.9 million and $774,000, respectively. In June 2021, the Company received a $774,000 dividend from one of our equity investments, Xiaoyi XingAn Gallium Co., Ltd. ("Xiaoyi XingAn"). For years ended December 31, 2022 and 2021, the aggregate dividends paid to minority shareholders by our PRC subsidiaries and PRC raw material joint ventures were approximately $0 and $0, respectively. All of these distributions were paid to our PRC subsidiaries and the minority shareholders. For the year ended December 31, 2022, no transfers, dividends, or distributions have been made to date between the Company and its PRC subsidiaries, or to investors, except for the settlement of amounts owed under our transfer pricing arrangements in the ordinary course of business. We have no current intentions to distribute to our investor's earnings under our corporate structure. We settle amounts owed under our transfer pricing arrangements in the ordinary course of business.

The cash generated from one PRC subsidiary is not used to fund another PRC subsidiary's operations. None of our PRC subsidiaries has ever faced difficulties or limitations on its ability to transfer cash between our subsidiaries. We have cash management policies that dictate the amount of such funding.

We are subject to a number of unique legal and operational risks associated with our corporate structure, any of which could result in a material change in our operations and/or the value of our common stock or cause the value of such securities to significantly decline or be worthless. Please carefully read the information beginning on page 9 of this report and included in Item 1A. Risk Factors. In particular, the following risk factors address issues associated with our corporate structure:

- Although we are a Delaware corporation and are neither a PRC operating company nor do we conduct our operations in China through the use of VIEs, in the event we inadvertently concluded that we do not require any permissions or approvals from the CSRC or other PRC central government authorities to complete a public offering of securities in the U.S. or applicable laws, regulations, or interpretations change, we may be required to obtain such permissions or approvals to complete such a public offering of securities.
- The PRC central government may intervene in or influence our PRC operations at any time and the rules and regulations in China can change quickly with little advance notice.
- The PRC central government may also exert more control over offerings conducted overseas and/or foreign investment in China-based issuers, which could result in a material change in our operations and/or the value of our common stock.
- Changes in China's political, social, regulatory or economic environments may affect our financial performance.
- Joint venture raw material companies in China bring certain risks.
- Risks exist in utilizing our new gallium arsenide manufacturing sites efficiently.
- The Chinese central government is increasingly aware of air pollution and other forms of environmental pollution and their reform efforts can impact our manufacturing, including intermittent mandatory shutdowns.
- Shutdowns or underutilizing our manufacturing facilities may result in declines in our gross margins.
- Enhanced trade tariffs, import restrictions, export restrictions, Chinese regulations or other trade barriers may materially harm our business.
- If China places restrictions on freight and transportation routes and on ports of entry and departure this could result in shipping delays or increased costs for shipping.
- Our international operations are exposed to potential adverse tax consequence in China.
- We derive a significant portion of our revenue from international sales, and our ability to sustain and increase our international sales involves significant risks.
- The terms of the private equity raised in China as a first step toward an IPO on the STAR Market grant each Investor a right of redemption if Tongmei fails to achieve its IPO.
- We are subject to foreign exchange gains and losses that may materially impact our statement of operations.
- Although the audit report incorporated by reference in this prospectus is prepared by an independent registered public accounting firm that is currently inspected fully by the Public Company Accounting

Oversight Board (the "PCAOB"), there is no guarantee that future audit reports will be prepared by an independent registered public accounting firm that is completely inspected by the PCAOB.

Our independent registered public accounting firm is BPM, which is registered with PCAOB. The Holding Foreign Companies Accountable Act (the "HFCA Act") requires that the PCAOB determine whether it is unable to inspect or investigate completely registered public accounting firms located in a non-U.S. jurisdiction because of a position taken by one or more authorities in that jurisdiction. On December 16, 2021, the PCAOB issued a report on its determinations that the PCAOB is unable to inspect or investigate completely registered public accounting firms headquartered in the PRC and Hong Kong because of positions taken by PRC authorities in those jurisdictions. BPM is neither headquartered in the PRC or Hong Kong nor is it subject to the determinations announced by the PCAOB. Accordingly, the Company does not expect the HFCA Act, the Accelerating Holding Foreign Companies Accountable Act and the related regulations to affect the Company and does not expect to be identified by the Securities and Exchange Commission, or SEC, under the HFCA Act. On December 15, 2022, the PCAOB vacated its 2021 determinations that the positions taken by authorities in the PRC and Hong Kong prevented it from inspecting and investigating completely registered public accounting firms headquartered in those jurisdictions. See "Although the audit report is prepared by an independent registered public accounting firm who is currently inspected fully by the PCAOB, there is no guarantee that future audit reports will be prepared by an independent registered public accounting firm that is completely inspected by the PCAOB" under Item 1A. Risk Factors for further information on risks attendant to our foreign operations and dependence.

We were incorporated in California in December 1986 and reincorporated in Delaware in May 1998. The Company went public in 1998. We changed our name from American Xtal Technology, Inc. to AXT, Inc. in July 2000. Our principal corporate office is located at 4281 Technology Drive, Fremont, California 94538, and our telephone number at this address is (510) 438-4700.

Industry Background

Certain electronic and opto-electronic applications have performance requirements that exceed the capabilities of conventional silicon substrates, also known as wafers, and often require high-performance compound wafers (mixture of two materials) or single element wafer substrates. Examples of higher performance non-silicon based wafer substrates include GaAs, InP, gallium nitride (GaN), silicon carbide (SiC) and Ge. One of the earliest broadly used alternative wafer substrates was GaAs and GaAs wafer substrates were the earliest wafer substrates we produced.

Silicon substrates dominate the semiconductor substrate market. Silicon wafers are larger in diameter and significantly lower in cost. AXT and our competitors exist because the laws of physics prevent certain functions from performing properly, or at all, if silicon material is used as the wafer substrate. Our substrate wafers are used when a typical silicon substrate wafer cannot meet the performance requirements of a semiconductor chip or optoelectronic device. Demand for higher performance non-silicon-based wafer substrates, such as the substrates in which AXT specializes, is expected to increase as new applications are adopted. In contrast to the ever-more complex electronic circuit designs and the skill sets required to accomplish such designs, the knowledge base and skill sets required for AXT and our competitors are material science-based. We do not design or manufacture the semiconductor chips and other electronic circuits. Instead, we apply our deep knowledge in material science to grow single crystal ingots that are then sliced into individual wafer substrates. We add value by researching, developing and producing the specialty material wafers. This places us at the beginning of the semiconductor "food chain".

InP is a high-performance semiconductor substrate used in broadband and fiber optic applications, 5G infrastructure and data center connectivity. More recently, InP substrates are being used in certain consumer products. InP substrates are also used in biometric wearables and other health monitoring applications. In recent years, InP demand has increased. Semi-insulating GaAs substrates are used to create various high-speed microwave components, including power amplifier chips used in cell phones, satellite communications and broadcast television applications. Semi-conducting GaAs substrates are used to create opto-electronic products, including high brightness light emitting diodes (HBLEDs) that are often used to backlight wireless handsets and liquid crystal display (LCD) TVs and also used for automotive panels, signage, display and lighting applications. A new application for semi-conducting GaAs substrates is 3-D sensing chips using VCSELs (vertical cavity surface emitting lasers) as an array of lasers on a single chip that can be used in cell phones and other devices. GaAs wafers could also be used for making vertical cavity surface emitting lasers (VCSELs) and micro-LEDs targeting improved screen technology. Ge substrates are used in applications such as solar cells for space and terrestrial photovoltaic applications.

The AXT Advantages

We believe that we benefit from the following advantages:

- *New facilities, equipment and added capacity.* We believe we are the only company in our industry to have added significant new facilities, equipment and capacity in 2021 and 2022. Although current customers and prospective customers previously viewed our relocation process as a risk, we believe our success in managing this process now positions us as the “go to” supplier with a state of the art manufacturing line, a proven ability to add capacity and a commitment to continuous improvement.

- *Funds from the recent private equity investments in Tongmei and the anticipated future IPO of Tongmei are viewed favorably by our customers, prospective customers and government agencies in China.* New applications using InP and GaAs wafer substrates could require significant capital investments to add capacity, purchase and install advanced process and test equipment or construct additional facilities. We believe customers view the funds raised in December 2020 and January 2021, and intended to be raised in the IPO, as a sign of our commitment to meet their needs and to deploy this capital to increase capacity as needed. Further, we believe Tongmei is viewed more favorably by local government agencies in light of its intention to go public on the STAR Market.

- *Key leadership in InP technology and revenue growth.* We believe our InP wafers have the lowest defect densities, stress and slip lines on the market, enabling our customers to achieve the highest wafer fab and device yields. We have developed a strong base of proprietary InP technology that we continue to expand. There are significant barriers to entry in the InP substrate market and currently, there are only three primary suppliers, including AXT. We believe that this market will continue to expand and grow. We intend to promote our track record of successfully adding capacity as the market expands.

- *Key provider of low defect density GaAs wafer substrates.* In recent years customer demand for low etch pit density (“EPD”) GaAs wafer substrates has increased, particularly for LED lighting, the deployment of 3-D sensing for facial recognition in cell phones and world facing camera technology in cell phones. The requirement of low EPD is a barrier to entry and we believe there are a limited number of potential substrate providers that can meet this requirement, including AXT. As we qualify low EPD wafers from our new location, we believe the quality of our low EPD wafers and our ability to expand manufacturing capacity quickly will enable us to support new applications and generate additional revenue.

- *Proprietary process technology drives manufacturing.* In our industry, the single crystal growth process and the wafer manufacturing process incorporate proprietary process technology. We have a substantial body of proprietary process technology and we believe this gives us a competitive advantage, especially in InP. This also creates a barrier to entry.

- *Low-cost manufacturing operation in China.* Since 2004, we have manufactured all of our products in China, which generally has favorable costs for facilities and labor compared to costs of comparable facilities and labor in the United States, Japan or Europe. As of December 31, 2022, 1,532 of our 1,559 employees (including employees at our Beijing, Kazuo and Dingxing facilities as well as our consolidated raw material companies) were located in China. Our primary competitors have their major manufacturing operations in Germany or Japan. Our presence in China also enables us to closely manage our raw materials supply chain.

- *We believe that we are the only compound semiconductor substrate supplier to have a position in raw materials.* We have partial ownership of raw material companies in China that form an integral part of our supply chain. We believe our subsidiaries and raw material companies in China provide us with a more reliable supply of, and shorter lead-times for, the raw materials central to our final manufactured products compared to third-party providers. We believe that this dedicated supply chain will enable us to meet increases in demand from our customers by providing an increased volume of raw materials quickly, efficiently and cost effectively.

- *Our diverse product offering results in a broader range of customers and applications*. We offer a diverse range of products and are able to provide custom-defined products that meet our customers' specifications. We have a strong technical sales support team that engages with our customers and understands their product requirements. A significant percentage of the members of our team that engage with customers have PhDs in physics or materials science. This combination of technical sales strength and our willingness to accept our customers' unique product specifications results in a broad range of customers and applications. As demand for our wafer substrates expands it could strain the supply of raw materials making our business model even more important.

- *Enhanced revenue diversity through the sale of raw materials.* Our strategy allows our consolidated subsidiaries to also sell raw materials in the open market to third parties. Revenue from non-substrate products provides further diversity in our customer base and business model.

- *Business model unique among current competitors.* We believe we are the only publicly traded company producing InP, GaAs and Ge wafer substrates. Our main competitors are either privately owned companies or divisions within very large companies that are publicly listed in Japan. We believe the combination of access to U.S. and China capital markets, China-based manufacturing and a unique strategy for the supply of many of the raw materials we need is a competitive advantage as well as an attractive business model to our customers.

Strategy

Our goal is to become the leading worldwide supplier of high-performance compound and single element semiconductor substrates. Key elements of our strategy include:

Promote our strengths in InP. As cloud-based data centers continue to combine integrated circuits and InP-based lasers to transfer data through light, we believe there will be increased demand for InP substrates. More recently InP is being used in 5G infrastructure. Future applications could include driverless cars, 5G in cell phones and health and well-being biometric wearables.

Add InP capacity and continue InP R&D. We are continuing to add manufacturing capacity for InP to support the growth for this product line. End market applications using our wafer substrate products often have long product life cycles. We believe the end market applications using InP could have product life cycles that are similar to the long product life cycles of end market applications using GaAs. In addition to adding manufacturing capacity, we are continuing to invest in InP crystal growth technology and wafer processing technology. For example, we are developing six-inch diameter ingots and improving the relative flatness of the wafer surface to improve performance.

Target GaAs based 3-D and Time of Flight sensing array applications in mobile devices. Although 3-D sensing has not yet been widely adopted and embraced, we believe its use in world-facing cameras will accelerate adoption and generate a significant impact for high-quality GaAs suppliers. We believe 3-D sensing technology will also be used as sensors in driverless automobiles. The GaAs substrate requirements for 3-D sensing applications include very low defect densities or etch pitch densities. We intend to capture opportunities in these markets by promoting our strengths and capabilities.

Analyze and monitor the potential market for GaAs-based micro-LEDs. There is growing interest in developing micro-LEDs for advanced screen technology. If such technology is adopted successfully for use in smart phones, then the total available market could be significant and we would endeavor to serve that market.

Create customer awareness that the new facilities are designed to allow us to add equipment and capacity rapidly. The construction of new facilities and infrastructure takes much longer to complete in comparison to the installation of furnaces and other manufacturing equipment. We have proven our ability to do both and we believe this ability makes us an attractive supplier for customers.

Offer diverse products, including custom products. We believe AXT has a reputation in the market for providing a broad range of products, including custom products that are supported by a team of technical sales support professionals, the majority of whom hold advanced graduate degrees in physics or materials science. We plan to further promote this brand image as a way to differentiate ourselves in the market. We believe this strategy will lead to a more diverse customer base and higher volumes.

Sustain manufacturing efficiencies. We seek to continue to leverage our China-based manufacturing advantage by increasing efficiencies in our manufacturing methods, systems and processes. We promote the concept and practice of continuous improvement within our company culture.

Increase productivity and seek profitability in our subsidiaries/consolidated raw material companies. The supply and demand equation for specialty materials can be complex and volatile. Over the years, we have established or invested in raw material companies in China that are an integral part of our supply chain. We will continue to provide strategic support to these companies and they, in turn, will continue to be the backbone of our supply chain. We plan to work closely with these companies to increase their productivity and improve their financial performance as they continue to support our supply chain.

Materials of the future. The specialty materials substrate market is dynamic and subject to continued changes and cycles. We plan to use our deep knowledge and experience in specialty materials and wafer substrates to seek new applications for existing substrates in our portfolio and explore additional materials that may be synergistic with our knowledge base, customer needs and manufacturing lines.

Technology

Wafer substrates on which integrated circuits and optical devices are fabricated serve as a foundation for semiconductor device fabrication. Wafers are derived from ingots that are grown in a cylindrical form. The diameter and length of an ingot will vary depending on the type of material and the growth process used. An ingot can be single-crystalline (a single crystal) or multi-crystalline (polycrystalline). A single crystal is a continuous lattice of atoms with no boundaries within the structure. The ingot must be a single crystal in order for it to be useful in making wafers for device fabrication. A single crystal ingot can be made from a single element such as germanium or silicon, or it can be made from two or more elements such as gallium arsenide (with gallium and arsenic) or indium phosphide (with indium and phosphorous). Depending on physical properties of the materials in a wafer, the performance of devices and circuits can be remarkably different.

AXT uses its proprietary vertical gradient freeze (VGF) technology for growing single crystal Indium Phosphide (InP), Gallium Arsenide (GaAs) and Germanium (Ge) ingots. After growing the crystalline ingot, the ingot is then sliced into individual substrates or wafers. Before specialty material wafers can be used, a thin layer of structured chemicals is grown on the surface of the substrate. This is called an epitaxial layer and it is a complicated and highly technical process. We do not grow the epitaxial layer. We sell the majority of our substrates to companies that specialize in applying the epitaxial layer. Our wafers are then used to produce state-of-the-art electronic circuits and opto-electronic devices. The chips are used in a wide variety of applications.

InP and GaAs compounds are formed by combining elements from Groups III and V in the periodic table of elements, whereas Ge is a Group IV elemental material. Each of these materials has unique properties that determine the best device and/or circuit applications. As a result of their special high electron mobility combined with their direct ban-gap properties, both InP and GaAs wafers have enjoyed dominant roles in the production of light-emitting diodes (LEDs), solid-state lasers and power amplifiers for mobile phones, to name a few applications. Ge wafers, on the other hand, have played a key role in the manufacturing of special solar cells known as triple junction solar cells (TJSCs) for space and terrestrial power generation.

With the recent evolution in several applications, InP lasers are projected to play a dominant role in the optoelectronics arena, e.g. silicon photonics (where InP lasers are a key component), autonomous cars (where special wavelength InP-based lasers are used for object sensing and collision avoidance), health and well-being biometric wearables and certain consumer products. Crystal growth process technology frequently contains steps and procedures that are considered proprietary secrets held by the producer, often including methods to control the temperature within the crucible. InP crystal growth relies on extreme pressure within the crucible. As such it requires not only temperature control methodologies, but also pressure control and stabilization process methodologies, many of which AXT considers proprietary trade secrets. It is this combination of variables and the required methods to control them that create a barrier to entry. We believe our long-term investment in InP research and development has resulted in a substantive body of proprietary knowledge.

After growing the crystalline ingot, the material is then sliced into individual substrates or wafers. We have continued to invest in wafer processing technology covering each step in the process from sawing to edge smoothing to final cleaning and we believe we have technology and trade secrets addressing the scope of wafer processing. One focus in our recent development programs has been on automation, particularly in cleaning the wafers.

Ideally, all the atoms in a wafer or substrate are arrayed in a specific periodic order. However, sensitivities in the ingot growth process will cause some atoms to be improperly aligned and these are referred to as dislocations. The aggregate number of dislocations in a wafer is referred to as the dislocation density. Dislocation densities can be seen as a group of tiny marks or pits under a microscope by etching the wafer with acid and each wafer has an etch pit density or EPD. Certain micro devices, such as GaAs industrial lasers, require wafers with very low EPD. AXT considers the process technology we use to achieve low EPD as proprietary process technology and we believe we are one of only a few substrate manufacturing companies that can produce low EPD wafers.

Products

We have two product lines: specialty material substrates and raw materials integral to these substrates. We design, develop, manufacture and distribute high-performance semiconductor substrates, also known as wafers. Through two consolidated subsidiaries in our supply chain, we also sell certain raw materials. InP is a high-performance semiconductor substrate used in fiber optic lasers and detectors, passive optical networks (PONs), telecommunication, 5G infrastructure, metro and data center connectivity, silicon photonics, photonic ICs (PICs), terrestrial solar cell (CPV), lasers, RF amplifiers, infrared motion control and infrared thermal imaging. During the year ended December 31, 2022, two consumer products were released that use chips fabricated on our InP substrate wafers. We make semi-insulating GaAs substrates used in making semiconductor chips in applications such as power amplifiers for wireless devices and high-performance transistors. Our semi-conducting GaAs substrates are used to create opto-electronic products, which include High Brightness LEDs that are often used to backlight wireless handsets and LCD TVs and for automotive, signage, display and lighting applications, as well as high power industrial lasers for material processing (welding, cutting, drilling, soldering, marking and surface modification). Our semi-conducting GaAs substrates can be used to make micro-LEDs for advanced screen technologies and to create opto-electronic products for 3-D sensing using VCSELs. Ge substrates are used in emerging applications, such as triple junction solar cells for space and terrestrial photovoltaic applications and for optical applications.

Substrates. We currently sell compound substrates manufactured from InP and GaAs, as well as single-element substrates manufactured from Ge. We supply InP substrates in two-, three- and four-inch diameters, and are developing six-inch diameter InP substrates. We supply Ge substrates in two-, four- and six-inch diameters. We supply both semi-insulating and semi-conducting GaAs substrates in one-, two-, three-, four-, five- and six-inch diameters. We are developing eight-inch diameter GaAs substrate wafers and began selling samples in the second half of 2022. Many of our customers require customized specifications, such as special levels of iron or sulfur dopants or a special wafer thickness.

Raw Materials. Our two consolidated raw material subsidiaries produce and sell certain raw materials, some of which are used in our substrate manufacturing process and some of which are sold to other companies. One of these consolidated companies produces pBN crucibles and the other consolidated company converts raw gallium to purified gallium and produces InP base material.

We promote our product diversity as a way to differentiate ourselves in the market. Some competitors provide only gallium arsenide substrates. We provide gallium arsenide and also indium phosphide and germanium substrates. Some competitors limit their wafer diameters to only a few sizes. Our wafers range from one inch to up to eight inches in diameter. We also produce substrates with customer defined specifications, which may range in thickness, smoothness or flatness and may include adding special additional materials, such as iron or sulfur. In addition to our wafers or substrates, we also generate revenue from our two consolidated subsidiaries that sell raw materials. Product diversity can mitigate some of the down cycles in our market because we are not dependent on a single product or application for revenue.

Customers

Before specialty material wafers can be processed in a typical wafer manufacturing facility that constructs the electronic circuit, laser or optical device on a chip, a thin layer of structured chemicals is grown on the surface of the substrate. This is called an epitaxial layer. We do not grow the epitaxial layer. We sell our substrates to companies that apply the epitaxial layer, who then in turn sell the modified wafers to the wafer fabs, chip design companies, LED manufacturers and others. Some customers do both the epitaxial layer and wafer fabrication.

Epitaxial layer companies that form our customer base are located in Asia, the United States and Europe. We also sell our products to universities and other research organizations that use specialty materials for experimentation in various aspects of semi-conducting and semi-insulating applications. Our customers that purchase raw materials are located in Asia, the United States and Europe.

We have at times sold a significant portion of our products in any particular period to a limited number of customers. One customer, Landmark, represented 15% and 11% of our revenue for the years ended December 31, 2022 and 2020, respectively, and no customer represented more than 10% of our revenue for the year ended December 31, 2021. Our top five customers, although not the same five customers for each period, represented 34% of our revenue for the year 2022, 26% of our revenue for 2021 and 32% of our revenue for 2020.

For the year ended December 31, 2022, three customers of our consolidated subsidiaries, in aggregate, accounted for 29% of raw material sales. For the year ended December 31, 2021, three customers of our consolidated subsidiaries, in aggregate, accounted for 28% of raw material sales and for the year ended December 31, 2020, three customers accounted for 31% of raw material sales. Our subsidiaries and consolidated raw material companies are a key strategic benefit for us as they further diversify our sources of revenue.

Manufacturing, Raw Materials and Supplies

We manufacture all of our products in China. We believe this location generally has favorable costs for facilities and labor compared to the United States or compared to the location of some of our competitors in Japan and Germany.

We use a two-stage wafer manufacturing process. The first stage deploys our VGF technology for the crystal growth of single element or compound element ingots in diameters currently ranging from one inch to eight inches. The growth process occurs in high temperature furnaces built using our proprietary designs. Growing the crystalline elements into cylindrical ingots takes a number of days, depending on the diameter and length of the ingot produced. The crystal growth stage utilizes AXT proprietary process technology. The second stage includes slicing or sawing the ingot into wafers or substrates, then processing each substrate to strict specifications, including grinding to reduce the thickness, beveling the edges, and then polishing and cleaning each substrate. Many of the wafer processing steps use chemical baths and properly cleaning the wafer is a critical process. The wafer processing stage also utilizes AXT proprietary process technology.

Wafers from each ingot will include some material that does not meet specifications or quality standards. Defects may occur as a result of inherent factors in the materials used in the crystalline growth process. They may also result from variances in the manufacturing process. We have many steps in our line that are partially or fully automated but other manufacturing steps are performed manually. We intend to increase the level of automation, particularly in cleaning the wafers. Due to potential defects, yield is a key factor in our manufacturing cost. Other key elements are the initial cost of the raw material elements, manufacturing equipment, factory loading, facilities and labor. In 2015, we purchased wafer processing equipment. In addition, we secured a manufacturing license. This license includes detailed work instructions for using the equipment purchased and allows us to apply the licensed proprietary wafer processing technology at any step and on any form of equipment in our line.

Together with certain subsidiaries we have partial ownership of 10 raw material companies in China that form the backbone of our supply chain model. These companies generally provide us with reliable supply, market trend visibility, and shorter lead-times for raw materials central to our manufactured products, including gallium, gallium alloys, indium phosphide poly-crystal, high-purity arsenic, germanium, germanium dioxide, pBN and boron oxide. We believe that these raw material companies have been and will continue to be advantageous in allowing us to procure materials to support our planned growth. In addition, we purchase supply parts, components and raw materials from several other domestic and international suppliers. We depend on a single or limited number of suppliers for certain critical materials used in the production of our substrates, such as quartz tubing, arsenic, phosphorus and polishing solutions. We generally purchase our materials through standard purchase orders and not pursuant to long-term supply contracts.

Recycling

We developed a proprietary process technology that enables us to recycle remnants of indium phosphide processing material. The process was introduced into manufacturing in 2022. The process involves capturing certain InP waste materials generated in the manufacturing process. These materials can then be re-processed and cycled back into the normal process procedures. Not only is this beneficial for environmental reasons, it also reduces our total material costs and, ultimately, improves our gross margin. We are continuing this recycling effort and expect to apply this process to gallium arsenide processing in the future.

Sales and Marketing

We sell our substrate products directly to customers through our direct salesforce in the United States, China and Europe. We also use independent sales representatives and distributors in Japan, Taiwan, Korea and other areas. Our direct salesforce is knowledgeable in the use of compound and single-element substrates. Specialty material wafers are scientifically complicated. Our application engineers must work closely with customers during all stages of our wafer substrate manufacturing process, from developing the precise composition of the wafer substrate through manufacturing and processing the wafer substrate to the customer’s specifications. We believe that maintaining a close relationship with customers and providing them with engineering support improves customer satisfaction and provides us with a competitive advantage in selling. A significant percentage of the members of our technical sales support team who frequently engage with customers have PhDs in physics or materials science.

International Sales. International sales are a substantial part of our business. Sales to customers outside North America (primarily the United States) accounted for approximately 86% of our revenue for 2022 and approximately 90% of our revenue during each of 2021 and 2020. The primary markets for sales of our substrate products outside of North America are to customers located in Asia and Western Europe.

Our raw material companies sell specialty raw materials including 4N, 5N, 6N, 7N and 8N gallium, boron oxide, germanium, arsenic, germanium dioxide, pyrolytic boron nitride crucibles used in crystal growth, parts for MBE and parts used in manufacturing OLED rings. Each raw material company has its own separate sales force and sells directly to its own customers in addition to selling raw materials to us.

Research and Development

To maintain and improve our competitive position, we focus our research and development efforts on designing new proprietary processes and products, improving the performance of existing products, achieving new lows in EPD, increasing yields and reducing manufacturing costs. We also conduct research and development focusing on larger diameter wafers and, in our history, we have consistently developed new products based on larger wafer diameters. Crystal growth of specialty earth materials becomes significantly more difficult as the ingot diameter increases because a consistent temperature, and in the case of InP, consistent control of pressure, must be applied over a larger surface area. In 2015, we acquired certain proprietary InP crystal growth technology and equipment from Crystacomm.

Certain micro devices, such as those used in industrial lasers, require GaAs wafers with very low EPD. Low EPD will also be required for GaAs 8-inch diameter wafers that will be used in micro LED applications and InP wafers that will be used in certain high-end applications. Low EPD has been, and will remain, a focus in our research and development efforts.

Our current substrate research and development activities focus on continued development and enhancement of GaAs, InP and Ge substrates, including improved yield, enhanced surface and electrical characteristics and uniformity, greater substrate strength and increased crystal length. In 2015, we acquired proprietary wafer processing equipment from Hitachi Metals. The Hitachi Metals purchase includes a license covering the use of the proprietary equipment and Hitachi Metals' proprietary wafer processing technology. A particular focus of the equipment and process technology is on cleaning the wafers. It is important to remove any residual cleaning agents from each wafer to ensure that the epitaxial growth process is not encumbered by residual chemicals on the wafer.

As a manufacturing company, we must constantly improve our manufacturing processes to remain competitive, and our research and development programs must be integrated into our manufacturing lines. All of our research and development is conducted at our manufacturing facilities and the process technology developed by our China teams over the last 20 years enables us to remain competitive and to provide high-quality wafer substrates to our customers. Our China research and development teams must continue to stay close to the manufacturing sites and develop new process steps, features and benefits. We believe our teams are fully capable of moving the process technology forward.

Our consolidated subsidiaries conduct research and development, focusing on gallium alloys, gallium refinement and pyrolytic boron nitride crucibles used in high temperature crystal growth.

We have assembled a multi-disciplinary team of skilled scientists, engineers and technicians to meet our research and development objectives. Research and development expenses were $13.9 million in 2022, compared with $10.3 million in 2021 and $7.1 million in 2020. Development work focusing on yield, continuous improvement and other matters related to our research and development efforts also occurs within regular manufacturing processes. These costs are included in our cost of revenue because it is difficult to isolate them as research and development.

Competition

The semiconductor substrate industry is characterized by narrow technological boundaries, price erosion and generally intense competition. Certain wafer substrates, such as low-quality wafer substrates for consumer products using LED lighting, compete almost entirely on price. Other products, such as InP and low EPD GaAs wafers, have fewer competitors and quality is a key competitive factor in addition to price. We face actual and potential competition from a number of established companies who have the advantages of greater name recognition and more established relationships in the industry. In some cases, our competitors have substantially greater financial, technical and marketing resources as they are divisions of much larger companies. They may utilize these advantages to expand their product offerings more quickly, adapt to new or emerging technologies and changes in customer requirements more quickly, and devote greater resources to the marketing and sale of their products. We believe a critical factor in our business is the level of technical support we provide to the customer or prospective customer and we attempt to counter possible advantages of name recognition or size with superior technical support through our team of technical sales support professionals, the majority of whom hold PhDs in physics or materials science.

We believe that the primary competitive factors in the markets in which our substrate products compete are:

- quality;
- price;
- customer technical support;
- performance;
- meeting customer specifications; and
- manufacturing capacity.

Our ability to compete in target markets also depends on factors such as:

- the timing and success of the development and introduction of new products, including larger diameter wafers, and product features by us and our competitors;
- the availability of adequate sources of raw materials;
- protection of our proprietary methods, systems and processes;
- protection of our products and processes by effective use of intellectual property laws; and
- general economic conditions, which impact end markets using substrates.

A majority of our customers specialize in epitaxial growth, a complex series of chemical layers grown on top of our wafers. Our wafers cannot be used to make chips until the epitaxial layers are grown. Typically, our customer or prospective customer has at least two qualified substrate suppliers. Qualified suppliers must meet industry-standard specifications for quality, on-time delivery and customer support. Once a substrate supplier has qualified with a customer, price, consistent quality and current and future product delivery lead times become the most important competitive factors. A supplier that cannot meet a customer's current lead times or that a customer perceives will not be able to meet future demand and provide consistent quality can lose market share. Our primary competition in the market for compound and single element semiconductor substrates includes Sumitomo Electric Industries ("Sumitomo"), Japan Energy ("JX"), Freiberger Compound Materials ("Freiberger"), Umicore, China Crystal Technology Corp. ("CCTC") and Vital Materials. We believe that at least two of our competitors are shipping high volumes of GaAs substrates manufactured using a process similar to our VGF technology. In addition, we also face competition from semiconductor device manufacturers that may use other specialty material substrates that are not GaAs, InP or Ge based materials and that are actively exploring alternative materials. For example, silicon-on-insulator ("SOI") technology, a silicon wafer technology that produces satisfactory devices at lower cost, has been proven in the market. From 2012 to 2015, SOI technology displaced GaAs chips in key sectors, primarily the radio frequency ("RF") switching function in cell phones.

Because of our vertically integrated, sophisticated supply chain, we believe we are the only compound semiconductor substrate supplier to offer a broad suite of raw materials. We believe this gives us a unique competitive advantage because we have greater control and stability over many of our needed materials. Further, we believe we have some advantage in manufacturing costs. In the event of a significant increase in demand we believe our raw materials supply chain strategy and our ability to rapidly increase capacity can provide us some advantage.

Intellectual Property

Our success and the competitive position of our VGF technology depend on our ability to maintain our proprietary process technology secrets and other intellectual property protections. We rely on a combination of patents, trademark and trade secret laws, non-disclosure agreements and other intellectual property protection methods to protect our proprietary technology. We believe that, due to the rapid pace of technological innovation in the markets for our products, our ability to establish and maintain a position of technology leadership depends as much on the skills of our research and development personnel as upon the legal protections afforded our existing technologies. To protect our trade secrets, we take certain measures to ensure their secrecy, such as executing non-disclosure agreements with our employees, customers and suppliers. However, reliance on trade secrets is only an effective business practice insofar as trade secrets remain undisclosed and a proprietary product or process is not reverse engineered or independently developed.

In addition to proprietary process trade secrets, we also file patents. To date, we have been issued 111 patents that relate to our VGF products and processes; 83 in China, 11 in the United States, 8 in Japan, 4 in Taiwan, 3 in the European Union, and 2 in Germany. Patents have a protected life of 20 years (or 10 years for utility model patents in China) from their filing dates. Our patents have expiration dates ranging from 2023 to 2038. In some cases we may consider filing divisional, continuation or continuation-in-part of the existing patents for additional claims. We have several patent applications pending in China, United States, and rest of the world. Furthermore, in aggregate, our consolidated raw material companies have been issued 59 patents in China, including 26 patents issued to JinMei and 59 patents issued to BoYu.

In the normal course of business, we periodically receive and make inquiries regarding possible patent infringement. In dealing with such inquiries, it may become necessary or useful for us to obtain or grant licenses or other rights. However, there can be no assurance that such licenses or rights will be available to us on commercially reasonable terms. If we are not able to resolve or settle claims, obtain necessary licenses on commercially reasonable terms and/or successfully prosecute or defend our position, our business, financial condition and results of operations could be materially and adversely affected.

Environmental Regulations

We are subject to federal, state and local environmental and safety laws and regulations in all of our operating locations, including laws and regulations of China, such as laws and regulations related to the development, manufacture and use of our products, the use of hazardous materials, the operation of our facilities, and the use of the real property. These laws and regulations govern the use, storage, discharge and disposal of hazardous materials during manufacturing, research and development and sales demonstrations. We maintain a number of environmental, health and safety programs that are primarily preventive in nature. As part of these programs, we regularly monitor ongoing compliance. If we fail to comply with applicable regulations, we could be subject to substantial liability for clean-up efforts, personal injury, fines or suspension or be forced to cease our operations, and/or suspend or terminate the development, manufacture or use of certain of our products, the use of our facilities, or the use of our real property, each of which could have a material adverse effect on our business, financial condition and results of operations. The regulatory landscape shifts and changes in China as that country works to improve the environment. Because we manufacture all of our products in China, we are subject to an evolving set of regulations that could require changes in our equipment and processes and require us to obtain new permits. In 2017, China increased its focus on environmental concerns which increased pressure on manufacturing companies. During periods of severe air pollution in Beijing, manufacturing companies, including AXT, may be ordered by the local government to stop production for several days. For example, in the first quarter of 2018, over 300 manufacturing companies, including AXT, were intermittently shut down by the local government for a total of ten days from February 27 to March 31, due to severe air pollution.

Human Capital

As of December 31, 2022, AXT and Tongmei had 1,076 employees, which consisted of 26 employees in our headquarters in Fremont, California, one sales professional in France and 1,049 employees in our factories in China. In addition, our consolidated raw material companies had, in total, 483 employees. In aggregate, we and our consolidated raw material companies had 1,559 employees, of whom 1,158 were principally engaged in manufacturing, 184 in sales and administration and 217 in research and development. Of these 1,559 employees, 26, consisting of sales and marketing, accounting and finance, administration and corporate executives were located in the United States, one in

France and 1,532 in China. Our employees in China are citizens of China, have families and pay taxes in China. We believe these factors are viewed favorably by government agencies in China.

We believe that our future success largely depends upon our continued ability to attract and retain highly skilled employees. We provide our employees with competitive salaries and bonuses, opportunities for equity ownership, development programs that enable continued learning and growth and a robust employment package that promotes well-being across all aspects of their lives, including health care and paid time off. Most of our employees in China are represented by unions. As of December 31, 2022, 1,278 employees in China, including employees of our consolidated raw material companies, were represented by unions. We have never experienced a work stoppage and we consider our relations with our employees to be good.

Geographical Information

Please see Note 14 to our consolidated financial statements for information regarding our foreign operations, and see "Risks related to international aspects of our business" under Item 1A. Risk Factors for further information on risks attendant to our foreign operations and dependence.

Available Information

Our principal executive offices are located at 4281 Technology Drive, Fremont, CA 94538, and our main telephone number at this address is (510) 438-4700. Our Internet website address is www.axt.com. Our website address is given solely for informational purposes; we do not intend, by this reference, that our website should be deemed to be part of this Annual Report on Form 10-K or to incorporate the information available at our website address into this Annual Report on Form 10-K.

We file electronically with the SEC our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended. We make these reports available free of charge through our Internet website as soon as reasonably practicable after we have electronically filed such material with the SEC. These reports can also be obtained from the SEC's Internet website at www.sec.gov.

Item 1A. Risk Factors

For ease of reference, we have divided these risks and uncertainties into the following general categories:

I. Summary Risk Factors;

II. Risks Related to Our Business and Operations;

III. Risks Related to International Aspects of Our Business;

IV. Risks Related to Our Financial Results and Capital Structure;

V. Risks Related to Our Intellectual Property; and

VI. Risks Related to Compliance, Environmental Regulations and Other Legal Matters.

I. Summary Risk Factors

- We are subject to a number of unique legal and operational risks associated with our corporate structure.
- The PRC central government may intervene in or influence our PRC operations at any time and the rules and regulations in China can change quickly with little advance notice.

- Although the audit report included in this Annual Report is prepared by an independent registered public accounting firm who is currently inspected fully by the Public Company Accounting Oversight Board (the "PCAOB"), there is no guarantee that future audit reports will be prepared by an independent registered public accounting firm that is completely inspected by the PCAOB.
- Our NASDAQ stock price is volatile and our stock price could decline. Unpredictable fluctuations in our operating results, changes and events in our end markets and global trends cause volatility in our stock price.
- COVID-19 or other contagious diseases may affect our business operations and financial performance. Lack of supply of vaccines and resistance by some to be vaccinated could prolong COVID-19.
- Global economic and political conditions, including trade tariffs and restrictions from China, may have a negative impact on our business and financial results.
- Changes in China's political, social, regulatory or economic environments may affect our financial performance.
- The Chinese central government is increasingly aware of air pollution and other forms of environmental pollution and their reform efforts can impact our manufacturing, including intermittent mandatory shutdowns. Shutdowns or underutilizing our manufacturing facilities may result in declines in our gross margins.
- Enhanced trade tariffs, import restrictions, export restrictions, Chinese regulations or other trade barriers may materially harm our business.
- If China places restrictions on freight and transportation routes and on ports of entry and departure this could result in shipping delays or increased costs for shipping.
- Our international operations are exposed to potential adverse tax consequence in China.
- Our gross margin has fluctuated historically and may decline or increase due to several factors. Factors such as product mix, unit volume, yields and other manufacturing efficiencies can cause our gross margin to decrease or increase from quarter to quarter.
- The proposed Tongmei IPO on the STAR Market in China could fail to be completed. This could result in investor disappointment and in failure to secure sufficient capital needed to take advantage of market opportunities for our products. Our stock price could decline.
- The terms of the private equity raised by Tongmei in China grant each investor a right of redemption if the IPO fails to pass the audit of the Shanghai Stock Exchange, is not approved by the CSRC or Tongmei cancels the IPO application. This could result in disgorging the cash that we raised from the Investors.
- Defects in our products could diminish demand for our products. Our ability to receive orders from tier one customers is contingent on producing wafer substrates of very high quality and deploying best practices in manufacturing. We may not always be able to meet these requirements and we could then lose revenue.
- Difficulties in accurately estimating market demand could result in over-investing in equipment and capacity expansion or losing market share if we do not invest sufficiently.
- Attracting and retaining tier one customers requires that we succeed in our research and development programs. Customers establish difficult to meet product specifications regarding defect densities, surface flatness diameter size and other specifications pushing the boundaries of material science. We may not achieve these specifications.
- We are subject to foreign exchange gains and losses that materially impact our consolidated statements of operations. Because we are a global company we are exposed to changes and swings in foreign exchange, particularly when currencies experience periods of volatility.
- Joint venture raw material companies in China bring certain risks.
- Risks exist in utilizing our new gallium arsenide manufacturing sites efficiently.
- We derive a significant portion of our revenue from international sales, and our ability to sustain and increase our international sales involves significant risks.

II. Risks Related to Our Business and Operations

Silicon substrates (wafers) are significantly lower in cost compared to substrates made from specialty materials, such as those that we produce, and new silicon-based technologies could enable silicon-based substrates to replace specialty material-based substrates for certain applications.

Historically silicon wafers or substrates are less expensive than specialty material substrates, such as those that we produce. Electronic circuit designers will generally consider silicon first and only turn to alternative materials if silicon cannot provide the required functionality in terms of power consumption, speed, wave lengths or other specifications. Beginning in 2011, certain applications that had previously used GaAs substrates, specifically the RF chip in mobile phones, adopted a new silicon-based technology called silicon on insulator, or SOI. SOI technology uses a silicon-insulator-silicon layered substrate in place of conventional silicon substrates in semiconductor manufacturing. SOI substrates cost less than GaAs substrates and, although their performance is not as robust as GaAs substrates in terms of power consumption, heat generation and speed, they became acceptable in mobile phones and other applications that were previously dominated by GaAs substrates. The adoption of SOI resulted in decreased GaAs wafer demand, and decreased revenue. If SOI or new silicon-based technologies gain more widespread market acceptance, or are used in more applications, our sales of specialty material-based substrates could be reduced and our business and operating results could be significantly and adversely affected.

COVID-19 or other contagious diseases may affect our business operations and financial performance.

The spread of COVID-19 has impacted our operations and financial performance. This outbreak has triggered references to the SARS outbreak, which occurred in 2003 and affected our business operations. Any severe occurrence of an outbreak of a contagious disease such as COVID-19, SARS, Avian Flu or Ebola may cause us or the government to temporarily close our manufacturing operations in China. In January 2020, virtually all companies in China were ordered to remain closed after the traditional Lunar New Year holiday ended, including our subsidiaries in China. In late March 2022, as a result of an outbreak of COVID-19, Shanghai was locked down and certain manufacturing facilities were required to close. In the second quarter of 2022, rising COVID-19 infections in Beijing resulted in concerns of a city-wide lockdown which could have required our manufacturing facilities in Beijing to close temporarily. Although some apartment complexes were locked down, there was no city-wide lockdown. In December 2022, the PRC government ended its zero-COVID policy. If there is a renewed surge of the COVID-19 pandemic in cities in which our PRC subsidiaries and PRC joint ventures are located, the Chinese government may require these companies to close again. If one or more of our key suppliers is required to close for an extended period, we might not have enough raw material inventories to continue manufacturing operations. In addition, travel restrictions between China and the U.S. have disrupted our normal movement to and from China and this has impacted our efficiency. If COVID-19 vaccines are not widely available or people choose not to be vaccinated, our business operations may be affected negatively. The outbreak has affected transportation and reduced the availability of air transport, caused port closures, and increased border controls and closures. If our manufacturing operations were closed for a significant period or we experience difficulty in shipping our products, we could lose revenue and market share, which would depress our financial performance and could be difficult to recapture. If one of our key customers is required to close for an extended period, this may delay the placement of new orders. As a result, our revenue would decline. Further, customers might default on their obligations to us. In the first quarter of 2020 we observed an increase in our accounts receivable and believe this was the result of businesses slowing down and a general cautiousness due to the COVID-19 pandemic. Such events would negatively impact our financial performance.

Our gross margin has fluctuated historically and may decline due to several factors.

Our gross margin has fluctuated from period to period as a result of increases or decreases in total revenue, unit volume, shifts in product mix, shifts in the cost of raw materials, costs related to the relocation of our gallium arsenide and germanium production lines, including costs related to hiring additional manufacturing employees at our new locations, tariffs imposed by the U.S. government, the introduction of new products, decreases in average selling prices for products, utilization of our manufacturing capacity, fluctuations in manufacturing yields and our ability to reduce product costs. These factors and other variables change from period to period and these fluctuations are expected to continue in the future. For example, in the second quarter of 2019 our gross margin was 34.3% but it dropped to 21.0% in the fourth quarter of 2019 as a result of several of these factors.

Our raw material companies experience selling price volatility and purchase price volatility in acquiring base materials. We consolidate the results of two of these raw material companies any reduction in their gross margins could have a significant, adverse impact on our overall gross margins. One or more of our companies has in the past sold, and may in the future sell, raw materials at significantly reduced prices in order to gain volume sales or sales to new customers. In addition, at some points in the last three years, the market price of gallium dropped below our per unit inventory cost and we incurred an inventory write down under the lower of cost or net realizable value accounting rules.

Shutdowns or underutilizing our manufacturing facilities may result in declines in our gross margins.

An important factor in our success is the extent to which we are able to utilize the available capacity in our manufacturing facilities. A number of factors and circumstances may reduce utilization rates, including periods of industry overcapacity, low levels of customer orders, operating inefficiencies, mechanical failures and disruption of operations due to expansion, power interruptions, fire, flood, other natural disasters or calamities or government-ordered mandatory factory shutdowns, including as a result of the COVID-19 pandemic. Severe air pollution in Beijing can trigger mandatory factory shutdowns. For example, in the first quarter of 2018, over 300 manufacturing companies, including AXT, were intermittently shut down by the local government for a total of ten days from February 27 to March 31, due to severe air pollution. In late March 2022, as a result of an outbreak of COVID-19, Shanghai was locked down and certain manufacturing facilities were required to close. In the second quarter of 2022, rising COVID-19 infections in Beijing resulted in concerns of a city-wide lockdown, which could have required our manufacturing facilities in Beijing to close temporarily. Although some apartment complexes were locked down there was no city-wide lockdown. In December 2022, the PRC government ended its zero-COVID policy. Further, we have increased capacity by adding two new sites and this could reduce our utilization rate and increase our depreciation charges. Because many portions of our manufacturing costs are relatively fixed, high utilization rates are critical to our gross margins and operating results. If we fail to achieve acceptable manufacturing volumes or experience product shipment delays, our results of operations will be negatively affected. During periods of decreased demand, we have underutilized our manufacturing lines. If we are unable to improve utilization levels at our facilities during periods of decreased demand and correctly manage capacity, the fixed expense levels will have an adverse effect on our business, financial condition and results of operations. For example, in the three months ended December 31, 2019, our revenue dropped to $18.4 million and our gross margin was only 21.0%.

If we are unable to utilize the available capacity in our manufacturing facilities, we may need to implement a restructuring plan, which could have a material adverse effect on our revenue, our results of operations and our financial condition. For example, in 2013, we concluded that incoming orders were insufficient and that we were significantly underutilizing our factory capacity. As a result, in February 2014, we announced a restructuring plan with respect to our China company, Tongmei, in order to better align manufacturing capacity with demand. Under the restructuring plan, we recorded a charge of approximately $907,000 in the first quarter of 2014.

If we receive fewer customer orders than forecasted or if our customers delay or cancel orders, we may not be able to reduce our manufacturing costs in the short-term and our gross margins would be negatively affected. In addition, lead times required by our customers are shrinking, which reduces our ability to forecast orders and properly balance our capacity utilization.

If we have low product yields, the shipment of our products may be delayed and our product cost and operating results may be adversely impacted.

A critical factor in our product cost is yield. Our products are manufactured using complex crystal growth and wafer processing technologies, and the number of usable wafer substrates we produce can fluctuate as a result of many factors, including:

- poor control of furnace temperature and pressure;

- impurities in the materials used;
- contamination of the manufacturing environment;
- quality control and inconsistency in quality levels;
- lack of automation and inconsistent processing requiring manual manufacturing steps;
- substrate breakage during the manufacturing process; and
- equipment failure, power outages or variations in the manufacturing process.

An example where yield is of special concern is for our six-inch semi-conducting gallium arsenide substrates, which can be used for manufacturing industrial lasers and LED lighting. These applications require very low defect densities, also called EPD, and our yields will be lower than the yields achieved for the same substrate when it will be used in other applications. If we are unable to achieve the targeted quantity of low defect density substrates, then our manufacturing costs would increase and our gross margins would be negatively impacted.

In addition, we may modify our process to meet a customer specification, but this can impact our yields. If our yields decrease, our revenue could decline if we are unable to produce products to our customers' requirements. At the same time, our manufacturing costs could remain fixed, or could increase. Lower yields negatively impact our gross margin. We have experienced product shipment delays and difficulties in achieving acceptable yields on both new and older products, and such delays and poor yields have adversely affected our operating results. We may experience similar problems in the future and we cannot predict when they may occur, their duration or severity.

If our manufacturing processes result in defects in our products making them unfit for use by our customers, our products would be rejected, resulting in compensation costs paid to our customers, and possible disqualification. This could lead to revenue loss and market share loss.

Risks exist in utilizing our gallium arsenide manufacturing sites efficiently.

The Beijing city government is moving its offices to the Tongzhou district where our original manufacturing facility is currently located. The city government is in the process of moving thousands of government employees into this area. To create room and upgrade the district, the city instructed virtually all existing manufacturing companies, including AXT, to relocate all or some of their manufacturing lines. We were instructed to move our gallium arsenide manufacturing line out of the area.

Although the relocation is completed and we are in volume production at the new sites, unforeseen manufacturing issues at the new sites could still occur. Problems could occur as we add capacity or comply with strict guidelines as customers perform their qualifications. All of this will require us to continue to diligently address the many details that arise at each of our new sites. A failure to properly accomplish this could result in disruption to our production and have a material adverse impact on our revenue, our results of operations and our financial condition. If we fail to meet the product qualification and volume requirements of a customer, we may lose sales to that customer. Our reputation may also be damaged. Any loss of sales could have a material adverse effect on our revenue, our results of operations and our financial condition.

Some of our key employees are relocating to our new manufacturing sites. Travel restrictions within China resulting from COVID-19 have impacted their relocation and hindered commuting. Certain employees may choose not to relocate. If we are unable to continue to employ those key employees in our original manufacturing facility, we may be required to terminate those employees and could incur severance costs. If the Chinese government does not assist us in this matter it could materially and adversely impact our results of operations and our financial condition. Further, a loss of key employees or our inability to hire qualified employees could disrupt our production, which could materially and adversely impact our results of operations and our financial condition.

The Chinese government has in the past imposed temporary restrictions on manufacturing facilities, such as the restrictions imposed on polluting factories for the 2008 Olympics and the 2014 Asian Pacific Economic Cooperation event. These restrictions included a shutdown of the transportation of materials and power plants to reduce air pollution. To reduce air pollution in Beijing, the Chinese government has sometimes limited the construction of new, or expansion of existing, facilities by manufacturing companies in the Beijing area or required mandatory factory shutdowns. For example, in the first quarter of 2018, over 300 manufacturing companies, including AXT, were intermittently shut down by the local government for a total of ten days from February 27 to March 31 due to severe air pollution. In late March 2022, as a result of an outbreak of COVID-19, Shanghai was locked down and certain manufacturing facilities were required to close. In the second quarter of 2022, rising COVID-19 infections in Beijing resulted in concerns of a city-wide lockdown which could have required our manufacturing facilities in Beijing to close temporarily. Although some apartment complexes were locked down, there was no city-wide lockdown. In December 2022, the PRC government ended its zero-COVID policy. If the government applies similar restrictions to us or requires mandatory factory shutdowns in the future, then such restrictions or shutdowns could have an adverse impact on our results of operations and our financial condition. Our ability to supply current or new orders could be significantly impacted. Customers could then be required to purchase products from our competitors, causing our competitors to take market share from us.

In addition, from time to time, the Chinese government issues new regulations, which may require additional actions on our part to comply. On February 27, 2015, the China State Administration of Work Safety updated its list of hazardous substances. The previous list, which was published in 2002, did not restrict the materials that we use in our wafers. The new list added gallium arsenide. As a result of the newly published list, we were required to seek additional permits.

Additional customers may require that they re-qualify our gallium arsenide wafer substrates or our new sites as a result of relocating our gallium arsenide manufacturing lines.

Although some of our largest customers have qualified our new sites there may still be some who will decide to go through the qualification process. If we fail to meet the product qualification requirements of a customer, we may lose sales to that customer. Our reputation may also be damaged. Any loss of sales could have a material adverse effect on our revenue, our results of operations and our financial condition.

Global economic and political conditions, including trade tariffs and restrictions, may have a negative impact on our business and financial results.

In September 2018, the Trump Administration announced a list of thousands of categories of goods that became subject to tariffs when imported into the United States from China. This pronouncement imposed tariffs on wafer substrates we imported into the United States. The initial tariff rate was 10% and subsequently was increased to 25%. Approximately 14% of our revenue derives from importing our wafers into the United States. In the years ended December 31, 2022, 2021 and 2020 we paid approximately $3.3 million, $1.3 million and $1.3 million, respectively, in tariffs. The future impact of tariffs and trade wars is uncertain.

The economic and political conditions between China and the United States, in our view, create an unstable business environment. The United States has restricted access by certain Chinese technology companies to items produced domestically and abroad from U.S. technology and software, which may impact our ability to grow our revenue. Trade restrictions against China have resulted in a greater determination within China to be self-sufficient and produce more goods domestically. Government agencies in China may be encouraging and supporting the founding of new companies, the addition of new products in existing companies and more vertical integration within companies. This could negatively impact our sales in China.

Our operations and financial results depend on worldwide economic and political conditions and their impact on levels of business spending, which has deteriorated significantly in many countries and regions. Uncertainties in the political, financial and credit markets and U.S. financial system may cause our customers to postpone deliveries. The COVID-19 virus is an additional cause of uncertainty. Additionally, recent U.S. bank failures may affect our customers. Delays in the placement of new orders and extended uncertainties may reduce future sales of our products and services. The revenue growth and profitability of our business depends on the overall demand for our substrates. Because the end users of our products are primarily large companies whose businesses fluctuate with general economic and business conditions, a softening of demand for products that use our substrates, caused by a weakening economy, may result in decreased revenue. Customers may find themselves facing excess inventory from earlier purchases, and may defer or reconsider purchasing products due to the downturn in their business and in the general economy. For example, global business conditions deteriorated in the second half of 2022. In the second quarter of 2022, our revenue totaled $39.5 million. In the fourth quarter of 2022, our revenue declined to $26.8 million. If market conditions deteriorate, we may experience increased collection times and greater write-offs, either of which could have a material adverse effect on our profitability and our cash flow.

Future tightening of credit markets and concerns regarding the availability of credit may make it more difficult for our customers to raise capital, whether debt or equity, to finance their purchases of capital equipment or of the products we sell. Delays in our customers' ability to obtain such financing, or the unavailability of such financing, would adversely affect our product sales and revenues and, therefore, harm our business and operating results. We cannot predict the timing, duration of or effect on our business of any future economic downturn or the timing or strength of any subsequent recovery.

If any of our facilities are damaged by occurrences such as fire, explosion, power outage or natural disaster, we might not be able to manufacture our products.

The ongoing operation of our manufacturing and production facilities is critical to our ability to meet demand for our products. If we are not able to use all or a significant portion of our facilities for prolonged periods for any reason, we would not be able to manufacture products for our customers. For example, a fire or explosion caused by our use of combustible chemicals, high furnace temperatures or, in the case of InP, high pressure during our manufacturing processes could render some of our facilities inoperable for an indefinite period of time. Actions outside of our control, such as earthquakes or other natural disasters, could also damage our facilities, rendering them inoperable. If we are unable to operate our facilities and manufacture our products, we would lose customers and revenue and our business would be harmed.

On the evening of March 15, 2017, an electrical short-circuit fire occurred at our Beijing manufacturing facility. The electrical power supply supporting 2-inch, 3-inch and 4-inch gallium arsenide and germanium crystal growth was damaged and production in that area was stopped. In addition, a wastewater pipe was damaged resulting in a halt to wafer processing for four days until the pipe could be repaired. We were able to rotate key furnace hardware and use some of the 6-inch capacity for smaller diameter crystal growth production to mitigate the impact of the fire and resume production. If we are unable to recover from a fire or natural disaster, our business and operating results could be materially and adversely affected.

Demand for our products may decrease if demand for the end-user applications decrease or if manufacturers downstream in our supply chain experience difficulty manufacturing, marketing or selling their products.

Our products are used to produce components for electronic and opto-electronic products. Accordingly, demand for our products is subject to the demand for end-user applications, including certain consumer applications, which utilize our products, as well as factors affecting the ability of the manufacturers downstream in our supply chain to introduce and market their products successfully, including:

- worldwide economic and political conditions and their impact on levels of business spending;
- the competition such manufacturers face in their particular industries;
- end of life obsolescence of products containing devices built on our wafers;
- the technical, manufacturing, sales, marketing and management capabilities of such manufacturers;
- the financial and other resources of such manufacturers; and

- the inability of such manufacturers to sell their products if they infringe third-party intellectual property rights.

If demand for the end-user applications for which our products are used decreases, or if manufacturers downstream in our supply chain are unable to develop, market and sell their products, demand for our products will decrease. For example, during 2019 widespread political and economic instability and trade war concerns resulted in a general slowdown and our revenue decreased significantly. Additionally, in the second half of 2016, manufacturers producing and selling passive optical network devices known as EPONs and GPONs experienced a slowdown in demand resulting in surplus inventory on hand. The slowdown persisted until late in 2017. This resulted in a slowdown of sales of our InP substrates used in the PON market. More recently, global business conditions deteriorated in the second half of 2022. In the second quarter of 2022, our revenue totaled $39.5 million. In the fourth quarter of 2022 our revenue declined to $26.8 million. We expect similar cycles of strong demand followed by lower demand will occur for various InP, GaAs or Ge substrates in the future.

Our revenue, gross margins and profitability can be hurt if the average sales price of the various raw materials in our partially owned companies decreases.

Although the companies in our vertically integrated supply chain have historically made a positive contribution to our financial performance, when the average selling prices for the raw materials produced decline, this results in a negative impact on our revenue, gross margin and profitability. For example, the average selling prices for 4N gallium and for germanium were driven down by oversupply in the past, and negatively impacted our financial results. In 2022 and 2021, the companies accounted for under the equity method of accounting contributed a gain of $6.0 million and $4.4 million, respectively, to our consolidated financial statements. However, in 2019, the companies accounted for under the equity method of accounting contributed a loss of $1.9 million to our consolidated financial statements. Further, in several quarters over the past three years, one of our consolidated subsidiaries incurred a lower of cost or net realizable value inventory write down, which negatively impacted our consolidated gross margin. In the first quarter of 2019, we incurred an impairment charge of $1.1 million for a germanium materials company in China in which we have a 25% ownership interest, writing down our investment to zero value. If the pricing environment remains stressed by oversupply and our raw material companies cannot reduce their production costs, then the reduced average selling prices of the raw materials will have a continuing adverse impact on our revenue, gross margins and net profit.

Problems incurred in our raw material companies or our investment partners could result in a material adverse impact on our financial condition or results of operations.

We have invested in raw material companies in China that produce materials, including 99.99% pure gallium (4N Ga), high purity gallium (6N and 7N Ga), arsenic, germanium, germanium dioxide, pyrolytic boron nitride (pBN) crucibles and boron oxide (B2O3). We purchase a portion of the materials produced by these companies for our use and they sell the remainder of their production to third parties. We consolidate the companies in which we have a majority or controlling financial interest and employ equity accounting for the companies in which we have a smaller ownership interest. Several of these companies occupy space within larger facilities owned and/or operated by one of the other investment partners. Several of these partners are engaged in other manufacturing activities at or near the same facility. In some facilities, we share access to certain functions, including water, hazardous waste treatment or air quality treatment. If a partner in any of these ventures experiences problems with its operations, or deliberately withholds or disrupts services, disruptions in the operations of our companies could occur, having a material adverse effect on the financial condition and results of operation in these companies, and correspondingly on our financial condition or results of operations. For example, since gallium is a by-product of aluminum, our raw gallium company in China, which is housed in and receives services from an affiliated aluminum plant, could generate lower production and shipments of gallium as a result of reduced services provided by the aluminum plant. Accordingly, in order to meet customer supply obligations, our supply chain may have to source materials from another independent third-party supplier, resulting in higher costs and reduced gross margin.

The China central government has become increasingly concerned about environmental hazards. Air pollution has been a problem in Beijing and other parts of China. In days of severe air pollution, the government has ordered manufacturing companies to stop all production. The central government is also tightening control over hazardous chemicals and other hazardous elements such as arsenic, which is produced by two of our raw material companies. Further, the central government encourages employees to report to the appropriate regulatory agencies possible safety or environmental violations, but there may not be actual violations. Regular use in the normal course of business of hazardous chemicals or hazardous elements or a company's failure to meet the ever-tightening standards for control of hazardous chemicals or hazardous elements could result in orders to shut down permanently, fines or other severe measures. Any such orders directed at one of our raw material companies could result in impairment charges if the company is forced to close its business, cease operations or incurs fines or operating losses, which would have a material adverse effect on our financial results. In the first quarter of 2019, we incurred an impairment charge of $1.1 million for a germanium materials company in China in which we have a 25% ownership interest, writing down our investment to zero value.

Further, some of our raw material companies share facilities with our raw material investment partners. If either company is deemed to have violated applicable laws, rules or regulations governing the use, storage, discharge or disposal of hazardous chemicals, their operations could be adversely affected and we could be subject to substantial liability for clean-up efforts, personal injury, fines or suspension or termination of operations. Employees working for these companies could bring litigation against us even though we are not directly controlling those operations. While we would expect to defend ourselves vigorously in any litigation that is brought against us, litigation is inherently uncertain and it is possible that our business, financial condition, results of operations or cash flows could be affected. Even if we are not deemed responsible for the actions of the raw material companies or investment partners, litigation could be costly, time consuming to defend and divert management attention; in addition, if we are deemed to be the most financially viable of the partners, plaintiffs may decide to pursue us for damages.

Intense competition in the markets for our products could prevent us from increasing revenue and achieving profitability.

The markets for our products are intensely competitive. We face competition for our wafer substrate products from other manufacturers of substrates, such as Sumitomo, JX, Freiberger, Umicore, and CCTC, and from companies, such as Qorvo and Skyworks, that are actively considering alternative materials to GaAs and marketing semiconductor devices using these alternative materials. We believe that at least two of our major competitors are shipping high volumes of GaAs substrates manufactured using a process similar to our VGF process technology. Other competitors may develop and begin using similar technology. Sumitomo and JX also compete with us in the InP market. If we are unable to compete effectively, our revenue may decrease and we may not maintain profitability. We face many competitors that have a number of significant advantages over us, including:

- greater name recognition and market share in the business;
- more manufacturing experience;
- extensive intellectual property; and
- significantly greater financial, technical and marketing resources.

Our competitors could develop new or enhanced products that are more effective than our products.

The level and intensity of competition has increased over the past years and we expect competition to continue to increase in the future. Competitive pressures have resulted in reductions in the prices of our products, and continued or increased competition could reduce our market share, require us to further reduce the prices of our products, affect our ability to recover costs and result in reduced gross margins and profitability.

In addition, new competitors have and may continue to emerge, such as a crystal growing company established by a former employee in China that is supplying semi-conducting GaAs wafers to the LED market. Competition from sources such as this could increase, particularly if these competitors are able to obtain large capital investments. Further, recent trade tensions between China and the United States have resulted in a greater determination within China to be self-sufficient and produce more goods domestically. This could result in the formation of new competitors that would compete against our company and adversely affect our financial results.

Cyber-attacks, system security risks and data protection issues could disrupt our internal operations and cause a reduction in revenue, increase in expenses, negatively impact our results of operation or result in other adverse consequences.

Like most technology companies, we could be targeted in cyber-attacks. We face a risk that experienced computer programmers and hackers may be able to penetrate our network security and misappropriate or compromise our confidential and proprietary information, potentially without being detected. Computer programmers and hackers also may be able to develop and deploy viruses, worms, and other malicious software programs that attack our information technology infrastructure and demand a ransom payment. The costs to us to eliminate or alleviate cyber or other security problems, bugs, viruses, worms, malicious software programs and security vulnerabilities could be significant, and our efforts to address these problems may not be successful and could result in interruptions and delays that may impede our sales, manufacturing, distribution, accounting or other critical functions.

Breaches of our security measures could create system disruptions or cause shutdowns or result in the accidental loss, inadvertent disclosure or unapproved dissemination of proprietary information or sensitive or confidential data about us. Cyber-attacks could use fraud, trickery or other forms of deception. A cyber-attack could expose us to a risk of loss or misuse of information, result in litigation and potential liability, damage our reputation or otherwise harm our business. In addition, the cost and operational consequences of implementing further data protection measures could be significant.

Portions of our information technology infrastructure might also experience interruptions, delays or cessations of service or produce errors in connection with systems integration or migration work that takes place from time to time, which may have a material impact on our business. We may not be successful in implementing new systems and transitioning data, which could cause business disruptions and be more expensive, time consuming, disruptive and resource-intensive than originally anticipated. Such disruptions could adversely impact our ability to fulfill orders and interrupt other processes. Delayed sales, lower margins or lost customers could adversely affect our financial results and reputation.

The average selling prices of our substrates may decline over relatively short periods, which may reduce our revenue and gross margins.

Since the market for our products is characterized by declining average selling prices resulting from various factors, such as increased competition, overcapacity, the introduction of new products and decreased sales of products incorporating our products, the average selling prices for our products may decline over relatively short time periods. We have in the past experienced, and in the future may experience, substantial period-to-period fluctuations in operating results due to declining average selling prices. In certain years, we have experienced an average selling price decline of our substrate selling prices of approximately 5% to 10%, depending on the substrate product. It is possible that the pace of the decline of average selling prices could accelerate beyond these levels for certain products in a commoditizing market. We anticipate that average selling prices may decrease in the future in response to the unstable demand environment, price reductions by competitors, or by other factors, including pricing pressures from significant customers. When our average selling prices decline, our revenue and gross profit decline, unless we are able to sell more products or reduce the cost to manufacture our products. We generally attempt to combat an average selling price decline by improving yields and manufacturing efficiencies and working to reduce the costs of our raw materials and of manufacturing our products. We also need to sell our current products in increasing volumes to offset any decline in their average selling prices, and introduce new products, which we may not be able to do, or do on a timely basis.

In order to remain competitive, we must continually improve our processes, work to reduce the cost of manufacturing our products and improve our yields and manufacturing efficiencies. Our efforts may not allow us to keep pace with competitive pricing pressures which could adversely affect our margins. There is no assurance that any changes effected by us will result in sufficient cost reductions to allow us to reduce the price of our products to remain competitive or improve our gross margins.

Defects in our products could diminish demand for our products.

Our wafer products are complex and may contain defects, including defects resulting from impurities inherent in our raw materials or inconsistencies in our manufacturing processes. We have experienced quality control problems with some of our products, which caused customers to return products to us, reduce orders for our products, or both. If we experience quality control problems, or experience other manufacturing problems, customers may return product for credit, cancel or reduce orders or purchase products from our competitors. We may be unable to maintain or increase sales to our customers and sales of our products could decline. Defects in our products could cause us to incur higher manufacturing costs and suffer product returns and additional service expenses, all of which could adversely impact our operating results. If new products developed by us contain defects when released, our customers may be dissatisfied and we may suffer negative publicity or customer claims against us, lose sales or experience delays in market acceptance of our new products.

Our substrate products have a long qualification cycle that makes it difficult to forecast revenue from new customers or for new products sold to existing customers.

New customers typically place orders with us for our substrate products three months to a year or more after our initial contact with them. The sale of our products is subject to our customers' lengthy internal evaluation and approval processes. During this time, we may incur substantial expenses and expend selling, marketing and management efforts while the customers evaluate our products. These expenditures may not result in sales of our products. If we do not achieve anticipated sales in a period as expected, we may experience an unplanned shortfall in our revenue. As a result, our operating results would be adversely affected. In addition, if we fail to meet the product qualification requirements of the customer, we may not have another opportunity to sell that product to that customer for many months or even years. In the current competitive climate, the average qualification and sales cycle for our products has lengthened even further and is expected to continue to make it difficult for us to forecast our future sales accurately. We anticipate that sales of any future substrate products will also have lengthy qualification periods and will, therefore, be subject to risks substantially similar to those inherent in the lengthy sales cycles of our current substrate products.

The loss of one or more of our key substrate customers would significantly hurt our operating results.

From time to time, sales to one or more of our customers individually represent more than 10% of our revenue and if we were to lose a major customer the loss would negatively impact our revenue. Our customers are not obligated to purchase a specified quantity of our products or to provide us with binding forecasts of product purchases. In addition, our customers may reduce, delay or cancel orders. In the past, we have experienced a slowdown in bookings, significant push-outs and cancellation of orders from customers. If we lose a major customer or if a customer cancels, reduces or delays orders, our revenue would decline. In addition, customers that have accounted for significant revenue in the past may not continue to generate revenue for us in any future period. Any loss of customers or any delay in scheduled shipments of our products could cause revenue to fall below our expectations and the expectations of market analysts or investors, causing our stock price to decline.

The cyclical nature of the semiconductor industry may limit our ability to maintain or increase net sales and operating results during industry downturns.

The semiconductor industry is highly cyclical and periodically experiences significant economic downturns characterized by diminished product demand, resulting in production overcapacity and excess inventory in the markets we serve. A downturn can result in lower unit volumes and rapid erosion of average selling prices. The semiconductor industry has experienced significant downturns, often in connection with, or in anticipation of, maturing product cycles of both semiconductor companies' and their customers' products or a decline in general economic conditions. This may adversely affect our results of operations and the value of our business.

Our continuing business depends in significant part upon manufacturers of electronic and opto-electronic compound semiconductor devices, as well as the current and anticipated market demand for these devices and products using these devices. As a supplier to the semiconductor industry, we are subject to the business cycles that characterize the industry. The timing, length and volatility of these cycles are difficult to predict. The compound semiconductor industry has historically been cyclical due to sudden changes in demand, the amount of manufacturing capacity and changes in the technology employed in compound semiconductors. The rate of changes in demand, including end demand, is high, and the effect of these changes upon us occurs quickly, exacerbating the volatility of these cycles. These changes have affected the timing and amounts of customers' purchases and investments in new technology. These industry cycles create pressure on our revenue, gross margin and net income.

Our industry has in the past experienced periods of oversupply and that has resulted in significantly reduced prices for compound semiconductor devices and components, including our products, both as a result of general economic changes and overcapacity. Oversupply causes greater price competition and can cause our revenue, gross margins and net income to decline. During periods of weak demand, customers typically reduce purchases, delay delivery of products and/or cancel orders for our products. Order cancellations, reductions in order size or delays in orders could occur and would materially adversely affect our business and results of operations. Actions to reduce our costs may be insufficient to align our structure with prevailing business conditions. We may be required to undertake additional cost-cutting measures, and may be unable to invest in marketing, research and development and engineering at the levels we believe are necessary to maintain our competitive position. Our failure to make these investments could seriously harm our business.

A significant portion of our operating expense and manufacturing costs are relatively fixed. If revenue for a particular quarter is lower than we expect, we likely will be unable to proportionately reduce our operating expenses or fixed manufacturing costs for that quarter, which would harm our operating results.

If we do not successfully develop new product features and improvements and new products that respond to customer requirements, our ability to generate revenue, obtain new customers, and retain existing customers may suffer.

Our success depends on our ability to offer new product features, improved performance characteristics and new products, such as larger diameter substrates, low defect density substrates, thicker or thinner substrates, substrates with extreme surface flatness specifications, substrates that are manufactured with a doped crystal growth process or substrates that incorporate leading technology and other technological advances. This is an ongoing iterative research and development process performed by our China team in collaboration with our manufacturing managers. New products must meet customer needs and compete effectively on quality, price and performance. The markets for our products are characterized by rapid technological change, changing customer needs and evolving industry standards. If our competitors introduce products employing new technologies or performance characteristics, our existing products could become obsolete and unmarketable. Over time, we have seen our competitors selling more substrates manufactured using a crystal growth technology similar to ours, which has eroded our technological differentiation.

The development of new product features, improved performance characteristics and new products can be a highly complex process, and we may experience delays in developing and introducing them. Any significant delay could cause us to fail to timely introduce and gain market acceptance of new products. Further, the costs involved in researching, developing and engineering new products could be greater than anticipated. If we fail to offer new products or product enhancements or fail to achieve higher quality products, we may not generate sufficient revenue to offset our development costs and other expenses or meet our customers' requirements.

We have made and may continue to make strategic investments in raw materials suppliers, which may not be successful and may result in the loss of all or part of our investment.

We have made direct investments or investments through our subsidiaries in raw material suppliers in China, which provide us with opportunities to gain supplies of key raw materials that are important to our substrate business. These affiliates each have a market beyond that provided by us. We do not have significant influence over every one of these companies and in some we have made only a strategic, minority investment. We may not be successful in achieving the financial, technological or commercial advantage upon which any given investment is premised, and we could end up losing all or part of our investment which would have a negative impact on our results of operations. In the first quarter of 2017, we incurred an impairment charge of $313,000 against one of our partially owned suppliers, writing down our investment to zero value. In the first quarter of 2019, we incurred an impairment charge of $1.1 million for a germanium materials company in China in which we have a 25% ownership interest, writing down our investment to zero value. A significant decline in the selling prices of raw materials began in 2015 and weakened some of these companies and their losses negatively impacted our financial results for several years. Further, the increasing concern and restrictions in China of hazardous chemicals and other hazardous elements could result in orders to shut down permanently, fines or other severe measures. Any such orders directed at one of our joint venture companies could result in impairment charges if the company is forced to close its business, cease operations or incurs fines, or operating losses, which would have a material adverse effect on our financial results.

We purchase critical raw materials and parts for our equipment from single or limited sources, and could lose sales if these sources fail to fill our needs.

We depend on a limited number of suppliers for certain raw materials, components and equipment used in manufacturing our products, including key materials such as quartz tubing, and polishing solutions. We generally purchase these materials through standard purchase orders and not pursuant to long-term supply contracts, and no supplier guarantees supply of raw materials or equipment to us. If we lose any of our key suppliers, our manufacturing efforts could be significantly hampered and we could be prevented from timely producing and delivering products to our customers. Prior to investing in our subsidiaries and joint ventures, we sometimes experienced delays obtaining critical raw materials and spare parts, including gallium, and we could experience such delays again in the future due to shortages of materials or for other reasons. Delays in receiving equipment or materials could result in higher costs and cause us to delay or reduce production of our products. If we have to delay or reduce production, we could fail to meet customer delivery schedules and our revenue and operating results could suffer.

We may not be able to identify or form additional complementary raw material joint ventures.

We might invest in additional joint venture companies in order to remain competitive in our marketplace and ensure a supply of critical raw materials. However, we may not be able to identify additional complementary joint venture opportunities or, even once opportunities are identified, we may not be able to reach agreement on the terms of the business venture with the other investment partners. Further, geopolitical tensions and trade wars could result in government agencies blocking such new joint ventures. New joint ventures could require cash investments or cause us to incur additional liabilities or other expenses, any of which could adversely affect our financial condition and operating results.

The financial condition of our customers may affect their ability to pay amounts owed to us.

Some of our customers may be undercapitalized and cope with cash flow issues. The recent U.S. bank failures may affect our customers. Because of competitive market conditions, we may grant our customers extended payment terms when selling products to them. Subsequent to our fulfilling an order, some customers have been unable to make payments when due, reducing our cash balances and causing us to incur charges to allow for a possibility that some accounts might not be paid. We observed an increase in our accounts receivable in the first quarter of 2020 and believe this has resulted from work stoppages, shelter-in-place orders and general cautiousness due to the COVID-19 pandemic. In the past we, have had some customers file for bankruptcy. If our customers do not pay amounts owed to us then we will incur charges that would reduce our earnings.

We depend on the continuing efforts of our senior management team and other key personnel. If we lose members of our senior management team or other key personnel, or are unable to successfully recruit and train qualified personnel, our ability to manufacture and sell our products could be harmed.

Our future success depends on the continuing services of members of our senior management team and other key personnel. Our industry is characterized by high demand and intense competition for talent, and the turnover rate can be high. We compete for qualified management and other personnel with other specialty material companies and semiconductor companies. Our employees could leave our company with little or no prior notice and would be free to work for a competitor. If one or more of our senior executives or other key personnel were unable or unwilling to continue in their present positions, we may not be able to replace them easily or at all, and other senior management may be required to divert attention from other aspects of the business. The loss of any of these individuals or our ability to attract or retain qualified personnel could adversely affect our business.

Our results of operations may suffer if we do not effectively manage our inventory.

We must manage our inventory of raw materials, work in process and finished goods effectively to meet changing customer requirements, while keeping inventory costs down and improving gross margins. Although we seek to maintain sufficient inventory levels of certain materials to guard against interruptions in supply and to meet our near term needs, we may experience shortages of certain key materials. Alternatively, a sudden decline in demand could result in holding too much inventory. This occurred in the second half of 2022. Some of our products and supplies have in the past and may in the future become obsolete while in inventory due to changing customer specifications, or become excess inventory due to decreased demand for our products and an inability to sell the inventory within a foreseeable period. This would result in charges that reduce our gross profit and gross margin. Furthermore, if market prices drop below the prices at which we value inventory, we would need to take a charge for a reduction in inventory values in accordance with the lower of cost or net realizable value valuation rule. We have in the past had to take inventory valuation and impairment charges. Any future unexpected changes in demand or increases in costs of production that cause us to take additional charges for un-saleable, obsolete or excess inventory, or to reduce inventory values, would adversely affect our results of operations.

The effect of terrorist threats and actions on the general economy could decrease our revenue.

Countries such as the United States and China continue to be on alert for terrorist activity. The potential near and long-term impact terrorist activities may have in regards to our suppliers, customers and markets for our products and the economy is uncertain. There may be embargos of ports or products, or destruction of shipments or our facilities, or attacks that affect our personnel. There may be other potentially adverse effects on our operating results due to significant events that we cannot foresee. Since we perform all of our manufacturing operations in China, terrorist activity or threats against U.S.-owned enterprises are a particular concern to us.

III. Risks Related to International Aspects of Our Business

The Chinese central government is increasingly aware of air pollution and other forms of environmental pollution and their reform efforts can impact our manufacturing, including intermittent mandatory shutdowns.

The Chinese central government is demonstrating strong leadership to improve air quality and reduce environmental pollution. These efforts have impacted manufacturing companies through mandatory shutdowns, increased inspections and regulatory reforms. In the fourth quarter of 2017, many manufacturing companies in the greater Beijing area, including AXT, were instructed by the local government to cease most manufacturing for several days until the air quality improved. In the first quarter of 2018, from February 27 to March 31 over 300 manufacturing companies, including AXT, were again intermittently shut down by the local government for a total of ten days, or 30 percent of the remaining calendar days, due to severe air pollution. Our shipments were delayed and our revenue for the quarter was negatively impacted. We expect that mandatory factory shutdowns will occur in the future. If the frequency of such shutdowns increases, especially at the end of a quarter, or if the total number of days of shutdowns prevents us from producing enough wafers to ship, then these shutdowns will have a material adverse effect on our manufacturing output, revenue and factory utilization. Each of our raw material supply chain companies could also be impacted by environmental related orders from the central government.

Although we are a Delaware corporation and are neither a PRC operating company nor do we conduct our operations in China through the use of VIEs, in the event we inadvertently concluded that we do not require any permissions or approvals from the CSRC or other PRC central government authorities to complete a public offering of securities in the U.S. or applicable laws, regulations, or interpretations change, we may be required to obtain such permissions or approvals to complete such a public offering of securities.

We are a Delaware corporation and are neither a PRC operating company nor do we conduct our operations in China through the use of VIEs. All of our products are manufactured in the PRC by our PRC subsidiaries and PRC joint ventures. We believe that we do not require any permissions or approvals from the CSRC or other PRC central government authorities to complete a public offering of securities in the U.S. because we are a Delaware corporation with our principal corporate office in Fremont, California and the PRC laws and regulations that govern the listing of securities on a U.S. securities exchange apply to PRC companies. However, in the event that we inadvertently concluded that such permission or approvals are not required or applicable laws, regulations, or interpretations change and we are required to obtain such permissions or approvals in the future and we fail to obtain such permissions or approvals, then we may not be able to complete a public offering of securities in the U.S. We may also be pressured to delist our securities, which would force the holders to sell these securities and could result in a material adverse effect on the value of these securities. We may face sanctions by the CSRC or other PRC central government authorities or pressure from the PRC government in various business matters for failure to obtain such permissions or approvals. These sanctions or pressure may include fines and penalties on our operations in China, limitations on our operating privileges in China, delays in or restrictions on the repatriation of the proceeds from a public offering of securities in the U.S. into the PRC, restrictions on or prohibition of the payments or remittance of dividends by our subsidiaries in China, or other actions that could have a material and adverse effect on our business, financial condition, results of operations, reputation and prospects, as well as the trading price of our common stock.

The PRC central government may intervene in or influence our PRC operations at any time and the rules and regulations in China can change quickly with little advance notice.

The businesses of our PRC subsidiaries and PRC joint ventures are subject to complex and rapidly evolving laws and regulations in the PRC, which can change quickly with little advance notice. The PRC central government is a single party form of government with virtually unlimited authority and power to intervene in or influence commercial operations in China. In the past, we have experienced such intervention or influence by the PRC central government and a change in the rules and regulations in China when we were instructed by the Beijing municipal government to relocate our gallium arsenide manufacturing facility in Beijing and expect that such intervention or influence or change in the rules and regulations in China could occur in the future.

In the ordinary course of business, our PRC subsidiaries and PRC joint ventures require permits and licenses to operate in the PRC. Such permits and licenses include permits to use hazardous materials in manufacturing operations. From time to time, the PRC government issues new regulations, which may require additional actions on the part of our PRC subsidiaries and PRC joint ventures to comply. For example, on February 27, 2015, the China State Administration of Work Safety updated its list of hazardous substances. The previous list, which was published in 2002, did not restrict the materials that we use in our wafers. The new list added gallium arsenide. As a result of the newly published list, we were required to seek additional permits. Any such intervention or influence or change in the rules and regulations in China could result in a material change in our PRC operations and/or the value of our common stock.

The PRC central government may also exert more control over offerings conducted overseas and/or foreign investment in China-based issuers, which could result in a material change in our operations and/or the value of our common stock.

The PRC central government may also exert more control over offerings conducted overseas and/or foreign investment in China-based issuers, which could result in a material change in our operations and/or the value of our common stock. The PRC central government may also seek to significantly limit or completely hinder our ability to offer or continue to offer our securities to investors and cause the value of such securities to significantly decline or be worthless.

Dividends from within our corporate structure are subject to PRC withholding tax and SAFE approval.

Occasionally, one of our PRC subsidiaries or PRC raw material joint ventures declares and pays a dividend. These dividends generally occur when the PRC joint venture declares a dividend for all of its shareholders. We have no current intentions to distribute to our investors earnings under our corporate structure. Dividends paid to the Company are subject to a 10% PRC withholding tax. The Company is required to obtain approval from the State Administration of Foreign Exchange (“SAFE”) to transfer funds in or out of the PRC. SAFE requires a valid agreement to approve the transfers, which are processed through a bank. Other than PRC foreign exchange restrictions, the Company is not subject to any PRC restrictions and limitations on its ability to distribute earnings from its businesses. If SAFE approval is denied the dividend payable to the Company would be owed but would not be paid.

Our PRC subsidiaries and PRC joint ventures are subject to data security oversight.

Our PRC subsidiaries and PRC joint ventures are subject to oversight by the Cyberspace Administration of China (the "CAC") regarding data security. Except for routine personal information necessary to process payroll and other benefits and emergency contact information, our PRC subsidiaries and PRC joint ventures do not collect or maintain personal information. All of our products are manufactured in the PRC by our PRC subsidiaries and PRC joint ventures. Although we are neither a PRC operating company nor do we conduct our operations in China through the use of VIEs, cybersecurity is increasingly a focus of the central government and the CAC could require AXT to comply with PRC cybersecurity regulations, which could cause us to make changes to our operations that could materially harm our business, financial condition and results of operations.

Enhanced trade tariffs, import restrictions, export restrictions, Chinese regulations or other trade barriers may materially harm our business.

All of our wafer substrates are manufactured in China and in the year 2022 approximately 14% and in the years 2021 and 2020, approximately 10% of our revenue was generated by sales to customers in North America, primarily in the U.S. In September 2018, the Trump Administration announced a list of thousands of categories of goods that became subject to tariffs when imported into the United States from China. This pronouncement imposed tariffs on wafer substrates we imported into the United States. The initial tariff rate was 10% and subsequently was increased to 25%. In the years 2022, 2021 and 2020, we paid approximately $3.3 million, $1.3 million and $1.3 million, respectively, in tariffs. The future impact of tariffs and trade wars is uncertain. We may be required to raise prices, which may result in the loss of customers and our business, financial condition and results of operations may be materially harmed. Additionally, it is possible that our business could be adversely impacted by retaliatory trade measures taken by China or other countries in response to existing or future tariffs, which could cause us to raise prices or make changes to our operations, which could materially harm our business, financial condition and results of operations.

The economic and political conditions between China and the United States, in our view, create an unstable business environment. The United States government has restricted access by certain Chinese technology companies to items produced domestically and abroad from U.S. technology and software, which may impact our ability to grow our revenue. Trade restrictions against China have resulted in a greater determination within China to be self-sufficient and produce more goods domestically. Government agencies in China may be encouraging and supporting the founding of new companies, the addition of new products in existing companies and more vertical integration within companies. These factors have resulted in lower revenue from sales of our wafer substrates in China. Further, the continued threats of tariffs and other trade restrictions could have a generally disruptive impact on the global economy and, therefore, negatively impact our sales.

In addition, we may incur increases in costs and other adverse business consequences, including losses of customers and revenue or decreased gross margins, due to changes in tariffs, import or export restrictions, further trade barriers, or unexpected changes in regulatory requirements. For example, in July 2012, we received notice of retroactive value-added taxes (VATs) levied by the tax authorities in China, which applied for the period from July 1, 2011 to June 30, 2012. We expensed the retroactive VATs of approximately $1.3 million in the quarter ended June 30, 2012, which resulted in a decrease in our gross margins. These VATs will continue to negatively impact our gross margins for the future quarters. Given the relatively fluid regulatory environment in China and the United States, there could be additional tax or other regulatory changes in the future. Any such changes could directly and materially adversely impact our financial results and general business condition.

The spread of COVID-19 has affected our business operations and financial performance.

The spread of COVID-19 has impacted our operations and financial performance. This outbreak has triggered references to the SARS outbreak, which occurred in 2003 and affected our business operations. Any severe occurrence of an outbreak of a contagious disease such as COVID-19, SARS, Avian Flu or Ebola may cause us or the government to temporarily close our manufacturing operations in China. In January 2020, virtually all companies in China were ordered to remain closed after the traditional Lunar New Year holiday ended, including our subsidiaries in China. In late March 2022, as a result of an outbreak of COVID-19, Shanghai was locked down and certain manufacturing facilities were required to close. In the second quarter of 2022, rising COVID-19 infections in Beijing resulted in concerns of a city-wide lockdown, which could have required our manufacturing facilities in Beijing to close temporarily. Although some apartment complexes were locked down there was no city-wide lockdown. In December 2022. The PRC government ended its zero-COVID policy. If there is a renewed surge of the COVID-19 pandemic in cities in which our PRC subsidiaries and PRC joint ventures are located, the Chinese government may require companies to close again. If one or more of our key suppliers is required to close for an extended period, we might not have enough raw material inventories to continue manufacturing operations. In addition, travel restrictions between China and the U.S. have disrupted our normal movement to and from China and this has impacted our efficiency. The outbreak has affected transportation and reduced the availability of air transport, caused port closures, and increased border controls and closures. If our manufacturing operations were closed for a significant period or we experience difficulty in shipping our products, we could lose revenue and market share, which would depress our financial performance and could be difficult to recapture. If one of our key customers is required to close for an extended period this may delay the placement of new orders. As a result, our revenue would decline. Further, customers might default on their obligations to us. In the first quarter of 2020 we observed an increase in our accounts receivable and believe this is the result of businesses slowing down and a general cautiousness due to the COVID-19 pandemic. Such events would negatively impact our financial performance.

Financial market volatility and adverse changes in the domestic, global, political and economic environment could have a significant adverse impact on our business, financial condition and operating results.

We are subject to the risks arising from adverse changes and uncertainty in domestic and global economies. Uncertain global economic and political conditions or low or negative growth in China, Europe or the United States, along with volatility in the financial markets and U.S. financial system, increasing national debt and fiscal concerns in various regions and the adoption and availability of fiscal and monetary stimulus measures to counteract the impact of the COVID-19 pandemic, pose challenges to our industry. Currently China’s economy is slowing and this could impact our financial performance. In addition, tariffs, trade restrictions, trade wars, high levels of inflation, rising interest rates, the Russian invasion of Ukraine, Brexit, heightened tensions between the U.S. and China, and recent U.S. bank failures, among other factors, are creating an unstable environment and can disrupt or restrict commerce. Although we remain well-capitalized, the cost and availability of funds may be adversely affected by illiquid credit markets. Volatility in U.S. and international markets and economies may adversely affect our liquidity, financial condition and profitability. Another severe or prolonged economic downturn could result in a variety of risks to our business, including:

- increased volatility in our stock price;
- increased volatility in foreign currency exchange rates;
- delays in, or curtailment of, purchasing decisions by our customers or potential customers;
- increased credit risk associated with our customers or potential customers, particularly those that may operate in industries most affected by the economic downturn; and
- impairment of our tangible or intangible assets.

During challenging and uncertain economic times and in tight credit markets, many customers delay or reduce technology purchases. Should similar events occur again, our business and operating results could be significantly and adversely affected. In the fourth quarter of 2018 and continuing in 2019, we experienced delays in customer purchasing decisions and disruptions in a normal volume of customer orders that we believe were in part due to the uncertainties in the global economy, resulting in an adverse impact on consumer spending. We, and many other companies, experienced this in the second half of 2022.

We derive a significant portion of our revenue from international sales, and our ability to sustain and increase our international sales involves significant risks.

Approximately 86% of our revenue is from international sales. We expect that sales to customers outside the United States, particularly sales to customers in Japan, Taiwan, Europe and China, will continue to represent a significant portion of our revenue. Therefore, our revenue growth depends significantly on the expansion of our international sales and operations.

All of our manufacturing facilities and most of our suppliers are also located outside the United States. Managing our overseas operations presents challenges, including periodic regional economic downturns, trade balance issues, threats of trade wars, varying business conditions and demands, political instability, variations in enforcement of intellectual property and contract rights in different jurisdictions, differences in the ability to develop relationships with suppliers and other local businesses, changes in U.S. and international laws and regulations, including U.S. import and export restrictions, fluctuations in interest and currency exchange rates, the ability to provide sufficient levels of technical support in different locations, cultural differences and perceptions of U.S. companies, shipping delays and terrorist acts or acts of war, natural disasters and epidemics or pandemics, such as COVID-19, among other risks. Many of these challenges are present in China, which represents a large potential market for semiconductor devices. Global uncertainties with respect to: (i) economic growth rates in various countries; (ii) sustainability of demand for electronic products; (iii) capital spending by semiconductor manufacturers; (iv) price weakness for certain semiconductor devices; (v) changing and tightening environmental regulations; (vi) political instability in regions where we have operations and (vii) trade wars may also affect our business, financial condition and results of operations.

Our dependence on international sales involves a number of risks, including:

- changes in tariffs, import restrictions, export restrictions, or other trade barriers;
- unexpected changes in regulatory requirements;
- longer periods to collect accounts receivable;
- foreign exchange rate fluctuations;
- changes in export license requirements;
- political and economic instability; and
- unexpected changes in diplomatic and trade relationships.

Most of our sales are denominated in U.S. dollars, except for sales to our Chinese customers which are denominated in renminbi and our Japanese customers which are denominated in Japanese yen. We also have some small sales denominated in Euro. Increases in the value of the U.S. dollar could increase the price of our products in non-U.S. markets and make our products more expensive than competitors' products in these markets.

We are subject to foreign exchange gains and losses that may materially impact our consolidated statements of operations.

We are subject to foreign exchange gains and losses that may materially impact our statements of operations. For example, in 2022 we incurred a foreign exchange gain of $1.6 million and in 2021 and 2020 we incurred foreign exchange losses of $434,000 and $411,000, respectively.

The functional currency of our companies in China is the Chinese renminbi, the local currency. We can incur foreign exchange gains or losses when we pay dollars to one of our China-based companies or a third-party supplier in China. Similarly, if a company in China pays renminbi into one of our bank accounts transacting in dollars the renminbi will be converted to dollars and we can incur a foreign exchange gain or loss. Hedging renminbi will be considered in the future but it is complicated by the number of companies involved, the diversity of transactions and restrictions imposed by the banking system in China.

Sales to Japanese customers are denominated in Japanese yen. This subjects us to fluctuations in the exchange rates between the U.S. dollar and the Japanese yen and can result in foreign exchange gains and losses. This has been problematic in the past and, therefore, we instituted a foreign currency hedging program dealing with yen which has mitigated the problem.

Joint venture raw material companies in China bring certain risks.

Since our consolidated subsidiaries and all of our joint venture raw material companies reside in China, their activities could subject us to a number of risks associated with conducting operations internationally, including:

- unexpected changes in regulatory requirements that may limit our ability to manufacture, export the products of these companies, sell into particular jurisdictions or impose multiple conflicting tax laws and regulations;
- the imposition of tariffs, trade barriers and duties;
- difficulties in managing geographically disparate operations;
- difficulties in enforcing agreements through non-U.S. legal systems;
- political and economic instability, civil unrest or war;
- terrorist activities that impact international commerce;
- difficulties in protecting our intellectual property rights, particularly in countries where the laws and practices do not protect proprietary rights to as great an extent as do the laws and practices of the United States;
- new or changing laws and policies affecting economic liberalization, foreign investment, currency convertibility or exchange rates, taxation or employment;
- new or changing PRC regulations and policies regarding data security and oversight by the Cyberspace Administration of China of our consolidated subsidiaries and all of our joint venture raw material companies; and
- nationalization of foreign-owned assets, including intellectual property.

Uncertainty regarding the United States' foreign policy, particularly with regards to China, could disrupt our business.

We manufacture our substrates in China and, in 2022, approximately 86% of our sales were to customers located outside the United States. Further, we have partial ownership of raw material companies in China as part of our supply chain. The United States' current foreign policy has created uncertainty and caution in the international business community, resulting in disruptions in manufacturing, import/export, trade tariffs, sales, investments and other business activity. Such disruptions have had an adverse impact on our financial performance and could continue in the future.

If China places restrictions on freight and transportation routes and on ports of entry and departure this could result in shipping delays or increased costs for shipping.

In August 2015, there was an explosion at the Port of Tianjin, China. As a result of this incident the government placed restrictions on importing certain materials and on freight routes used to transport these materials. We experienced some modest disruption from these restrictions. If the government were to place additional restrictions on the transportation of materials, then our ability to transport our raw materials or products could be limited and result in manufacturing delays or bottlenecks at shipping ports, affecting our ability to deliver products to our customers. During periods of such restrictions, we may increase our stock of critical materials (such as arsenic, gallium and other items) for use during the period that these restrictions are likely to last, which will increase our use of cash and increase our inventory level. Any of these restrictions could materially and adversely impact our results of operations and our financial condition.

Our operating results depend in large part on continued customer acceptance of our substrate products manufactured in China and continued improvements in product quality.

We manufacture all of our products in China, and source most of our raw materials in China. We have in the past experienced quality problems with our China manufactured products. Our previous quality problems caused us to lose market share to our competitors, as some of our customers reduced their orders until our wafer surface quality was as good and as consistent as that offered by our competitors and instead allocated their requirements for compound semiconductor substrates to our competitors. If we are unable to continue to achieve customer qualifications for our products, or if we are unable to control product quality, customers may not increase purchases of our products, our China facilities will become underutilized, and we will be unable to achieve revenue growth.

Changes in China's political, social, regulatory or economic environments may affect our financial performance.

Our financial performance may be affected by changes in China's political, social, regulatory or economic environments. The role of the Chinese central and local governments in the Chinese economy is significant. The Beijing municipal government's decision to move to the Tongzhou district, the original location of our China company, resulted in the city instructing virtually all existing manufacturing companies, including AXT, to relocate all or some of their manufacturing lines. We were instructed to move our gallium arsenide manufacturing line out of the area. Chinese policies toward hazardous materials, including arsenic, environmental controls, air pollution, economic liberalization, laws and policies affecting technology companies, foreign investment, currency exchange rates, taxation structure and other matters could change, resulting in greater restrictions on our ability to do business and operate our manufacturing facilities in China. We have observed a growing fluidity and tightening of regulations concerning hazardous materials, other environmental controls and air pollution. The Chinese government could revoke, terminate or suspend our operating licenses for reasons related to environmental control over the use of hazardous materials, air pollution, labor complaints, national security and similar reasons without compensation to us. Further, the central government encourages employees to report to the appropriate regulatory agencies possible safety or environmental violations, but there may not be actual violations. In days of severe air pollution the government has ordered manufacturing companies to stop all production. For example, in the first quarter of 2018, from February 27 to March 31, over 300 manufacturing companies, including us, were again intermittently shut down by the local government for a total of ten days due to severe air pollution. Our shipments were delayed and our revenue for the quarter was negatively impacted. We expect that mandatory factory shutdowns will occur in the future. Any failure on our part to comply with governmental regulations could result in the loss of our ability to manufacture our products. Further, any imposition of surcharges or any increase in Chinese tax rates or reduction or elimination of Chinese tax benefits could hurt our financial results.

Our international operations are exposed to potential adverse tax consequence in China.

Our international operations create a risk of potential adverse tax consequences. Taxes on income in our China-based companies are dependent upon acceptance of our operational practices and intercompany transfer pricing by local tax authorities as being on an arm's length basis. Due to inconsistencies among taxing authorities in application of the arm's length standard, transfer pricing challenges by tax authorities could, if successful, materially increase our consolidated income tax expense. We are subject to tax audits in China and an audit could result in the assessment of additional income tax against us. This could have a material adverse effect on our operating results or cash flows in the period or periods for which that determination is made and could result in increases to our overall tax expense in subsequent periods. Various taxing agencies in China are increasingly focused on tax reform and other legislative action to increase tax revenue. In addition to risks regarding income tax we have in the past been retroactively assessed value added taxes ("VAT" or sales tax) and such VAT assessments could occur again in the future.

If there are power shortages in China, we may have to temporarily close our China operations, which would adversely impact our ability to manufacture our products and meet customer orders, and would result in reduced revenue.

In the past, China has faced power shortages resulting in power demand outstripping supply in peak periods. Instability in electrical supply has caused sporadic outages among residential and commercial consumers causing the Chinese government to implement tough measures to ease the energy shortage. If further problems with power shortages occur in the future, we may be required to make temporary closures of our operations or of our subsidiary and joint venture raw material companies. We may be unable to manufacture our products and would then be unable to meet customer orders except from finished goods inventory on hand. As a result, our revenue could be adversely impacted, and our relationships with our customers could suffer, impacting our ability to generate future revenue. In addition, if power is shut off at any of our facilities at any time, either voluntarily or as a result of unplanned brownouts, during certain phases of our manufacturing process including our crystal growth phase, the work in process may be ruined and rendered unusable, causing us to incur costs that will not be covered by revenue, and negatively impacting our cost of revenue and gross margins.

Although the audit report is prepared by an independent registered public accounting firm who is currently inspected fully by the PCAOB, there is no guarantee that future audit reports will be prepared by an independent registered public accounting firm that is completely inspected by the PCAOB.

Our independent registered public accounting firm, BPM, is registered with the PCAOB and is subject to regular inspections by the PCAOB to assess its compliance with the applicable professional standards. Although we have operations in China, a jurisdiction where the PCAOB was, until recently, unable to conduct inspections without the approval of the Chinese government authorities, our independent registered public accounting firm is currently inspected fully by the PCAOB.

Inspections of other independent registered public accounting firms conducted by the PCAOB outside China have at times identified deficiencies in those independent registered public accounting firms' audit procedures and quality control procedures, which may be addressed as part of the inspection process to improve future audit quality. The lack of PCAOB inspections of audit work undertaken in China prevented the PCAOB from regularly evaluating independent registered public accounting firms' audits and their quality control procedures. As a result, to the extent that any component of our independent registered public accounting firm's work papers is or becomes located in China, such work papers may not be subject to inspection by the PCAOB. As a result, investors would be deprived of such PCAOB inspections, which could result in limitations or restrictions to our access of the U.S. capital markets.

As part of a continued regulatory focus in the United States on access to audit and other information currently protected by national law, in particular PRC laws, in June 2019, a bipartisan group of lawmakers introduced bills in both houses of the U.S. Congress which, if passed, would require the SEC to maintain a list of issuers for which PCAOB is not able to inspect or investigate the audit work performed by a non-U.S. independent registered public accounting firm completely. The proposed Ensuring Quality Information and Transparency for Abroad-Based Listings on our Exchanges Act prescribes increased disclosure requirements for these issuers and, beginning in 2025, the delisting from U.S. national securities exchanges such as the Nasdaq Global Select Market of issuers included on the SEC's list for three consecutive years. It is unclear if this proposed legislation will be enacted. Furthermore, there have been recent deliberations within the U.S. government regarding potentially limiting or restricting companies based in China from accessing U.S. capital markets. On May 20, 2020, the U.S. Senate passed the HFCA Act, which includes requirements for the SEC to identify issuers whose audit work is performed by independent registered public accounting firms that the PCAOB is unable to inspect or investigate completely because of a restriction imposed by a non-U.S. authority in the independent registered public accounting firms' local jurisdiction. The U.S. House of Representatives passed the HFCA

Act on December 2, 2020, and the HFCA Act was signed into law on December 18, 2020. Additionally, in July 2020, the U.S. President's Working Group on Financial Markets issued recommendations for actions that can be taken by the executive branch, the SEC, the PCAOB or other federal agencies and department with respect to Chinese companies listed on U.S. stock exchanges and their independent registered public accounting firms, in an effort to protect investors in the United States. In response, on November 23, 2020, the SEC issued guidance highlighting certain risks (and their implications to U.S. investors) associated with investments in issuers based in China and summarizing enhanced disclosures the SEC recommends issuers based in China make regarding such risks. On March 18, 2021, the SEC adopted interim final rules to implement the HFCA Act, which requires the SEC to identify certain issuers that filed annual reports with audit reports issued by registered public accounting firms located in foreign jurisdictions and that the PCAOB is unable to inspect or investigate completely because of a position taken by an authority in those jurisdictions (the "Commission-Identified Issuers"). Specifically, the SEC implemented the submission and disclosure requirements of the HFCA Act. On December 2, 2021, the SEC issued amendments to finalize the interim final rules. Further, the SEC established procedures to identify Commission-Identified Issuers and prohibit the trading of the securities of Commission-Identified Issuers as required by the HFCA Act. We will be required to comply with these rules if the SEC identifies us as a Commission-Identified Issuer. Under the HFCA Act, our securities may be prohibited from trading on the Nasdaq Global Select Market or other U.S. stock exchanges if we are determined to be a Commission-Identified Issuer for three consecutive years, and this ultimately could result in our common stock being delisted. Furthermore, on June 22, 2021, the U.S. Senate passed the Accelerating Holding Foreign Companies Accountable Act, which, if enacted, would amend the HFCA Act and require the SEC to prohibit an issuer's securities from trading on any U.S. stock exchanges if the issuer is determined to be a Commission-Identified Issuer for two consecutive years instead of three. On December 15, 2021, the Accelerating Holding Foreign Companies Accountable Act was introduced to the U.S. House of Representatives. On September 22, 2021, the PCAOB adopted a final rule implementing the HFCA Act, which provides a framework for the PCAOB to use when determining, as contemplated under the HFCA Act, whether the PCAOB is unable to inspect or investigate completely independent registered public accounting firms located in a non-U.S. jurisdiction because of a position taken by one or more authorities in that jurisdiction and was approved by the SEC on November 5, 2021. On December 16, 2021, the PCAOB issued a report on its determinations that the PCAOB is unable to inspect or investigate completely registered public accounting firms headquartered in the PRC and Hong Kong because of positions taken by PRC authorities in those jurisdictions.

Beginning in March 2022, the SEC listed companies on either its conclusive list of issuers identified under the HFCA Act or its provisional list of issuers identified under the HFCA Act. Companies listed on the SEC's conclusive list of issuers identified under the HFCA Act are determined to be Commission-Identified Issuers. The SEC did not list AXT, Inc. on either its conclusive list of issuers identified under the HFCA Act or its provisional list of issuers identified under the HFCA Act.

On December 15, 2022, the PCAOB vacated its 2021 determinations that the positions taken by authorities in the PRC and Hong Kong prevented it from inspecting and investigating completely registered public accounting firms headquartered in those jurisdictions. As a result, the SEC will not provisionally or conclusively identify an issuer as a Commission-Identified Issuer if it files an annual report with an audit report issued by a registered public accounting firm headquartered in either jurisdiction on or after December 15, 2022, until such time as the PCAOB issues a new determination. The SEC will continue to include any Commission-Identified Issuer on the provisional or conclusive list if they filed an annual report with an audit report issued by a registered public accounting firm headquartered in mainland China and Hong Kong prior to the PCAOB's decision to vacate its 2021 determinations.

While an agreement has been reached among the CSRC, the SEC and the PCAOB regarding the inspection of PCAOB-independent registered public accounting firms in China, there can be no assurance that we will be able to comply with requirements imposed by U.S. regulators. If the PRC authorities do not fully perform their obligations under the agreement with the PCAOB in the future, or if authorities in the PRC otherwise take positions that render the PCAOB unable to inspect or investigate completely registered public accounting firms headquartered in the PRC and Hong Kong, the PCAOB will make determinations under the HFCA Act. Delisting of our common stock would force holders of our common stock to sell their shares. The market price of our common stock could be adversely affected as a result of anticipated negative impacts of these executive or legislative actions upon, as well as negative investor sentiment towards, companies with operations in China that are listed in the United States, regardless of whether these executive or legislative actions are implemented and regardless of our actual operating performance.

VI. Risks Related to Our Financial Results and Capital Structure

We may utilize our cash balances for relocating manufacturing lines, adding capacity, acquiring state-of-the-art equipment or offsetting a business downturn resulting in the decline of our existing cash and if we need additional capital, funds may not be available on acceptable terms, or at all.

Our liquidity is affected by many factors, including among others, the relocation of our gallium arsenide manufacturing lines, the expansion of our capacity to meet market demand, the acquisition of state-of-the-art equipment, other capital expenditures, operating activities, the effect of exchange rate changes and other factors related to the uncertainties of the industry and global economies. Such matters could draw down our cash reserves, which could adversely affect our financial condition, require us to incur debt, reduce our value and possibly impinge our ability to raise debt and equity funding in the future, at a time when we might need to raise additional cash or elect to raise additional cash. Accordingly, there can be no assurance that events will not require us to seek additional capital or, if required, that such capital would be available on terms acceptable to us, if at all.

The terms of the private equity raised in China as a first step toward an IPO on the STAR Market grant each Investor a right of redemption if Tongmei fails to achieve its IPO.

Pursuant to the Capital Investment Agreements with the Investors, each Investor has the right to require AXT to redeem any or all Tongmei shares held by such Investor at the original purchase price paid by such Investor, without interest, in the event the IPO fails to pass the audit of the Shanghai Stock Exchange, is not approved by the Chinese Securities Regulatory Commission ("CSRC") or Tongmei cancels the IPO application. The aggregate redemption amount is approximately $49 million.

Tongmei submitted its IPO application to the Shanghai Stock Exchange and it was formally accepted for review on January 10, 2022. The Shanghai Stock Exchange approved the IPO application on July 12, 2022. On August 1, 2022, the CSRC accepted for review Tongmei's IPO application. The STAR Market IPO remains subject to review and approval by the CSRC and other authorities. The process of going public on the STAR Market includes several periods of review and, therefore, is a lengthy process. Subject to review and approval by the CSRC and other authorities, Tongmei expects to accomplish this goal in the coming months. The listing of Tongmei on the STAR Market will not change the status of AXT as a U.S. public company. There can be no assurances that Tongmei will complete its IPO in 2023 or at all. In the event that investors exercise their redemption rights, we may be required to seek additional capital in order to redeem their Tongmei shares and there would be no assurances that such capital would be available on terms acceptable to us, if at all. Any redemptions could have a material adverse effect on our business, financial condition and results of operations.

Unpredictable fluctuations in our operating results could disappoint analysts or our investors, which could cause our stock price to decline.

We have experienced, and may continue to experience, significant fluctuations in our revenue, gross margins and earnings. Our quarterly and annual revenue and operating results have varied significantly in the past and may vary significantly in the future due to a number of factors, including:

- our ability to develop, manufacture and deliver high quality products in a timely and cost-effective manner;
- unforeseen disruptions at our new sites;
- disruptions in manufacturing if air pollution, or other environmental hazards, or outbreaks of contagious diseases causes the Chinese government to order work stoppages;
- fluctuation of our manufacturing yields;

- decreases in the prices of our or our competitors' products;
- fluctuations in demand for our products;
- the volume and timing of orders from our customers, and cancellations, push-outs and delays of customer orders once booked;
- decline in general economic conditions or downturns in the industry in which we compete;
- expansion of our manufacturing capacity;
- expansion of our operations in China;
- limited availability and increased cost of raw materials;
- costs incurred in connection with any future acquisitions of businesses or technologies; and
- increases in our expenses, including expenses for research and development.

Due to these factors, we believe that period-to-period comparisons of our operating results may not be meaningful indicators of our future performance.

A substantial percentage of our operating expenses are fixed, and we may be unable to adjust spending to compensate for an unexpected shortfall in revenue. As a result, any delay in generating revenue could cause our operating results to fall below the expectations of market analysts or investors, which could also cause our stock price to decline.

If our operating results and financial performance do not meet the guidance that we have provided to the public, our stock price may decline.

We provide public guidance on our expected operating and financial results. Although we believe that this guidance provides our stockholders, investors and analysts with a better understanding of our expectations for the future, such guidance is comprised of forward-looking statements subject to the risks and uncertainties described in this report and in our other public filings and public statements. Our actual results may not meet the guidance we have provided. If our operating or financial results do not meet our guidance or the expectations of investment analysts, our stock price may decline.

We have adopted certain anti-takeover measures that may make it more difficult for a third party to acquire us.

Our board of directors has the authority to issue up to 800,000 shares of preferred stock in addition to the outstanding shares of Series A preferred stock and to determine the price, rights, preferences and privileges of those shares without any further vote or action by the stockholders. The rights of the holders of common stock will be subject to, and may be adversely affected by, the rights of the holders of any preferred stock that may be issued in the future. The issuance of shares of preferred stock could have the effect of making it more difficult for a third party to acquire a majority of our outstanding voting stock. We have no present intention to issue additional shares of preferred stock.

Provisions in our restated certificate of incorporation and amended and restated bylaws may have the effect of delaying or preventing a merger, acquisition or change of control, or changes in our management, which could adversely affect the market price of our common stock. The following are some examples of these provisions:

- the division of our board of directors into three separate classes, each with three-year terms;

- the right of our board to elect a director to fill a space created by a board vacancy or the expansion of the board;
- the ability of our board to alter our amended and restated bylaws; and
- the requirement that only our board or the holders of at least 10% of our outstanding shares may call a special meeting of our stockholders.

Furthermore, because we are incorporated in Delaware, we are subject to the provisions of Section 203 of the Delaware General Corporation Law. These provisions prohibit us from engaging in any business combination with any interested stockholder (a stockholder who owns 15% or more of our outstanding voting stock) for a period of three years following the time that such stockholder became an interested stockholder, unless:

- $66^{2}/_{3}$% of the shares of voting stock not owned by the interested stockholder approve the merger or combination, or
- the board of directors approves the merger or combination or the transaction which resulted in the stockholder becoming an interested stockholder.

Our common stock may be delisted from The Nasdaq Global Select Market, which could negatively impact the price of our common stock and our ability to access the capital markets.

Our common stock is listed on The Nasdaq Global Select Market. The bid price of our common stock has in the past closed below the $1.00 minimum per share bid price required for continued inclusion on The Nasdaq Global Select Market under Marketplace Rule 5450(a). If the bid price of our common stock remains below $1.00 per share for thirty consecutive business days, we could be subject to delisting from the Nasdaq Global Select Market.

Any delisting from The Nasdaq Global Select Market could have an adverse effect on our business and on the trading of our common stock. If a delisting of our common stock were to occur, our common stock would trade in the over-the-counter market and be quoted on a service such as those provided by OTC Markets Group, Inc. Such alternatives are generally considered to be less efficient markets, and our stock price, as well as the liquidity of our common stock, may be adversely impacted as a result. Delisting from The Nasdaq Global Select Market could also have other negative results, including the potential loss of confidence by customers, suppliers and employees, the loss of institutional investor interest and fewer business development opportunities, as well as the loss of liquidity for our stockholders.

Our ability to use our net operating loss carryforwards and certain other tax attributes may be limited.

As of December 31, 2022, we had U.S. federal net operating loss carryforwards of approximately $31.9 million. We have net operating loss carryforwards of approximately $21,000, primarily in the state of California, as of December 31, 2022. AXT, Inc. does not expect to utilize the loss carryforwards in the next several years unless Tongmei pays a dividend. Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change," the corporation's ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes, such as research tax credits, to offset its post-change income and taxes may be limited. In general, an "ownership change" occurs if there is a cumulative change in our ownership by "5% shareholders" that exceeds 50 percentage points over a rolling three-year period. Similar rules may apply under state tax laws. We might have undergone prior ownership changes, and we may undergo ownership changes in the future, which may result in limitations on our net operating loss carryforwards and other tax attributes. Any such limitations on our ability to use our net operating loss carryforwards and other tax attributes could adversely impact our business, financial condition and results of operations.

V. Risks Related to Our Intellectual Property

Intellectual property infringement claims may be costly to resolve and could divert management attention.

Other companies may hold or obtain patents on inventions or may otherwise claim proprietary rights to technology necessary to our business. The markets in which we compete are comprised of competitors that in some cases hold substantial patent portfolios covering aspects of products that could be similar to ours. We could become subject to claims that we are infringing patent, trademark, copyright or other proprietary rights of others. We may incur expenses to defend ourselves against such claims or enter into cross license agreements that require us to pay royalty payments to resolve such claims. For example, in 2020, we and a competitor entered into a cross license and covenant agreement (the "Cross License Agreement"), which has a term that began on January 1, 2020 and expires on December 31, 2029. We have in the past been involved in lawsuits alleging patent infringement, and could in the future be involved in similar litigation.

If we are unable to protect our intellectual property, including our non-patented proprietary process technology, we may lose valuable assets or incur costly litigation.

We rely on a combination of patents, copyrights, trademarks, trade secrets and trade secret laws, non-disclosure agreements and other intellectual property protection methods to protect our proprietary technology. We believe that our internal, non-patented proprietary process technology methods, systems and processes are a valuable and critical element of our intellectual property. We must establish and maintain safeguards to avoid the theft of these processes. Our ability to establish and maintain a position of technology leadership also depends on the skills of our development personnel. Despite our efforts to protect our intellectual property, third parties can develop products or processes similar to ours. Our means of protecting our proprietary rights may not be adequate, and our competitors may independently develop similar technology, duplicate our products or design around our patents. We believe that at least two of our competitors ship GaAs substrates produced using a process similar to our VGF process. Our competitors may also develop and patent improvements to the VGF technology upon which we rely, and thus may limit any exclusivity we enjoy by virtue of our patents or trade secrets.

It is possible that pending or future United States or foreign patent applications made by us will not be approved, that our issued patents will not protect our intellectual property, or that third parties will challenge our ownership rights or the validity of our patents. In addition, the laws of some foreign countries may not protect our proprietary rights to as great an extent as do the laws of the United States and it may be more difficult to monitor the use of our intellectual property. Our competitors may be able to legitimately ascertain non-patented proprietary technology embedded in our systems. If this occurs, we may not be able to prevent the development of technology substantially similar to ours.

We may have to resort to costly litigation to enforce our intellectual property rights, to protect our trade secrets or know-how or to determine their scope, validity or enforceability. Enforcing or defending our proprietary technology is expensive, could cause us to divert resources and may not prove successful. Our protective measures may prove inadequate to protect our proprietary rights, and if we fail to enforce or protect our rights, we could lose valuable assets.

VI. Risks Related to Compliance, Environmental Regulations and Other Legal Matters

If we, or any of our partially owned supply chain companies, fail to comply with environmental and safety regulations, we may be subject to significant fines or forced to cease our operations.

We are subject to federal, state and local environmental and safety laws and regulations in all of our operating locations, including laws and regulations of China, such as laws and regulations related to the development, manufacture and use of our products, the use of hazardous materials, the operation of our facilities, and the use of our real property. These laws and regulations govern the use, storage, discharge and disposal of hazardous materials during manufacturing, research and development, and sales demonstrations. If we, or any of our partially owned supply chain companies, fail to comply with applicable regulations, we could be subject to substantial liability for clean-up efforts, personal injury, fines or suspension or be forced to close or temporarily cease our operations, and/or suspend or terminate the development, manufacture or use of certain of our products, the use of our facilities, or the use of our real property, each of which could have a material adverse effect on our business, financial condition and results of operations.

The Chinese central government is demonstrating strong leadership to improve air quality and reduce environmental pollution. The central government encourages employees to report to the appropriate regulatory agencies possible safety or environmental violations but there may not be actual violations. These efforts have impacted manufacturing companies through mandatory shutdowns, increased inspections and regulatory reforms. In the first quarter of 2018, from February 27 to March 31 over 300 manufacturing companies were again intermittently shut down by the local government for a total of ten days, or 30 percent of the remaining calendar days, due to severe air pollution. Our shipments were delayed and our revenue for the quarter was negatively impacted. We expect that mandatory factory shutdowns will occur in the future. If the frequency of such shutdowns increases, especially at the end of a quarter, or if the total number of days of shutdowns prevents us from producing enough wafers to ship, then the shutdowns will have a material adverse effect on our manufacturing output, revenue and factory utilization. We believe the relocation of our gallium arsenide and germanium manufacturing lines mitigates our exposure to factory shutdowns. Each of our raw material supply chain companies could also be impacted by environmental related orders from the central government.

In addition, from time to time, the Chinese government issues new regulations, which may require additional actions on our part to comply. For example, on February 27, 2015, the China State Administration of Work Safety updated its list of hazardous substances. The previous list, which was published in 2002, did not restrict the materials that we use in our wafers. The new list added gallium arsenide. As a result of the newly published list, we were required to seek additional permits.

We could be subject to suits for personal injuries caused by hazardous materials.

In 2005, a complaint was filed against us alleging personal injury, general negligence, intentional tort, wage loss and other damages, including punitive damages, as a result of exposure of plaintiffs to high levels of gallium arsenide in gallium arsenide wafers, and methanol. Other current and/or former employees could bring litigation against us in the future. Although we have in place engineering, administrative and personnel protective equipment programs to address these issues, our ability to expand or continue to operate our present locations could be restricted or we could be required to acquire costly remediation equipment or incur other significant expenses if we were found liable for failure to comply with environmental and safety regulations. Existing or future changes in laws or regulations in the United States and China may require us to incur significant expenditures or liabilities, or may restrict our operations. In addition, our employees could be exposed to chemicals or other hazardous materials at our facilities and we may be subject to lawsuits seeking damages for wrongful death or personal injuries allegedly caused by exposure to chemicals or hazardous materials at our facilities.

Litigation is inherently uncertain and while we would expect to defend ourselves vigorously, it is possible that our business, financial condition, results of operations or cash flows could be affected in any particular period by litigation pending and any additional litigation brought against us. In addition, future litigation could divert management's attention from our business and operations, causing our business and financial results to suffer. We could incur defense or settlement costs in excess of the insurance covering these litigation matters, or that could result in significant judgments against us or cause us to incur costly settlements, in excess of our insurance limits.

We are subject to internal control evaluations and attestation requirements of Section 404 of the Sarbanes-Oxley Act.

Pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, we must include in our Annual Report on Form 10-K a report of management on the effectiveness of our internal control over financial reporting. Ongoing compliance with this requirement is complex, costly and time-consuming and it extends to our companies in China. If: (1) we fail to maintain effective internal control over financial reporting; or (2) our management does not timely assess the adequacy of such internal control, we could be subject to regulatory sanctions and the public's perception of us may be adversely impacted.

We need to continue to improve or implement our systems, procedures and controls.

We rely on certain manual processes for data collection and information processing, as do our joint venture companies. If we fail to manage these procedures properly or fail to effectively manage a transition from manual processes to automated processes, our systems and controls may be disrupted. To manage our business effectively, we may need to implement additional management information systems, further develop our operating, administrative, financial and accounting systems and controls, add experienced senior level managers, and maintain close coordination among our executive, engineering, accounting, marketing, sales and operations organizations.

Item 1B. ***Unresolved Staff Comments***

None.

Item 2. ***Properties***

Our principal properties as of March 12, 2023 are as follows:

Location	Square Feet	Principal Use	Ownership
Fremont, CA	19,467	Administration	Operating lease, expires November 2023
Beijing, China	141,524	Production and Administration	Owned by AXT / Tongmei
DingXing, China	193,621	Production	Owned by AXT / Tongmei
Kazuo, China	528,390	Production	Owned by AXT / Tongmei
Kazuo, China	75,703	Production and Administration	Owned by Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd.*
Tianjin, China	146,012	Production and Administration	Owned by Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd., *
Kazuo, China	190,597	Production	Owned by ChaoYang JinMei Gallium Ltd.,*

* Raw material companies consolidated in our consolidated financial statements.

We consider each facility to be in good operating condition and adequate for its present use, and believe that each facility has sufficient plant capacity to meet its current and anticipated operating requirements.

Item 3. ***Legal Proceedings***

From time to time we may be involved in judicial or administrative proceedings concerning matters arising in the ordinary course of business. We do not expect that any of these matters, individually or in the aggregate, will have a material adverse effect on our business, financial condition, cash flows or results of operations.

Item 4. ***Mine Safety Disclosures***

Not applicable.

PART II

Item 5. ***Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities***

Our common stock has been trading publicly on the NASDAQ Global Market (NASDAQ) under the symbol "AXTI" since May 20, 1998, the date we consummated our initial public offering, and beginning on January 3, 2011, our common stock began trading on the NASDAQ Global Select Market under the same symbol. The following table sets forth the range of high and low sales prices of the common stock for the periods indicated, as reported by NASDAQ.

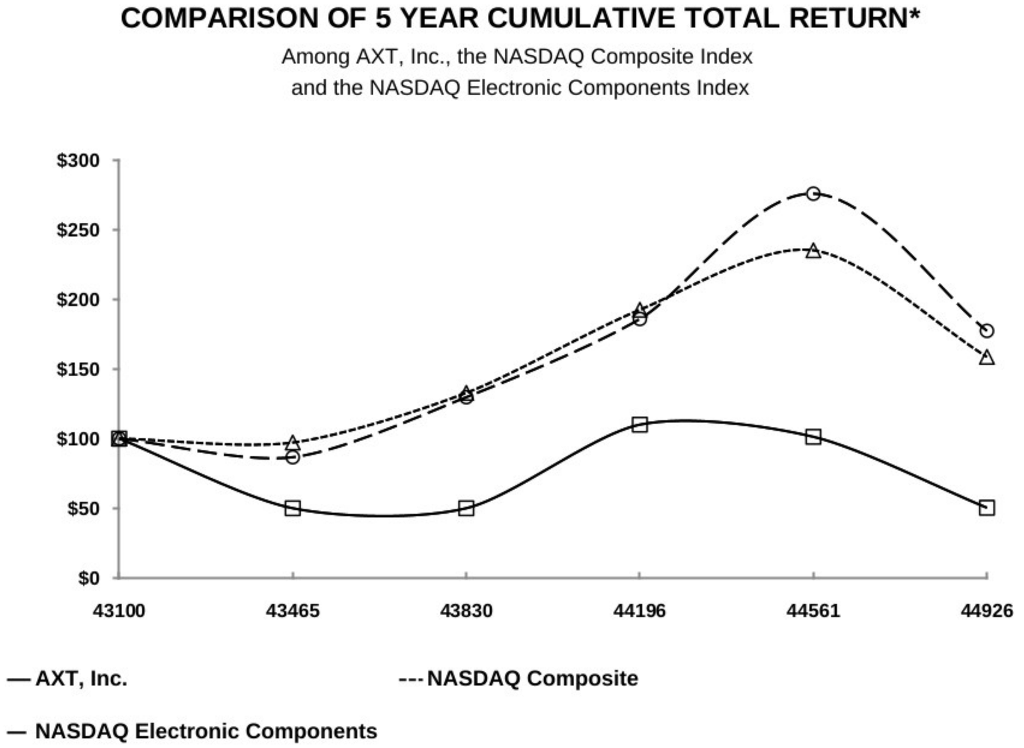
	High	Low
2022		
First Quarter	$ 9.30	$ 6.20
Second Quarter	$ 7.10	$ 4.97
Third Quarter	$ 9.94	$ 5.57
Fourth Quarter	$ 7.12	$ 4.17
2021		
First Quarter	$ 15.84	$ 9.62
Second Quarter	$ 12.56	$ 8.45
Third Quarter	$ 11.00	$ 6.53
Fourth Quarter	$ 9.60	$ 7.03

As of March 6, 2023, there were 162 holders of record of our common stock. Because many shares of AXT's common stock are held by brokers and other institutions on behalf of stockholders, we are unable to estimate the total number of beneficial owners of our common stock.

We have never paid or declared any cash dividends on our common stock and do not anticipate paying cash dividends in the foreseeable future. Dividends accrue on our outstanding Series A preferred stock at the rate of $0.20 per annum per share of Series A preferred stock. The 883,000 shares of Series A preferred stock issued and outstanding as of December 31, 2022 are valued at $3,532,000 and are non-voting and non-convertible preferred stock with a 5.0% cumulative annual dividend rate payable when declared by our board of directors, and a $4.00 per share liquidation preference over common stock that must be paid before any distribution is made to the holders of our common stock. These shares of preferred stock were issued to shareholders of Lyte Optronics, Inc. in connection with the completion of our acquisition of Lyte Optronics, Inc. on May 28, 1999. By the terms of the Series A preferred stock, so long as any shares of Series A preferred stock are outstanding, neither the Company nor any subsidiary of the Company shall redeem, repurchase or otherwise acquire any shares of common stock, unless all accrued dividends on the Series A preferred stock have been paid. During 2013 and 2015, we repurchased shares of our outstanding common stock. As of December 31, 2015, the Series A preferred stock had cumulative dividends of $2.9 million and we include such cumulative dividends in "Accrued liabilities" in our consolidated balance sheets. No shares were repurchased during 2022, 2021 and 2020 under this program. If we are required to pay the cumulative dividends on the Series A preferred stock, our cash and cash equivalents would be reduced. We account for the cumulative year to date dividends on the Series A preferred stock when calculating our earnings per share.

Comparison of Stockholder Return

Set forth below is a line graph comparing the annual percentage change in the cumulative total return to the stockholders of the Company on our common stock with the CRSP Total Return Index for the Nasdaq Stock Market (U.S. Companies) and the Nasdaq Electronic Components Index for the period commencing December 31, 2017 and ending December 31, 2022.



	12/17	12/18	12/19	12/20	12/21	12/22
AXT, Inc.	**100**	50.00	50.00	110.00	101.26	50.34
NASDAQ Composite	**100**	97.16	132.81	192.47	235.15	158.65
NASDAQ Electronic Components	**100**	86.61	129.69	185.86	275.79	177.31

Recent Sales of Unregistered Securities

Not applicable.

Issuer Purchases of Equity Securities

On October 27, 2014, our Board of Directors approved a stock repurchase program pursuant to which we may repurchase up to $5.0 million of our outstanding common stock. These repurchases can be made from time to time in the open market and are funded from our existing cash balances and cash generated from operations. During 2015, we repurchased approximately 908,000 shares at an average price of $2.52 per share for a total purchase price of approximately $2.3 million under the stock repurchase program. No shares were repurchased during 2022 or 2021 under this program. As of December 31, 2022 and 2021, approximately $2.7 million remained available for future repurchases under this program, respectively.

Item 6. ***Reserved***

Item 7. ***Management's Discussion and Analysis of Financial Condition and Results of Operations***

In addition to historical information, the following discussion contains forward-looking statements that are subject to risks and uncertainties. Actual results may differ substantially from those referred to herein due to a number of factors, including but not limited to risks described in the section entitled Item 1A. "Risk Factors" and elsewhere in this Annual Report on Form 10-K. This discussion should be read in conjunction with our consolidated financial statements and related notes included elsewhere in this Form 10-K.

Critical Accounting Policies and Estimates

We prepare our consolidated financial statements in accordance with accounting principles generally accepted in the United States of America ("U.S. GAAP"). Accordingly, we make estimates, assumptions and judgments that affect the amounts reported on our consolidated financial statements. These estimates, assumptions and judgments about future events and their effects on our results cannot be determined with certainty, and are made based upon our historical experience and on other assumptions that are believed to be reasonable under the circumstances. These estimates may change as new events occur or additional information is obtained, and we may periodically be faced with uncertainties, the outcomes of which are not within our control and may not be known for a prolonged period of time.

We have identified the policies below as critical to our business operations and understanding of our financial condition and results of operations. Critical accounting policies are material to the presentation of our consolidated financial statements and require us to make difficult, subjective or complex judgments that could have a material effect on our financial condition and results of operations. They may require us to make assumptions about matters that are highly uncertain at the time of the estimate. Different estimates that we could have used, or changes in the estimate that are reasonably likely to occur, may have a material impact on our financial condition or results of operations. We also refer you to Note 1 to our consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

Revenue Recognition and Sales Returns

We manufacture and sell high-performance compound semiconductor substrates including indium phosphide, gallium arsenide and germanium wafers, and our consolidated subsidiaries sell certain raw materials, including high purity gallium (6N and 7N Ga), pyrolytic boron nitride (pBN) crucibles and boron oxide (B2O3). After we ship our products, there are no remaining obligations or customer acceptance requirements that would preclude revenue recognition. Our products are typically sold pursuant to purchase orders placed by our customers, and our terms and conditions of sale do not require customer acceptance. We account for a contract with a customer when there is a legally enforceable contract, which could be the customer's purchase order, the rights of the parties are identified, the contract has commercial terms, and collectibility of the contract consideration is probable. The majority of our contracts have a single performance obligation to transfer products and are short term in nature, usually less than six months. Our revenue is measured based on the consideration specified in the contract with each customer in exchange for transferring products that are generally based upon a negotiated, formula, list or fixed price. Revenue is recognized when control of the promised goods is transferred to our customer, which is either upon shipment from our dock, receipt at the customer's dock, or removal from consignment inventory at the customer's location, in an amount that reflects the consideration we expect to be entitled to receive in exchange for those goods.

We have elected to account for shipping and handling as activities to fulfill the promise to transfer the goods. As such, shipping and handling fees billed to customers in a sales transaction are recorded in revenue. Shipping and handling costs incurred are recorded in cost of revenue. Sales taxes and value added taxes in foreign jurisdictions that are collected from customers and remitted to governmental authorities are accounted for on a net basis and, therefore, are excluded from revenue.

We do not provide training, installation or commissioning services. We accrue for future returns based on historical data, prior experience, current economic trends and changes in customer demand at the time revenue is recognized. We do not recognize any asset associated with the incremental cost of obtaining revenue generating customer contracts. As such, sales commissions and other related expenses are expensed as incurred, given that the expected period of benefit is less than one year.

Accounts Receivable and Allowance for Doubtful Accounts

Accounts receivable are recorded at the invoiced amount and are not interest bearing. We review at least quarterly, or when there are changes in credit risks, the likelihood of collection on our accounts receivable balances and provide an allowance for doubtful accounts receivable for any expected credit losses primarily based upon the age of these accounts. We evaluate receivables from U.S. customers with an emphasis on balances in excess of 90 days and for receivables from customers located outside the U.S. with an emphasis on balances in excess of 120 days and establish a reserve allowance on the receivable balances if needed. The reason for the difference in the evaluation of receivables between foreign and U.S. customers is that U.S. customers have historically made payments in a shorter period of time than foreign customers. Foreign business practices generally require us to allow customer payment terms that are longer than those accepted in the United States. We assess the probability of collection based on a number of factors, including the length of time a receivable balance has been outstanding, our past history with the customer and their credit-worthiness.

We exercise judgment when determining the adequacy of our reserves as we evaluate historical bad debt trends, general economic conditions in the United States and internationally, and changes in customer financial conditions. Uncollectible receivables are recorded as bad debt expense when a credit loss is expected through the establishment of an allowance, which would then be written off when all efforts to collect have been exhausted and recoveries are recognized when they are received. As of December 31, 2022 and 2021, our accounts receivable, net balance was $29.3 million and $34.8 million, respectively, which was net of an allowance for doubtful accounts of $307,000 and $130,000 as of December 31, 2022 and 2021, respectively. During 2022, we increased the allowance for doubtful accounts by $177,000 due to the poor financial condition of a customer. During 2021, we decreased the allowance for doubtful accounts by $87,000 due to the write-off of accounts receivable for a customer. If actual uncollectible accounts differ substantially from our estimates, revisions to the estimated allowance for doubtful accounts would be required, which could have a material impact on our financial results for the future periods.

Warranty Reserve

We maintain a warranty reserve based upon our claims experience during the prior twelve months and any pending claims and returns of which we are aware. Warranty costs are accrued at the time revenue is recognized. As of December 31, 2022 and 2021, accrued product warranties totaled $669,000 and $743,000, respectively. The decrease in accrued product warranties is primarily attributable to decreased claims for quality issues experienced by customers. If actual warranty costs or pending new claims differ substantially from our estimates, revisions to the estimated warranty liability would be required, which could have a material impact on our financial condition and results of operations for future periods.

Inventory Valuation

Inventories are stated at the lower of cost (approximated by standard cost) or net realizable value. Cost is determined using the weighted average cost method. Our inventory consists of raw materials as well as finished goods and work-in-process that include material, labor and manufacturing overhead costs. We routinely evaluate the levels of our inventory in light of current market conditions in order to identify excess and obsolete inventory, and we provide a reserve for certain inventories based upon the age and quality of the product and the projections for sale of the completed products. As of December 31, 2022 and 2021, we had an inventory reserve of $24.7 million and $19.6 million, respectively, for excess and obsolete inventory and $47,000 and $66,000, respectively, for lower of cost or net realizable value reserves. If actual demand for our products were to be substantially lower than estimated, additional inventory adjustments for excess or obsolete inventory might be required, which could have a material impact on our business, financial condition and results of operations.

Impairment of Investments

We classify marketable investments in debt securities as available-for-sale debt securities in accordance with Accounting Standards Codification ("ASC") Topic 320, *Investments—Debt Securities*. All available-for-sale debt securities with a quoted market value below cost (or adjusted cost) are reviewed in order to determine whether the decline is other-than-temporary. Factors considered in determining whether a loss is temporary include the magnitude of the decline in market value, the length of time the market value has been below cost (or adjusted cost), credit quality, and our ability and intent to hold the debt securities for a period of time sufficient to allow for any anticipated recovery in market value. We also review our debt investment portfolio at least quarterly, or when there are changes in credit risks or other potential valuation concerns to identify and evaluate whether an allowance for expected credit losses or impairment would be necessary.

We also invest in equity instruments of privately-held raw material companies in China for business and strategic purposes. Investments in our unconsolidated joint venture raw material companies are classified as other assets and accounted for under either the equity or cost method, depending on whether we have the ability to exercise significant influence over their operations or financial decisions. We monitor our investments for impairment and record reductions in carrying value when events or changes in circumstances indicate that the carrying value may not be recoverable. Determination of impairment is highly subjective and is based on a number of factors, including an assessment of the strength of the subsidiary's management, the length of time and extent to which the fair value has been less than our cost basis, the financial condition and near-term prospects of the subsidiary, fundamental changes to the business prospects of the subsidiary, share prices of subsequent offerings, and our intent and ability to hold the investment for a period of time sufficient to allow for any anticipated recovery in our carrying value.

For the years ended December 31, 2022, 2021 and 2020, we had no impairment charges.

Fair Value of Investments

ASC Topic 820, *Fair Value Measurement* establishes three levels of inputs that may be used to measure fair value.

Level 1 instruments represent quoted prices in active markets. Therefore, determining fair value for Level 1 instruments does not require significant management judgment, and the estimation is not difficult.

Level 2 instruments include observable inputs other than Level 1 prices, such as quoted prices for similar instruments in markets with insufficient volume or infrequent transactions (less active markets), issuer bank statements, credit ratings, non-binding market consensus prices that can be corroborated with observable market data, model-derived valuations in which all significant inputs are observable or can be derived principally from or corroborated with observable market data for substantially the full term of the assets or liabilities, or quoted prices for similar assets or liabilities. These Level 2 instruments require more management judgment and subjectivity compared to Level 1 instruments, including:

- Determining which instruments are most comparable to the instrument being priced requires management to identify a sample of similar securities based on the coupon rates, maturity, issuer, credit rating, and instrument type, and subjectively select an individual security or multiple securities that are deemed most similar to the security being priced.

- Determining which model-derived valuations to use in determining fair value requires management judgment. When observable market prices for similar securities or similar securities are not available, we price our marketable debt instruments using non-binding market consensus prices that are corroborated with observable market data or pricing models, such as discounted cash flow models, with all significant inputs derived from or corroborated with observable market data.

Level 3 instruments include unobservable inputs to the valuation methodology that are significant to the measurement of fair value of assets or liabilities. The determination of fair value for Level 3 instruments requires the most management judgment and subjectivity.

We place short-term foreign currency hedges that are intended to offset the potential cash exposure related to fluctuations in the exchange rate between the United States dollar and Japanese yen. We measure the fair value of these foreign currency hedges at each month end and quarter end using current exchange rates and in accordance with generally accepted accounting principles. At quarter end any foreign currency hedges not settled are netted in “Accrued liabilities” on the consolidated balance sheet and classified as Level 3 assets and liabilities. As of December 31, 2022 and 2021, the net change in fair value from the placement of the hedge to settlement at each month end during the quarter had a de minimis impact to the consolidated results.

Impairment of Long-Lived Assets

We evaluate the recoverability of property, equipment and intangible assets in accordance with ASC Topic 360, *Property, Plant and Equipment*. When events and circumstances indicate that long-lived assets may be impaired, we compare the carrying value of the long-lived assets to the projection of future undiscounted cash flows attributable to such assets. In the event that the carrying value exceeds the future undiscounted cash flows, we record an impairment charge against income equal to the excess of the carrying value over the asset’s fair value. Fair values are determined based on quoted market values, discounted cash flows or internal and external appraisals, as applicable. Assets held for sale are carried at the lower of carrying value or estimated net realizable value. We had no “Assets held for sale” or any impairment of long-lived assets on the consolidated balance sheets as of December 31, 2022 and 2021.

Stock-Based Compensation

We account for stock-based compensation in accordance with ASC Topic 718, *Stock-based Compensation*. Share-based awards granted include stock options and restricted stock awards. We utilize the Black-Scholes option pricing model to estimate the grant date fair value of stock options, which requires the input of highly subjective assumptions, including estimating stock price volatility and expected term. Historical volatility of our stock price was used while the expected term for our options was estimated based on historical option exercise behavior and post-vesting forfeitures of options, and the contractual term, the vesting period and the expected term of the outstanding options. Further, we apply an expected forfeiture rate in determining the amount of share-based compensation. We use historical forfeitures to estimate the rate of future forfeitures. Changes in these inputs and assumptions can materially affect the measure of estimated fair value of our stock compensation. The cost of restricted stock awards is determined using the fair value of our common stock on the date of grant.

We recognize the compensation costs net of an estimated forfeiture rate over the requisite service period of the options award, which is generally the vesting term of four years. Compensation expense for restricted stock awards is recognized over the vesting period, which is generally one, three or four years. Stock-based compensation expense is recorded in cost of revenue, research and development, and selling, general and administrative expenses. (see Note 1—Summary of Significant Accounting Policies—Stock-Based Compensation).

Income Taxes

We account for income taxes in accordance with ASC topic 740, *Income Taxes* (“ASC 740”), which requires that deferred tax assets and liabilities be recognized using enacted tax rates for the effect of temporary differences between the book and tax bases of recorded assets and liabilities. ASC 740 also requires that deferred tax assets be reduced by a valuation allowance if it is more likely than not that a portion of the deferred tax asset will not be realized. Our deferred tax assets have been reduced to zero by valuation allowance.

We provide for income taxes based upon the geographic composition of worldwide earnings and tax regulations governing each region, particularly China. The calculation of tax liabilities involves significant judgment in estimating the impact of uncertainties in the application of complex tax laws, particularly in foreign countries such as China.

See Note 12—"Income Taxes" in the consolidated financial statements for additional information.

Results of Operations

Overview

We were founded in 1986 to commercialize and enhance our proprietary VGF technology for producing high-performance compound semiconductor substrates or wafers. We have one operating segment and two product lines: specialty material substrates and raw materials used to make such substrates or other related products. We recorded our first substrate sales in 1990 and our substrate products currently include indium phosphide (InP), gallium arsenide (GaAs) and germanium (Ge) substrates used to produce semiconductor devices for use in applications such as fiber optic and wireless telecommunications, light emitting diodes (LEDs), lasers and for solar cells for space and terrestrial photovoltaic applications. Our two raw material companies sell, among other items, purified gallium and pBN crucibles.

Operating Results

We manufacture all of our products in the People's Republic of China (PRC or China), which generally has favorable costs for facilities and labor compared with comparable facilities in the United States, Europe or Japan. Our supply chain includes partial ownership of raw material companies in China (joint ventures). We believe this supply chain arrangement provides us with pricing advantages, reliable supply and enhanced sourcing lead-times for key raw materials which are central to our final manufactured products.

Our annual revenue increased in 2022 from $137.4 million to $141.1 million in 2022 an increase of 2.7%. Our annual revenue increased in 2021 from $95.4 million in 2020 to $137.4 million in 2021 an increase of 44.1%. Our annual revenue increased in 2020 from $83.3 million in 2019 to $95.4 million in 2020 an increase of 14.5%. In 2022, our gross margin increased from 34.5% of total revenue in 2021 to 36.9% of total revenue in 2022. In 2021, our gross margin increased from 31.7% of total revenue in 2020 to 34.5% of total revenue in 2021. In 2020, our gross margin increased from 29.8% of total revenue in 2019 to 31.7% of total revenue in 2020.

Revenue

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
Product Type:							
Substrates	$ 111,094	$ 103,026	$ 75,587	$ 8,068	7.8 %	$ 27,439	36.3 %
Raw materials and other	30,024	34,367	19,774	(4,343)	(12.6)%	14,593	73.8 %
Total revenue	$ 141,118	$ 137,393	$ 95,361	$ 3,725	2.7 %	$ 42,032	44.1 %

Revenue increased $3.7 million, or 2.7%, in 2022 from $137.4 million in 2021. The $8.1 million increase in wafer substrate sales was led by strong demand for InP wafer substrates for 5G applications, data center upgrades (silicon photonics) and consumer related applications, partially offset by lower demand for our GaAs wafer substrates as the result of decreased demand for LED products, industrial lasers and other applications requiring low defect densities in the wafer substrate and Ge wafer substrates decreased primarily as a result of lower demand from our customers in China. The $4.3 million raw materials revenue decrease as compared to the same period in 2021 was primarily the result of decreased revenue from sales of purified gallium and unfavorable pricing, partially offset by increased demand for pBN crucibles and pBN-based OLED manufacturing tools sold by BoYu, one of our consolidated raw material companies.

Revenue increased $42.0 million, or 44.1%, in 2021 from $95.4 million in 2020. The $27.4 million increase in wafer substrate sales was led by strong demand for InP wafer substrates for 5G applications and data center upgrades (silicon photonics). GaAs revenue also grew as the result of increased demand for LED products, industrial lasers and other applications requiring low defect densities in the wafer substrate. Revenue from Ge wafer substrates increased modestly, primarily as a result of higher demand from our customers in China. The $14.6 million raw materials revenue increase as compared to the same period in 2020 was primarily the result of increased revenue from sales of purified gallium and favorable pricing. In addition, increased demand for pBN crucibles and pBN-based OLED manufacturing tools resulted in increased revenue for BoYu, one of our consolidated raw material companies.

Revenue by Geographic Region

	Year Ended Dec. 31,			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
China	$ 55,414	$ 67,394	$ 35,150	$ (11,980)	(17.8)%	$ 32,244	91.7 %
% of total revenue	39 %	49 %	37 %				
Taiwan	28,780	16,841	16,485	11,939	70.9 %	356	2.2 %
% of total revenue	21 %	12 %	17 %				
Japan	11,724	10,112	7,624	1,612	15.9 %	2,488	32.6 %
% of total revenue	8 %	7 %	8 %				
Asia Pacific (excluding China, Taiwan and Japan)	4,188	7,540	5,458	(3,352)	(44.5)%	2,082	38.1 %
% of total revenue	3 %	6 %	6 %				
Europe (primarily Germany)	20,592	23,069	19,673	(2,477)	(10.7)%	3,396	17.3 %
% of total revenue	15 %	17 %	21 %				
North America (primarily the United States)	20,420	12,437	10,971	7,983	64.2 %	1,466	13.4 %
% of total revenue	14 %	9 %	11 %				
Total revenue	$ 141,118	$ 137,393	$ 95,361	$ 3,725	2.7 %	$ 42,032	44.1 %

Sales to customers located outside of North America represented approximately 86% of our revenue in 2022 and approximately 90% of our revenue during 2021 and 2020, respectively.

Revenue from customers in China decreased in 2022 by 17.8%, primarily due to lower demand for refined gallium and pBN crucibles sold by our consolidated subsidiaries. In addition, revenue from InP and Ge wafer substrates decreased, partially offset by increased demand for GaAs wafer substrates. Revenue from customers in Taiwan increased in 2022 by 70.9%, primarily due to an increase in demand for InP wafer substrates, partially offset by a decline in wireless applications using GaAs wafer substrates. Revenue from customers in Japan increased in 2022 by 15.9% as a result of increased demand for refined gallium and pBN crucibles sold by our consolidated subsidiaries, partially offset by lower demand for GaAs wafer substrates used in wireless applications. Revenue from customers in Asia Pacific decreased by 44.5% as a result of decreased demand for GaAs used in wireless applications, InP wafer substrates and pBN crucibles sold by one of our consolidated subsidiaries. Revenue from customers in Europe decreased in 2022 by 10.7%, primarily due to lower demand for GaAs used in LED applications, Ge wafer substrates and pBN crucibles sold by one of our consolidated subsidiaries, partially offset by increased demand for InP wafer substrates. Revenue from customers in North America increased by 64.2% primarily due to increased demand for our InP wafer substrates and pBN crucibles sold by one of our consolidated subsidiaries, partially offset by lower demand for our GaAs and Ge wafer substrates.

Revenue from customers in China increased in 2021 by 91.7%, primarily due to higher demand for refined gallium and pBN crucibles sold by our consolidated subsidiaries. In addition, revenue from InP, GaAs and Ge wafer substrates increased. Revenue from customers in Taiwan increased in 2021 by 2.2%, primarily due to an increase in demand for wireless applications using GaAs wafer substrates, partially offset by a decline in InP revenue in Taiwan that was transferred to North America. Revenue from customers in Japan increased in 2021 by 32.6% as a result of increased demand for InP wafer substrates, partially offset by lower demand for pBN crucibles sold by one of our consolidated subsidiaries and GaAs used in wireless applications. Revenue from customers in Asia Pacific increased by 38.1% as a result of increased demand for GaAs used in wireless applications and InP wafer substrates, partially offset by lower demand for pBN crucibles sold by one of our consolidated subsidiaries. Revenue from customers in Europe increased in 2021 by 17.3%, primarily due to increased demand for GaAs used in LED applications, InP wafer substrates and pBN crucibles sold by one of our consolidated subsidiaries, partially offset by lower demand for Ge wafer substrates. Revenue from customers in North America increased by 13.4% primarily due to increased demand for our InP and Ge wafer substrates, and pBN crucibles sold by one of our consolidated subsidiaries.

Gross Margin

	Year Ended Dec. 31,			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Gross profit	$ 52,121	$ 47,414	$ 30,275	$ 4,707	9.9 %	$ 17,139	56.6 %
Gross Profit %	*36.9 %*	*34.5 %*	*31.7 %*				

Gross profit increased $4.7 million in 2022 as compared to 2021. Gross margin in 2022 was 36.9% as compared to 34.5% in 2021. The increase in gross profit is attributed to higher revenue resulting in fixed costs being spread over more units and a favorable change in product mix.

Gross profit increased $17.1 million in 2021 as compared to 2020. Gross margin in 2021 was 34.5% as compared to 31.7% in 2020. The increase in gross profit is attributed to higher revenue resulting in fixed costs being spread over more units and a favorable change in product mix.

Selling, General and Administrative Expenses

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Selling, general and administrative expenses	$ 25,654	$ 24,189	$ 19,200	$ 1,465	6.1 %	$ 4,989	26.0 %
% of total revenue	*18.2 %*	*17.6 %*	*20.1 %*				

Selling, general and administrative expenses increased $1.5 million, or 6.1%, to $25.7 million for 2022 compared to $24.2 million for 2021. The higher selling, general and administrative expenses were primarily from higher personnel-related expenses, professional services, stock compensation expenses, and bad debt expense, partially offset by lower license and fees and outside commissions.

Selling, general and administrative expenses increased $5.0 million, or 26.0%, to $24.2 million for 2021 compared to $19.2 million for 2020. The higher selling, general and administrative expenses were primarily from higher personnel-related expenses, stock compensation expenses, license and fees, and an increase in outside commission expenses due to higher volume of sales in 2021, partially offset by lower bad debt expense.

Research and Development Expenses

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Research and development	$ 13,913	$ 10,328	$ 7,135	$ 3,585	34.7 %	$ 3,193	44.8 %
% of total revenue	*9.9 %*	*7.5 %*	*7.5 %*				

Research and development expenses increased $3.6 million, or 34.7%, to $13.9 million in 2022 from $10.3 million in 2021. The increase in research and development expenses in 2022 was primarily due to higher development expenses for 8-inch GaAs and 6-inch InP wafer substrates and the development of new features for certain of our GaAs and InP wafer substrates, new product testing and personnel-related expenses.

Research and development expenses increased $3.2 million, or 44.8%, to $10.3 million in 2021 from $7.1 million in 2020. The increase in research and development expenses in 2021 was primarily due to higher development expenses for 8-inch GaAs and 6-inch InP wafer substrates and the development of new features for certain of our GaAs and InP wafer substrates, new product testing and personnel-related expenses.

Interest Expense, Net

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Interest expense, net	$ 1,071	$ 213	$ 179	$ 858	402.8 %	$ 34	19.0 %
% of total revenue	*0.8 %*	*0.2 %*	*0.2 %*				

Interest expense, net increased in 2022 as compared to the same period in 2021, primarily due to lower investment balances in 2022 and increased borrowings in 2022. Interest expense, net increased in 2021 as compared to the same period in 2020, primarily due to lower investment balances in 2021 and increased borrowings in 2021.

Equity in Income of Unconsolidated Joint Venture Companies

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Equity in income of unconsolidated joint ventures	$ 5,957	$ 4,409	$ 111	$ 1,548	35.1 %	$ 4,298	3,872.1 %
% of total revenue	*4.2 %*	*3.2 %*	*0.1 %*				

Equity in income of unconsolidated joint ventures is the aggregate net income (loss) from our minority-owned supply chain joint venture companies that are not consolidated. Equity in income of unconsolidated joint ventures increased $1.5 million to an income of $6.0 million in 2022 from an income of $4.4 million in 2021 as our unconsolidated joint ventures reported better performance in 2022 as compared to 2021.

Equity in income of unconsolidated joint ventures is the aggregate net income (loss) from our minority-owned supply chain joint venture companies that are not consolidated. Equity in income of unconsolidated joint ventures increased $4.3 million to an income of $4.4 million in 2021 from an income of $0.1 million in 2020 as our unconsolidated joint ventures reported better performance in 2021 as compared to 2020.

Other Income, Net

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Other income, net	$ 3,487	$ 509	$ 3,200	$ 2,978	585.1 %	$ (2,691)	(84.1)%
% of total revenue	*2.5 %*	*0.4 %*	*3.4 %*				

Other income, net increased $3.0 million to an income of $3.5 million for 2022 as compared to an income of $0.5 million in 2021, primarily due to foreign exchange gains of $1.6 million in 2022 compared to foreign exchange losses of $434,000 in 2021 and compensation received from the China government by one of our consolidated subsidiaries for relocating their facilities to Kazuo in 2022 as compared to 2021.

Other income, net decreased $2.7 million to an income of $0.5 million for 2021 as compared to an income of $3.2 million in 2020, primarily due to lower compensation received from the China government by three of our consolidated subsidiaries for relocating their facilities to Kazuo in 2021 as compared to 2020.

Provision for Income Taxes

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Provision for income taxes	$ 2,185	$ 1,093	$ 2,031	$ 1,092	99.9 %	$ (938)	(46.2)%
% of total revenue	*1.5 %*	*0.8 %*	*2.1 %*				

Provision for income taxes for 2022 and 2021 were $2.2 million and $1.1 million, respectively, which were mostly related to our consolidated wafer substrate subsidiaries in China and our two partially owned consolidated raw material companies. No income taxes or benefits have been provided for AXT as the income in the U.S. had been fully offset by utilization of federal and state net operating loss carryforwards. Additionally, there is uncertainty of generating future profit in the U.S., which has resulted in our deferred tax assets being fully reserved. We have accrued approximately $855,000 in federal income tax for AXT-Tongmei for the year ended December 31, 2022, which has no net operating loss carryover. Our estimated tax rate can vary greatly from year to year because of the change or benefit in the mix of taxable income between our U.S. and China-based operations.

Due to our uncertainty regarding our future profitability, we recorded a valuation allowance against our net deferred tax assets of $11.9 million and $15.4 million for the years 2022 and 2021, respectively.

Net Income Attributable to Noncontrolling Interests and Redeemable Noncontrolling Interests

	Years Ended Dec. 31			2021 to 2022		2020 to 2021	
	2022	2021	2020	Increase (Decrease)	% Change	Increase (Decrease)	% Change
	($ in thousands)						
Net income attributable to noncontrolling interests and redeemable noncontrolling interests	$ 2,931	$ 1,934	$ 1,803	$ 997	51.6 %	$ 131	7.3 %
% of total revenue	*2.1 %*	*1.4 %*	*1.9 %*				

The increase in noncontrolling interests and redeemable noncontrolling interests' share of income for 2022 as compared to 2021 was primarily due to the structural changes of the legal entities in China (see Note 1 to our consolidated financial statements) and to a lesser degree, losses generated by our consolidated subsidiary, ChaoYang XinMei High Purity Semiconductor Materials Co., Ltd. (ChaoYang XinMei").

The increase in noncontrolling interests and redeemable noncontrolling interests' share of income for 2021 as compared to 2020 was primarily due to the structural changes of the legal entities in China (see Note 1 to our consolidated financial statements) and to a lesser degree, losses generated by our consolidated subsidiary, ChaoYang XinMei.

Liquidity and Capital Resources

	Year Ended December 31,		
	2022	2021	2020
		($ in thousands)	
Net cash provided by (used in):			
Operating activities	$ (8,765)	$ (3,305)	$ 5,865
Investing activities	(25,223)	(38,810)	(16,422)
Financing activities	38,031	5,725	52,662
Effect of exchange rate changes	542	551	3,605
Net change in cash, restricted cash and cash equivalents	4,585	(35,839)	45,710
Cash and cash equivalents—beginning year	36,763	72,602	26,892
Cash, restricted cash and cash equivalents—end of year	41,348	36,763	72,602
Short and long-term investments—end of year	11,457	14,995	5,966
Total cash, restricted cash, cash equivalents and short-term and long-term investments	$ 52,805	$ 51,758	$ 78,568

We consider cash and cash equivalents, short-term investments and long-term investments as liquid and available for use within two years in our current operations. Short-term investments and long-term investments are comprised of money market accounts, certificates of deposit, corporate bonds and notes, and government securities. As of December 31, 2022, we and our consolidated joint ventures held approximately $26.1 million in cash and investments in foreign bank accounts.

Total cash, restricted cash and cash equivalents, short-term and long-term investments increased by $1.0 million in 2022. As of December 31, 2022, our principal source of liquidity was $52.8 million, which consisted of cash, restricted cash and cash equivalents of $41.3 million and short-term and long-term investments of $11.5 million. In 2022, cash, restricted cash and cash equivalents increased by $4.6 million and short-term and long-term investments decreased by $3.5 million. The increase in cash, restricted cash and cash equivalents of $4.6 million in 2022 was primarily due to net cash provided by financing activities of $38.0 million and the effect of exchange rate changes of $0.5 million, partially offset by net cash used in investing activities of $25.2 million and operating activities of $8.8 million.

Total cash and cash equivalents, short-term and long-term investments decreased by $26.8 million in 2021. As of December 31, 2021, our principal source of liquidity was $51.8 million, which consisted of cash and cash equivalents of $36.8 million and short-term and long-term investments of $15.0 million. In 2021, cash and cash equivalents decreased by $35.8 million and short-term and long-term investments increased by $9.0 million. The decrease in cash and cash equivalents of $35.8 million in 2021 was primarily due to net cash used in investing activities of $38.8 million and operating activities of $3.3 million and partially offset by net cash provided by financing activities of $5.8 million and the effect of exchange rate changes of $0.6 million.

Net cash used in operating activities of $8.8 million for 2022 was primarily comprised of net change in operating assets and liabilities of $35.2 million, gain on equity method investments of $6.0 million offset in part by our net income of $18.7 million, adjustment of non-cash items of depreciation and amortization of $8.1 million, stock-based compensation of $4.0 million, return of equity method investments (dividends) of $1.6 million, and amortization of marketable securities premium of $0.1 million. The $35.2 million net change in operating assets and liabilities primarily resulted from a $31.4 million increase in inventories, a $5.5 million decrease in accounts payable, a $3.5 million increase in prepaid expenses and other current assets, a $2.1 million decrease in accrued liabilities, and a $0.5 million increase in other assets offset in part by a $4.5 million decrease in accounts receivable and a $3.3 million increase in other long-term liabilities, including royalties.

Net cash used in operating activities of $3.3 million for 2021 was primarily comprised of net change in operating assets and liabilities of $30.3 million and gain on equity method investments of $4.4 million, offset in part by our net income of $16.5 million, adjustment of non-cash items of depreciation and amortization of $7.1 million, stock-based compensation of $4.5 million, deferred tax assets of $2.3 million, return of equity method investments (dividends) of $0.8 million and amortization of marketable securities premium of $0.1 million. The $30.3 million net change in operating assets and liabilities primarily resulted from a $12.4 million increase in inventories, a $9.7 million increase in accounts receivable, a $6.3 million increase in other assets, a $3.4 million decrease in accrued liabilities, a $1.2 million decrease in other long-term liabilities, including royalties, and a $0.8 million increase in prepaid expenses and other current assets, offset in part by a $3.6 million increase in accounts payable.

Net cash provided by operating activities of $5.9 million for 2020 was primarily comprised of our net income of $5.0 million, an adjustment of non-cash items of depreciation and amortization of $4.3 million, stock-based compensation of $2.6 million, provision for doubtful accounts of $0.2 million, loss on disposal of equipment of $0.1 million, offset in part by our net change in operating assets and liabilities of $6.3 million and gain on equity method investments of $0.1 million. The $6.3 million net change in operating assets and liabilities primarily resulted from a $6.7 million increase in prepaid expenses and other current assets, a $5.3 million increase in accounts receivable a $0.9 million increase in inventories and a $0.1 million increase in other assets offset in part by a $2.3 million decrease in accounts payable, a $1.9 million decrease in other long-term liabilities, including royalties and a $2.6 million decrease in accrued liabilities.

Net cash used in investing activities of $25.2 million for 2022 was primarily due to property, plant and equipment of $28.5 million in preparation for our new manufacturing sites, additional equipment for our Beijing site and equipment and facility costs incurred by our consolidated subsidiaries and the purchases of marketable investment securities of $2.2 million, which were partially offset by proceeds from maturities and sales of available-for-sale debt securities of $5.4 million.

Net cash used in investing activities of $38.8 million for 2021 was primarily due to property, plant and equipment of $29.6 million in preparation for our new manufacturing sites, additional equipment for our Beijing site and equipment and facility costs incurred by our consolidated subsidiaries and the purchases of marketable investment securities of $9.6 million, which were partially offset by proceeds from maturities and sales of available-for-sale debt securities of $0.5 million.

Net cash used in investing activities of $16.4 million for 2020 was primarily due to property, plant and equipment of $19.9 million in preparation for our new manufacturing sites, additional equipment for our Beijing site and equipment and facility costs incurred by our consolidated subsidiaries and the purchases of marketable investment securities of $6.0 million, which were partially offset by proceeds from maturities and sales of available-for-sale debt securities of $9.4 million.

Net cash provided by financing activities was $38.0 million for 2022 which mainly consisted of the proceeds of $53.1 million from short-term loans in China, $2.2 million from the capital increase in subsidiary shares from noncontrolling interest, and $0.5 million from the exercise of common stock options, which were partially offset by payments on short-term loans of $17.8 million.

Net cash provided by financing activities was $5.7 million for 2021 which mainly consisted of the proceeds of $20.5 million from short-term loans in China, $1.8 million from short-term loan from noncontrolling interest, $1.7 million from the exercise of common stock options, $1.3 million from the formation of new subsidiary with noncontrolling interests and $0.5 million from sale of Tongmei shares to noncontrolling interests, which were partially offset by payments on short-term loans of $19.1 million and $1.1 million of issuance costs in connection with issuance of Tongmei common stock to redeemable noncontrolling interests.

Net cash provided by financing activities was $52.7 million for 2020 which mainly consisted of the proceeds of $47.6 million from issuance of common stock to noncontrolling interests net of issuance cost, $10.4 million from short-term loan in China, $2.5 million from the exercise of common stock options, $0.4 million from sale of Tongmei shares to noncontrolling interests partially offset by payments on short-term loans of $6.0 million and dividends paid by joint ventures to their minority shareholders of $2.2 million.

On October 27, 2014, our Board of Directors approved a stock repurchase program pursuant to which we may repurchase up to $5.0 million of our outstanding common stock. These repurchases can be made from time to time in the open market and are funded from our existing cash balances and cash generated from operations. During 2015, we repurchased approximately 908,000 shares at an average price of $2.52 per share for a total purchase price of approximately $2.3 million under the stock repurchase program. No shares were repurchased during 2022, 2021 and 2020 under this program. As of December 31, 2022, approximately $2.7 million remained available for future repurchases under this program. Currently, we do not plan to repurchase additional shares.

Dividends accrue on our outstanding Series A preferred stock, and are payable as and when declared by our board of directors. We have never paid or declared any dividends on the Series A preferred stock. By the terms of the Series A preferred stock, so long as any shares of Series A preferred stock are outstanding, neither the Company nor any subsidiary of the Company shall redeem, repurchase or otherwise acquire any shares of common stock, unless all accrued dividends on the Series A preferred stock have been paid. During 2013 and 2015, we repurchased shares of our outstanding common stock. As of December 31, 2015, the Series A preferred stock had cumulative dividends of $2.9 million and we included this amount in “Accrued liabilities” in our consolidated balance sheets. At the time we pay this accrued liability, our cash and cash equivalents would be reduced. We account for the cumulative year to date dividends on the Series A preferred stock when calculating our earnings per share. See Item 5, Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities in Part II.

Occasionally, one of our PRC subsidiaries or PRC raw material joint ventures declares and pays a dividend. These dividends generally occur when the PRC joint venture declares a dividend for all of its shareholders. Dividends paid to the Company are subject to a 10% PRC withholding tax. The Company is required to obtain approval from SAFE to transfer funds in or out of the PRC. SAFE requires a valid agreement to approve the transfers, which are processed through a bank. Other than PRC foreign exchange restrictions, the Company is not subject to any PRC restrictions and limitations on its ability to distribute earnings from its businesses, including its PRC subsidiaries and PRC joint ventures, to the Company and its investors as well as the ability to settle amounts owed by the Company to its PRC subsidiaries and PRC joint ventures. If SAFE approval is denied the dividend payable to the Company would be owed but would not be paid.

For the years ended December 31, 2022, 2021 and 2020, the aggregate dividends paid to us, directly or to an intermediate entity within our corporate structure, by our PRC subsidiaries and PRC raw material joint ventures were approximately $2.9 million, $774,000 and $0, respectively. In June 2022, July 2022 and August 2022, we received a dividend of $1.3 million from BoYu, $1.5 million from one of our equity investments, Xiaoyi XingAn and $0.1 million from JiYa Semiconductor Material Co. Ltd., respectively. In June 2021, we received a dividend of $774,000, from one of our equity investments, Xiaoyi XingAn. For the years ended December 31, 2022 and 2021, the aggregate dividends paid to minority shareholders by our PRC subsidiaries and PRC raw material joint ventures were approximately $0 and $0, respectively. All of these distributions were paid to the PRC companies and the minority shareholders.

We have no current intentions to distribute to our investors earnings under our corporate structure. We settle amounts owed under our transfer pricing arrangements in the ordinary course of business.

The cash generated from one PRC subsidiary is not used to fund another PRC subsidiary’s operations. None of our PRC subsidiaries has ever faced difficulties or limitations on its ability to transfer cash between our subsidiaries. AXT has cash management policies that dictate the amount of such funding.

As one of the first steps in the process of listing Tongmei on the STAR Market and going public, we sold approximately 7.28% of Tongmei to private equity investors for approximately $49 million in the aggregate. Pursuant to the Capital Investment Agreements with the Investors, each Investor has the right to require AXT to redeem any or all

Tongmei shares held by such Investor at the original purchase price paid by such Investor, without interest, in the event the IPO fails to pass the audit of the Shanghai Stock Exchange, is not approved by the CSRC or Tongmei cancels the IPO application. The aggregate redemption amount is approximately $49 million.

Tongmei submitted its IPO application to the Shanghai Stock Exchange, and it was formally accepted for review on January 10, 2022. The Shanghai Stock Exchange approved the IPO application on July 12, 2022. On August 1, 2022, the CSRC accepted for review Tongmei's IPO application. The STAR Market IPO remains subject to review and approval by the CSRC and other authorities. The process of going public on the STAR Market includes several periods of review and, therefore, is a lengthy process. Subject to review and approval by the CSRC and other authorities, Tongmei hopes to accomplish this goal in the coming months. The listing of Tongmei on the STAR Market will not change the status of AXT as a U.S. public company.

We believe that we have adequate cash and investments to meet our operating needs and capital expenditures over the next twelve months. If our sales decrease, however, our ability to generate cash from operations will be adversely affected which could adversely affect our future liquidity, require us to use cash at a more rapid rate than expected, and require us to seek additional capital.

On July 27, 2021, we filed with the SEC a registration statement on Form S-3, pursuant to which we may offer up to $60 million of common stock, preferred stock, debt securities, depositary shares, warrants, subscription rights, purchase contracts and/or units in one or more offerings and in any combination. A prospectus supplement, which we will provide each time we offer securities, will describe the specific amounts, prices and terms of the securities we determine to offer. We currently expect to use the net proceeds from the sale of securities under the shelf registration statement for working capital, capital expenditures and other general corporate purposes. We may also use a portion of the net proceeds to acquire, license or invest in complementary products, technologies or businesses. On May 17, 2022, the SEC declared the registration statement effective.

Cash from operations could be affected by various risks and uncertainties, including, but not limited to those set forth below under Item 1A. "Risk Factors" above.

Bank Loans and Line of Credit

Our bank loans and credit facilities typically have a term of 12 months or less and are included in "Bank loan" in our consolidated balance sheets. The following table represents bank loans as of December 31, 2022 and 2021 (in thousands, except interest rate data):

Subsidiary	Bank	Loan Detail	Interest Rate	Start Date	Due Date	December 31, 2021	December 31, 2022
Tongmei	Bank of China (1)	$ 1,405	3.9 %	September-21	March-22	$ 1,573	$ -
		1,050	3.9 %	September-21	March-22	1,220	-
		3,935	4.6 %	January-22	January-23	-	4,059
		2,108	2.7 %	September-22	March-23	-	2,175
		1,405	4.2 %	April-22	April-23	-	1,450
	Bank of Communications (2)	2,811	4.0 %	September-21	September-22	3,144	-
		1,405	4.0 %	November-21	November-22	1,573	-
		1,405	3.3 %	January-22	January-23	-	1,450
		1,405	3.3 %	January-22	January-23	-	1,450
	Bank of Communications (5)	1,450	3.3 %	December-22	December-23	-	1,450
	China Merchants Bank (3)	1,405	3.6 %	December-21	December-22	1,573	-
	China Merchants Bank (5)	1,405	4.2 %	December-21	December-22	1,573	-
	Bank of Beijing (4)	3,192	4.2 %	May-22	May-23	-	3,292
	Industrial Bank (5)	5,621	4.4 %	June-22	June-23	-	5,798
		2,811	4.4 %	September-22	September-23	-	2,900
	NingBo Bank (5)	1,405	4.8 %	June-22	June-23	-	1,450
		1,405	4.8 %	August-22	August-23	-	1,450
		1,405	4.8 %	September-22	September-23	-	1,450
		1,406	4.5 %	November-22	November-23	-	1,450
		2,900	4.5 %	December-22	December-23	-	2,900
	Industrial and Commercial Bank of China (5)	5,621	3.2 %	September-22	July-23	-	5,800
	NanJing Bank (5)	2,811	4.3 %	September-22	September-23	-	2,899
		1,265	4.3 %	November-22	November-23	-	1,305
BoYu	Industrial and Commercial Bank of China (6)	1,405	3.9 %	December-21	December-22	1,573	-
		1,450	2.8 %	December-22	December-23	-	1,450
	NingBo Bank (5)	703	4.8 %	September-22	March-23	-	725
		1,406	3.6 %	November-22	May-23	-	1,450
		$ 725	4.8 %	December-22	June-23	-	725
	Loan Balance					$ **12,229**	$ **47,078**

Collateral for the above bank loans and line of credit

(1) Baoding Tongmei's land use rights and all of its buildings located at its facility in Dingxing, China.
(2) ChaoYang Tongmei's land use rights and all of its buildings located at its facility in Kazuo, China.
(3) Beijing Capital Financing Guarantee Co., Ltd. in exchange for the guarantee fee of 1.5% of the loan amount.
(4) AXT time deposit.
(5) Not collateralized.
(6) BoYu's land use rights and its building located at its facility in Tianjin, China and BoYu's accounts receivable. In addition, the December 2022 loan attracts a guarantee fee amounting to 1.78% of the loan amount.

Off-Balance Sheet Arrangements

We did not have any off-balance sheet financing arrangements and have never established any special purpose entities as defined under SEC Regulation S-K Item 303(a)(4)(ii). We have not entered into any options on non-financial assets.

Contractual Obligations

We lease certain office space, warehouse facilities and equipment under long-term operating leases expiring at various dates through July 2029. The majority of our lease obligations relate to our lease agreement for a nitrogen system to be used during the manufacturing process for our facility in Dingxing, China. The equipment lease became effective in August 2019 and will expire in July 2029. There are no variable lease payments, residual value guarantees or any restrictions or covenants imposed by the equipment lease. The remainder relate to our lease agreement for our facility in Fremont, California with approximately 19,467 square feet, which expires in November 2023. We are reasonably certain to renew the lease for another five years. There are no variable lease payments, residual value guarantees or any restrictions or covenants imposed by the facility lease. All other operating leases have a term of 12 months or less. Total rent expenses under these operating leases charged to selling, general and administrative were approximately $458,000, $431,000 and $322,000 for the years ended December 31, 2022, 2021 and 2020, respectively, primarily related to our Fremont facility. Total rent expenses under these operating leases charged to cost of revenue were approximately $303,000, $296,000 and $266,000 for the years ended December 31, 2022, 2021 and 2020, respectively, primarily related to the nitrogen system at our facility in Dingxing.

In 2020, we and a competitor entered into the Cross License Agreement, which has a term that begins on January 1, 2020 and expires on December 31, 2029. The Cross License Agreement is a fixed-cost cross license and not a variable-cost cross license that is based on revenue or units. Under the Cross License Agreement, we are obligated to make annual payments over a 10-year period. For the years ended December 31, 2022 and 2021, the royalty expense under the Cross License Agreement was not considered material to our consolidated financial statements.

Land Purchase and Investment Agreement

We have established a wafer processing production line in Dingxing, China. In addition to a land rights and building purchase agreement that we entered into with a private real estate development company to acquire our new manufacturing facility, we also entered into a cooperation agreement with the Dingxing local government. In addition to pledging its full support and cooperation, the Dingxing local government will issue certain tax credits to us as we achieve certain milestones. We, in turn, agreed to hire local workers over time, pay taxes when due and eventually demonstrate a total investment of approximately $90 million in value, assets and capital. The investment will include cash paid for the land and buildings, cash on deposit in our name at local banks, the gross value of new and used equipment (including future equipment that might be used for indium phosphide and germanium substrates production), the deemed value for our customer list or the end user of our substrates (for example, the end users of the 3-D sensing VCSELs), a deemed value for employment of local citizens, a deemed value for our proprietary process technology, other intellectual property, other intangibles and additional items of value. There is no timeline or deadline by which this must be accomplished, rather it is a good faith covenant entered into between AXT and the Dingxing local government. Further, there is no specific penalty contemplated if either party breaches the agreement, however the agreement does state that each party has a right to seek from the other party compensation for losses. Under certain conditions, the Dingxing local government may purchase the land and building at the appraised value. We believe that such cooperation agreements are normal, customary and usual in China and that the future valuation is flexible. We have a similar agreement with the city of Kazuo, China, although on a smaller scale. The total investment targeted by AXT in Kazuo is approximately $15 million in value, assets and capital.

Purchase Obligations with Penalties for Cancellation

In the normal course of business, we issue purchase orders to various suppliers. In certain cases, we may incur a penalty if we cancel the purchase order. As of December 31, 2022, we do not have any outstanding purchase orders that will incur a penalty if canceled by the Company.

Recent Accounting Pronouncements

Recent accounting pronouncements are detailed in Note 1 to our consolidated financial statements included in this Annual Report on Form 10-K.

Item 7A. ***Quantitative and Qualitative Disclosures about Market Risk***

Foreign Currency Risk

A significant portion of our business is conducted in currencies other than the U.S. dollar. Foreign exchange losses have had a material adverse effect on our operating results and cash flows in the past and could have a material adverse effect on our operating results and cash flows in the future. If we do not effectively manage the risks associated with this currency risk, our revenue, cash flows and financial condition could be adversely affected. Although during 2022, we recorded a foreign exchange gain of $1.6 million, during 2021 and 2020 we recorded net foreign exchange loss of $434,000 and $411,000, respectively, included as part of other income, net in our consolidated statements of operations. We incur foreign currency transaction exchange gains and losses due to operations in general. In the future we may experience foreign exchange losses on our non-functional currency denominated receivables and payables to the extent that we have not mitigated our exposure. Foreign exchange losses could have a materially adverse effect on our operating results and cash flows.

Our product sales to Japanese customers are typically invoiced in Japanese yen. As such we have foreign exchange exposure on our accounts receivable and on any Japanese yen denominated cash deposits. To partially protect us against fluctuations in foreign currency resulting from accounts receivable in Japanese yen, starting in 2015, we instituted a foreign currency hedging program. We place short term hedges that are intended to offset the potential cash exposure related to fluctuations in the exchange rate between the United States dollar and Japanese yen. We measure the fair value of these hedges at each month end and quarter end using current exchange rates and in accordance with generally accepted accounting principles. At quarter end and year end any foreign currency hedges not settled are netted on the consolidated balance sheet and consolidated balance sheet, respectively, and classified as Level 3 assets and liabilities. As of December 31, 2022 the net change in fair value from the placement of the hedge to settlement at each month end during the quarter had a de minimis impact to the consolidated results.

The functional currency for our foreign operations is the renminbi, the local currency of China, and in the future we may establish short term hedges covering renminbi. Most of our operations are conducted in China and most of our costs are incurred in Chinese renminbi, which subjects us to fluctuations in the exchange rates between the U.S. dollar and the Chinese renminbi. We incur transaction gains or losses resulting from consolidation of expenses incurred in local currencies for our Chinese subsidiaries, as well as in translation of the assets and liabilities at each balance sheet date. Our financial results could be adversely affected by factors such as changes in foreign currency exchange rates or weak economic conditions in foreign markets, including the revaluation by China of the renminbi, and any future adjustments that China may make to its currency such as any move it might make to a managed float system with opportunistic interventions. We may also experience foreign exchange losses on our non-functional currency denominated receivables and payables.

We currently are using a hedging program to minimize the effects of currency fluctuations relating to the Japanese yen. While we may apply this program to other currencies, such as the Chinese renminbi, our hedging position is partial and may not exist at all in the future. It may not succeed in minimizing our foreign currency fluctuation risks. Our primary objective in holding these instruments is to reduce the volatility of earnings and cash flows associated with changes in foreign currency. The program is not designated for trading or speculative purposes. The company may choose not to hedge certain foreign exchange exposures for a variety of reasons, including but not limited to accounting considerations and the prohibitive economic cost of hedging particular exposures. However, even with our hedging program, we still experience losses on foreign exchange from time to time.

Interest Rate Risk

Cash and cash equivalents earning interest and certain variable rate debt instruments are subject to interest rate fluctuations. The following table sets forth the probable impact of a 10% change in interest rates (in thousands):

Instrument	Balance as of December 31, 2022	Current Interest Rate	Projected Annual Interest Income	Proforma 10% Interest Rate Decline Income	Proforma 10% Interest Rate Increase Income
Cash, cash equivalents and restricted cash	$ 41,348	0.36 %	$ 149	$ 134	$ 164
Investments in marketable debt securities	11,457	1.13 %	129	116	142
			$ 278	$ 250	$ 306

The primary objective of our investment activities is to preserve principal while maximizing income without significantly increasing risk. Financial instruments that potentially subject us to concentration of credit risk consist primarily of cash and cash equivalents, short-term investments, and accounts receivable. We invest primarily in money market accounts, certificates of deposits, corporate bonds and notes, and government securities. We are exposed to credit risks in the event of default by the issuers to the extent of the amount recorded on the consolidated balance sheets. These securities are generally classified as available-for-sale and consequently are recorded on the balance sheet at fair value with unrealized gains or losses reported as a separate component of accumulated other comprehensive income (loss), net of estimated tax, further reduced by a valuation allowance for expected credit losses, if any. Our cash, cash equivalents and short-term investments and long-term investments are in high-quality instruments placed with major banks and financial institutions and commercial paper. We have no investments in auction rate securities.

Credit Risk

We perform ongoing credit evaluations of our customers' financial condition, and limit the amount of credit extended when deemed necessary, but generally do not require collateral. The credit risk in our accounts receivable is mitigated by our credit evaluation process and the geographical dispersion of sales transactions. Two customers accounted for more than 10% of our accounts receivable as of December 31, 2022 and no customer accounted for more than 10% of our accounts receivable as of December 31, 2021.

Equity Risk

As part of our supply chain strategy, we maintain minority investments in privately-held raw material companies located in China either invested directly by us and our subsidiaries or through our consolidated joint venture companies. These minority investments are reviewed for other than temporary declines in value on a quarterly basis. These investments are classified as other assets in the consolidated balance sheets and accounted for under either the equity or cost method, depending on whether we have the ability to exercise significant influence over their operations or financial decisions. We monitor our investments for impairment and record reductions in carrying value when events or changes in circumstances indicate that the carrying value may not be recoverable. Reasons for other than temporary declines in value include whether the related company would have insufficient cash flow to operate for the next twelve months, significant changes in the operating performance and changes in market conditions. As of December 31, 2022 and 2021, we did not maintain any direct investments under the cost method. Our minority investments under the equity method as of December 31, 2022 and 2021 totaled $14.6 million and $10.2 million, respectively.

Inflation Risk

While the historical impact of inflation is difficult to accurately measure due to the imprecise nature of the estimates required, we do not believe the effects of inflation on our consolidated results of operations and financial condition have been material. However, there can be no assurance that our consolidated results of operations and financial condition will not be materially impacted by inflation in the future, including by heightened levels of inflation currently experienced globally. Nonetheless, if our costs were to become subject to significant inflationary pressures, we may not be able to fully offset such higher costs. Our inability or failure to do so could harm our business, consolidated results of operations or financial condition.

Item 8. ***Consolidated Financial Statements and Supplementary Data***

The consolidated financial statements, related notes thereto and financial statement schedules required by this item are listed and set forth beginning on page 71, and are incorporated by reference here.

Item 9. ***Changes in and Disagreements with Accountants on Accounting and Financial Disclosure***

None.

Item 9A. ***Controls and Procedures***

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and our Chief Financial Officer, evaluated the effectiveness of the design and operation of our disclosure controls and procedures as of the end of the period covered by this Annual Report on Form 10-K. Based upon this evaluation, our Chief Executive Officer and Chief Financial Officer have concluded that our disclosure controls and procedures as defined under Exchange Act Rules 13a-15(e) and 15d-15(e) were effective at the reasonable assurance level to ensure that information required to be disclosed in our Securities Exchange Act reports is recorded, processed, summarized and reported within the time periods specified by the Securities and Exchange Commission and is accumulated and communicated to management, including our Chief Executive Officer and our Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

Our disclosure controls and procedures include components of our internal control over financial reporting. Management's assessment of the effectiveness of our internal control over financial reporting is expressed at the level of reasonable assurance because a control system, no matter how well designed and operated, can provide only reasonable assurance that the control system's objectives will be met.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act. Internal control over financial reporting is a process designed by, or under the supervision of, our Chief Executive Officer and Chief Financial Officer, and implemented by our Board of Directors, management and other personnel to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with U.S. GAAP. Internal control over financial reporting includes those policies and procedures that:

- pertain to the maintenance of records that in reasonable detail accurately and fairly reflect our transactions and dispositions of our assets;

- provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with U.S. GAAP, and that receipts and expenditures are being made only in accordance with authorizations of our management and directors; and

- provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on the consolidated financial statements.

Because of 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.

Our management, under the supervision and with the participation of our Chief Executive Officer and Chief Financial Officer, has assessed the effectiveness of our internal control over financial reporting as of December 31, 2022 based on the criteria established in *Internal Control—Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Management has concluded that our internal control over financial reporting was effective as of December 31, 2022. The Company's internal control over financial reporting as of December 31, 2022 has been audited by BPM, the independent registered public accounting firm who also audited the Company's financial statements. BPM's report on the effectiveness of the Company's internal control over financial reporting as of December 31, 2022.

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting during our fourth quarter of fiscal 2022 that has materially affected, or is reasonably likely to materially affect, AXT's internal control over financial reporting.

Item 9B. ***Other Information***

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections

Not Applicable.

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of AXT, Inc.

Opinion on Internal Control Over Financial Reporting

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

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the consolidated balance sheets as of December 31, 2022 and 2021 and the related consolidated statements of operations, comprehensive income (loss), stockholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2022, and the related notes (collectively referred to as the "consolidated financial statements") of the Company and our report dated March 16, 2023 expressed an unqualified opinion on those consolidated financial statements.

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 Controls over Financial Reporting. Our responsibility is to express an opinion on the entity'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 of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included 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

An entity'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 accounting principles generally accepted in the United States of America ("U.S. GAAP"). An entity'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 entity; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with U.S. GAAP, and that receipts and expenditures of the entity are being made only in accordance with authorizations of management and directors of the entity; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the entity'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/ BPM LLP

San Jose, California
March 16, 2023

PART III

The SEC allows us to include information required in this report by referring to other documents or reports we have already filed or will soon be filing. This is called “Incorporation by Reference.” We intend to file our definitive proxy statement for our annual meeting of stockholders to be held on May 18, 2023 (the “Proxy Statement”) pursuant to Regulation 14A not later than 120 days after the end of the fiscal year covered by this report, and certain information therein is incorporated in this report by reference.

Item 10. *Directors, Executive Officers and Corporate Governance*

The information required by this item with respect to identification of directors is incorporated by reference to the information contained in the section captioned “Information About our Board of Directors” in the Proxy Statement. The information with respect to our executive officers, is incorporated by reference to the information contained in the section captioned “Executive Officers” in the Proxy Statement. Information with respect to Items 405 of Regulation S-K is incorporated by reference to the information contained in the sections of the Proxy Statement captioned “Section 16(a) Beneficial Ownership Reporting Compliance.” There will be no disclosure under Item 407(c)(3). Information with respect to Items 407(d)(4) and 407(d)(5) is incorporated by reference to the information contained in the sections of the Proxy Statement captioned “Corporate Governance—Committees of the Board of Directors.”

The Board of Directors of AXT, Inc. has adopted a Code of Conduct and Ethics (the “Code”) that applies to our principal executive officers, principal financial officer, and corporate controller, as well as all other employees. A copy of this Code has been posted on our Internet website at www.axt.com. Any amendments to, or waivers from, a provision of our Code that applies to our principal executive officer, principal financial officer, controller, or persons performing similar functions and that relates to any element of the Code enumerated in paragraph (b) of Item 406 of Regulation S-K shall be disclosed by posting such information on our website.

Item 11. *Executive Compensation*

The information required by this Item is incorporated herein by reference to information set forth in our Proxy Statement under the section entitled “Executive Compensation and Other Matters.”

Item 12. *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters*

The information required by this Item is incorporated herein by reference to information set forth in our Proxy Statement under the section entitled “Security Ownership of Certain Beneficial Owners and Management” and “Equity Compensation Plan Information.”

Item 13. *Certain Relationships and Related Transactions and Director Independence*

Information required by this item will be set forth in our Proxy Statement under the headings “Compensation Committee Interlocks and Insider Participation” and “Certain Relationships and Related Transactions,” which information is incorporated herein by reference.

Item 14. *Principal Accountant Fees and Services*

The information required by this Item is incorporated herein by reference to information set forth in our Proxy Statement under the section entitled “Ratification of Appointment of Independent Registered Public Accountants.”

PART IV

Item 15. ***Exhibits and Financial Statement Schedules***

(a) The following documents are filed as part of this report:

(1) Financial Statements:

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

(2) Financial Statement Schedules

All schedules have been omitted because the required information is not applicable or because the information required is included in the consolidated financial statements or notes thereto.

(b) Exhibits

See Index to Exhibits attached elsewhere to this Annual Report on Form 10-K. The exhibits listed in the accompanying Index to Exhibits are filed as part of, or incorporated by reference into, this Annual Report on Form 10-K.

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of AXT, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of AXT, Inc. (a Delaware corporation) and its subsidiaries (the “Company”) as of December 31, 2022, and 2021, and the related consolidated statements of operations, comprehensive income (loss), stockholders’ equity, and cash flows for each of the years in the three-year period ended December 31, 2022, and the related notes (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 as of December 31, 2022, and 2021, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2022, in conformity with accounting principles generally accepted in the United States of America.

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 (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), and our report dated March 16, 2023, expressed an unqualified opinion.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s consolidated 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 consolidated 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 Matter

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 consolidated 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.

Inventories – Reserve for Excess and Obsolete Inventory

As described in Notes 1 and 3 to the consolidated financial statements, the Company’s consolidated inventories balance was $89.6 million as of December 31, 2022, which was net of a reserve of $24.7 million for excess and obsolete inventories. The Company’s inventories are stated at the lower of weighted average costs (approximated by standard cost) or net realizable value. The Company routinely evaluates the levels of its inventories in light of current market conditions in order to identify excess and obsolete inventories, and to provide a reserve for certain inventories to their estimated net realizable value based upon the age, quality and life expectancy of the product, and the projections for sale of the completed products. If actual demand were to be substantially lower than estimated, there could be a significant adverse impact on the carrying value of inventories and consolidated results of operations.

The principal considerations for our determination that performing procedures relating to reserve for excess and obsolete inventories is a critical audit matter are the significant amount of judgment by management in developing the assumptions of the forecasted product demand, which in turn led to significant auditor judgment, subjectivity, and effort in performing audit procedures and evaluating audit evidence relating to the forecasted product demand. Additionally, for certain new product launches there may be limited historical data with which to evaluate forecasts.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of internal controls relating to management's reserve for excess and obsolete inventories, including internal controls over the development of assumptions related to forecasted product demand. The procedures also included, among others, testing management's process for developing the reserve for excess and obsolete inventories, testing the completeness and accuracy of the underlying data used in the estimate, and evaluating management's assumptions of forecasted product demand. Evaluating management's demand forecast for reasonableness involved considering historical sales or usage by product, comparing prior period estimates to actual results of the same period, and determining whether the demand forecast used was consistent with evidence obtained in other areas of the audit.

/s/ BPM LLP

We have served as the Company's auditor since 2004.

San Jose, California
March 16, 2023

AXT, INC.

CONSOLIDATED BALANCE SHEETS
(In thousands, except per share data)

	December 31, 2022	December 31, 2021
ASSETS		
Current assets:		
Cash and cash equivalents	$ 34,948	$ 36,763
Restricted cash	6,400	—
Short-term investments	9,339	5,419
Accounts receivable, net of allowances of $307 and $130 as of December 31, 2022 and December 31, 2021	29,252	34,839
Inventories	89,629	65,912
Prepaid expenses and other current assets	13,977	17,252
Total current assets	183,545	160,185
Long-term investments	2,118	9,576
Property, plant and equipment, net	161,017	142,415
Operating lease right-of-use assets	1,761	2,324
Other assets	21,631 `	17,941
Total assets	$ 370,072	$ 332,441
LIABILITIES, REDEEMABLE NONCONTROLLING INTERESTS AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 10,084	$ 16,649
Accrued liabilities	18,164	17,057
Short-term loan from noncontrolling interest	—	1,887
Bank loans	47,078	12,229
Total current liabilities	75,326	47,822
Noncurrent operating lease liabilities	1,322	1,935
Other long-term liabilities	3,678	2,453
Total liabilities	80,326	52,210
Commitments and contingencies (Note 16)		
Redeemable noncontrolling interests (Note 18)	44,846	50,385
Stockholders' equity:		
Preferred stock Series A, $0.001 par value; 2,000 shares authorized; 883 shares issued and outstanding as of December 31, 2022 and December 31, 2021 (Liquidation preference of $7,699 and $7,522 as of December 31, 2022 and December 31, 2021)	3,532	3,532
Common stock, $0.001 par value; 70,000 shares authorized; 43,554 and 42,886 shares issued and outstanding as of December 31, 2022 and December 31, 2021	44	43
Additional paid-in capital	235,308	231,622
Accumulated deficit	(14,159)	(29,970)
Accumulated other comprehensive income (loss)	(3,118)	6,302
Total AXT, Inc. stockholders' equity	221,607	211,529
Noncontrolling interests	23,293	18,317
Total stockholders' equity	244,900	229,846
Total liabilities, redeemable noncontrolling interests and stockholders' equity	$ 370,072	$ 332,441

See accompanying notes to consolidated financial statements.

AXT, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except per share data)

	Year Ended December 31, 2022	2021	2020
Revenue	$ 141,118	$ 137,393	$ 95,361
Cost of revenue	88,997	89,979	65,086
Gross profit	52,121	47,414	30,275
Operating expenses:			
Selling, general and administrative	25,654	24,189	19,200
Research and development	13,913	10,328	7,135
Total operating expenses	39,567	34,517	26,335
Income from operations	12,554	12,897	3,940
Interest expense, net	(1,071)	(213)	(179)
Equity in income of unconsolidated joint ventures	5,957	4,409	111
Other income, net	3,487	509	3,200
Income before provision for income taxes	20,927	17,602	7,072
Provision for income taxes	2,185	1,093	2,031
Net income	18,742	16,509	5,041
Less: Net income attributable to noncontrolling interests and redeemable noncontrolling interests	(2,931)	(1,934)	(1,803)
Net income attributable to AXT, Inc.	$ 15,811	$ 14,575	$ 3,238
Net income attributable to AXT, Inc. per common share:			
Basic	$ 0.37	$ 0.35	$ 0.08
Diluted	$ 0.37	$ 0.34	$ 0.07
Weighted-average number of common shares outstanding:			
Basic	42,104	41,367	40,152
Diluted	42,715	42,720	41,025

See accompanying notes to consolidated financial statements.

AXT, INC.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)
(In thousands)

	Year Ended December 31,		
	2022	2021	2020
Net income	$ 18,742	$ 16,509	$ 5,041
Other comprehensive income (loss), net of tax:			
Change in foreign currency translation gain (loss), net of tax	(10,994)	3,719	8,443
Change in unrealized gain (loss) on available-for-sale debt investments, net of tax	(238)	(68)	6
Total other comprehensive income (loss), net of tax	(11,232)	3,651	8,449
Comprehensive income	7,510	20,160	13,490
Less: Comprehensive income attributable to noncontrolling interests and redeemable noncontrolling interests	(1,117)	(2,492)	(2,181)
Comprehensive income attributable to AXT, Inc.	$ 6,393	$ 17,668	$ 11,309

See accompanying notes to consolidated financial statements.

AXT, INC.

CONSOLIDATED STATEMENTS OF STOCKHOLDERS’ EQUITY
(In thousands)

	Preferred Stock		Common Stock							
	Shares	Amount	Shares	Amount	Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	AXT, Inc. Stockholders’ Equity	Noncontrolling Interests	Total Stockholders’ Equity
Balance as of January 1, 2020	883	$ 3,532	40,632	$ 41	236,957	$ (47,783)	$ (4,862)	$ 187,885	$ 4,877	$ 192,762
Common stock options exercised			905	1	2,535			2,536		2,536
Sale of subsidiary shares to noncontrolling interests					396			396		396
Purchase of subsidiary shares from noncontrolling interests					(1,398)			(1,398)	(202)	(1,600)
Restricted stock awards canceled			(13)							—
Stock-based compensation					2,623			2,623		2,623
Issuance of common stock in the form of restricted stock			443							—
Adjustment to noncontrolling interests in connection with the reorganization and alignment of assets under Tongmei					(10,732)			(10,732)	10,732	—
Net dividend declared by joint ventures									(2,238)	(2,238)
Net income						3,238		3,238	1,803	5,041
Other comprehensive income							8,071	8,071	378	8,449
Balance as of December 31, 2020	883	3,532	41,967	42	230,381	(44,545)	3,209	192,619	15,350	207,969
Common stock options exercised			507	1	1,669			1,670		1,670
Formation of new subsidiary with noncontrolling interests					(262)			(262)	1,413	1,151
Transfer of subsidiary with noncontrolling interests					(1,229)			(1,229)	1,229	—
Restricted stock awards canceled			(14)							—
Stock-based compensation					4,519			4,519		4,519
Issuance of common stock in the form of restricted stock			426							—
Purchase of subsidiary shares from noncontrolling interests					(2,691)			(2,691)	(1,039)	(3,730)
Transfer of subsidiary with redeemable noncontrolling interests					(1,241)			(1,241)		(1,241)
Noncontrolling interest portion of Tongmei stock-based compensation					(62)			(62)	40	(22)
Sale of common stock to employees in connection with the reorganization					538			538		538
Net income						14,575		14,575	1,045	15,620
Other comprehensive income							3,093	3,093	279	3,372
Balance as of December 31, 2021	883	3,532	42,886	43	231,622	(29,970)	6,302	211,529	18,317	229,846
Common stock options exercised			172	1	517			518		518
Investment in subsidiary with noncontrolling interest					(466)			(466)	2,699	2,233
Investment in subsidiary with redeemable noncontrolling interest					(471)			(471)		(471)
Restricted stock			(91)							—

awards canceled										
Stock-based compensation					3,273			3,273		3,273
Issuance of common stock in the form of restricted stock			587					—		—
Tongmei stock-based compensation					733			733		733
Noncontrolling interest portion of Tongmei stock-based compensation					100			100	(42)	58
Investment in subsidiary from noncontrolling interest								—	1,887	1,887
Net income						15,811		15,811	1,333	17,144
Other comprehensive income (loss)							(9,420)	(9,420)	(901)	(10,321)
Balance as of December 31, 2022	883	$ 3,532	43,554	$ 44	$ 235,308	$ (14,159)	$ (3,118)	$ 221,607	$ 23,293	$ 244,900

See accompanying notes to consolidated financial statements.

AXT, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
	2022	2021	2020
Cash flows from operating activities:			
Net income	$ 18,742	$ 16,509	$ 5,041
Adjustments to reconcile net income to net cash provided by (used in) operating activities:			
Depreciation and amortization	8,119	7,078	4,333
Amortization of marketable securities premium	58	68	34
Stock-based compensation	4,006	4,519	2,623
Provision for doubtful accounts	(177)	87	183
(Gain) loss on disposal of equipment	(85)	(8)	50
Return of equity method investments (dividends)	1,608	774	—
Equity in income of unconsolidated joint ventures	(5,957)	(4,409)	(111)
Deferred tax assets	104	2,340	—
Changes in operating assets and liabilities:			
Accounts receivable	4,535	(9,748)	(5,333)
Inventories	(31,412)	(12,401)	(916)
Prepaid expenses and other current assets	(3,486)	(798)	(6,719)
Other assets	(471)	(6,283)	(104)
Accounts payable	(5,519)	3,563	2,305
Accrued liabilities	(2,127)	(3,445)	2,601
Other long-term liabilities, including royalties	3,297	(1,151)	1,878
Net cash provided by (used in) operating activities	(8,765)	(3,305)	5,865
Cash flows from investing activities:			
Purchases of property, plant and equipment	(28,465)	(29,645)	(19,855)
Purchases of available-for-sale debt securities	(2,158)	(9,645)	(5,968)
Proceeds from sales and maturities of available-for-sale debt securities	5,400	480	9,401
Net cash used in investing activities	(25,223)	(38,810)	(16,422)
Cash flows from financing activities:			
Proceeds from common stock options exercised	518	1,670	2,536
Proceeds from sale of subsidiary shares to noncontrolling interests	—	538	396
Proceeds from bank loans	53,078	20,543	10,401
Proceeds from long-term loan from noncontrolling interest	—	1,834	—
Payments on bank loans	(17,798)	(19,066)	(5,996)
Proceeds from capital increase in subsidiary shares from noncontrolling interest	2,233	—	—
Formation of new subsidiary with noncontrolling interests	—	1,283	—
Proceeds from issuance of Tongmei's common stock to redeemable noncontrolling interests, net of costs	—	(1,077)	47,563
Dividends paid by joint ventures to their minority shareholders	—	—	(2,238)
Net cash provided by financing activities	38,031	5,725	52,662
Effect of exchange rate changes on cash and cash equivalents, and restricted cash	542	551	3,605
Net increase (decrease) in cash and cash equivalents, and restricted cash	4,585	(35,839)	45,710
Cash and cash equivalents at the beginning of the year	36,763	72,602	26,892
Cash and cash equivalents, and restricted cash at the end of the period	$ 41,348	$ 36,763	$ 72,602
Supplemental disclosures:			
Income taxes paid, net of refunds	$ 1,692	$ 3,177	$ 1,959
Supplemental disclosure of non-cash flow information:			
Notes Receivables paid to purchase fixed assets	$ 6,835	$ —	$ —
Conversion of related party borrowings to Additional Paid-in Capital	$ 1,887	$ —	$ —
Investment in subsidiary shares from noncontrolling interest	$ 937	$ —	$ —
Consideration payable to repurchase subsidiary shares from noncontrolling interests, included in accrued liabilities	$ —	$ —	$ 1,439
Reduction of noncontrolling interests in excess (deficit) of total consideration paid and payable in connection with the repurchase of subsidiary shares from noncontrolling interests	$ —	$ —	$ (1,398)
Bank loan proceeds paid directly to a third-party vendor, included in accounts payable	$ 474	$ —	$ —
Other receivable regarding sales of land and building to unconsolidated joint venture	$ 976	$ —	$ —
Consideration payable in connection with construction in progress, included in accrued liabilities	$ 4,135	$ 2,974	$ 1,457

See accompanying notes to consolidated financial statements.

AXT, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Note 1. The Company and Summary of Significant Accounting Policies

The Company

AXT, Inc. (“AXT”, “the Company”, “we,” “us,” and “our” refer to AXT, Inc. and its consolidated subsidiaries) is a worldwide materials science company that develops and produces high-performance compound and single element semiconductor substrates, also known as wafers. Our consolidated subsidiaries produce and sell certain raw materials some of which are used in our substrate manufacturing process and some of which are sold to other companies.

Our substrate wafers are used when a typical silicon substrate wafer cannot meet the conductive requirements of a semiconductor or optoelectronic device. The dominant substrates used in producing semiconductor chips and other electronic circuits are made from silicon. However, certain chips may become too hot or perform their function too slowly if silicon is used as the base material. In addition, optoelectronic applications, such as LED lighting and chip-based lasers, do not use silicon substrates because they require a wave form frequency that cannot be achieved using silicon. Alternative or specialty materials are used to replace silicon as the preferred base in these situations. Our wafers provide such alternative or specialty materials. We do not design or manufacture the chips. We add value by researching, developing and producing the specialty material wafers. We have two product lines: specialty material substrates and raw materials integral to these substrates. In 2022, our substrate product group generated 79% of our revenue and raw materials product group generated 21%. Our compound substrates combine indium with phosphorous (indium phosphide: InP) or gallium with arsenic (gallium arsenide: GaAs). Our single element substrates are made from germanium (Ge).

Our raw materials include purified gallium, InP based material and pBN crucibles. We use purified gallium in producing our GaAs substrates and also sell purified gallium in the open market to other companies for use in magnetic materials, high temperature thermometers and growing single crystal ingots including gallium arsenide, gallium nitride, gallium antimonite, gallium phosphide and other materials and alloys. Pyrolytic boron nitride (pBN) crucibles are used in the high temperature (typically in the range 500 C to 1,500 C) growth process of single crystal ingots and epitaxial layer growth in MBE reactors. We use these pBN crucibles in our own ingot growth processes and also sell them in the open market to other companies.

Principles of Consolidation

The consolidated financial statements include the accounts of AXT, and our consolidated subsidiaries, Beijing Tongmei Xtal Technology Co., Ltd. (“Tongmei”), AXT-Tongmei, Inc. (“AXT-Tongmei”), Baoding Tongmei Xtal Technology Co., Ltd. (“Baoding Tongmei”), ChaoYang Tongmei Xtal Technology Co., Ltd. (“ChaoYang Tongmei”), ChaoYang LiMei Semiconductor Technology Co., Ltd. (“ChaoYang LiMei”), ChaoYang XinMei High Purity Semiconductor Materials Co., Ltd. (“ChaoYang XinMei”), Nanjing JinMei Gallium Co., Ltd. (“JinMei”), ChaoYang JinMei Gallium Ltd. (“ChaoYang JinMei”), ChaoYang ShuoMei High Purity Semiconductor Materials Co., Ltd. (“ChaoYang ShuoMei”), MaAnShan JinMei Gallium Ltd., (“MaAnShan JinMei”) and Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd. (“BoYu”). Baoding Tongmei is located in the city of Dingxing, China. Each of ChaoYang Tongmei and ChaoYang LiMei is located in the city of Kazuo, China. All significant inter-company accounts and transactions have been eliminated. Investments in business entities in which we do not have controlling interests, but have the ability to exercise significant influence over operating and financial policies (generally 20-50% ownership), are accounted for by the equity method. For the years ended 2022 and 2021, we have six and five companies accounted for by the equity method, respectively. For the majority-owned subsidiaries that we consolidate, we reflect the portion we do not own as either noncontrolling interests in stockholder’s equity or as redeemable noncontrolling interests in temporary equity on our consolidated balance sheets and in our consolidated statements of operations.

When market conditions are warranted, we intend to construct facilities at the ChaoYang LiMei location to provide us with additional production capacity. For the years ended 2022 and 2021, expenses associated with ChaoYang LiMei had a de minimis impact on our consolidated financial statements.

In February 2021, Tongmei signed a joint venture agreement with certain investors to fund a new company, ChaoYang XinMei. The agreement called for a total investment of approximately $3.0 million, of which Tongmei would fund approximately $1.8 million for a 58.5 percent ownership of ChaoYang XinMei. In February 2021, the investors completed the initial funding of approximately $1.5 million. Tongmei's portion of the investment was approximately $0.9 million. In May 2021, the investors completed the funding of the remaining balance of approximately $1.5 million. Tongmei's portion of the final investment was approximately $0.9 million, for a total investment of approximately $1.8 million for a 58.5 percent ownership of ChaoYang XinMei. In September 2021 and October 2021, ChaoYang XinMei received funding from a minority investor of $0.9 million and $1.0 million, respectively. In December 2021 and January 2022, ChaoYang XinMei received funding from Tongmei of $1.4 million and $1.4 million, respectively. In January 2022, the China local government certified this additional funding in ChaoYang XinMei as an equity investment. Tongmei's ownership remained at 58.5% after these equity investments. In April 2022, Tongmei entered into a capital increase agreement (the "Capital Increase Agreement") with minority investors to further invest $4.5 million in ChaoYang XinMei. Tongmei's portion of the investment was approximately $2.6 million, of which $1.1 million was invested in April 2022 and $0.8 million was invested in May 2022. The minority investors' portion of the investment was approximately $1.9 million, of which $0.7 million was invested in April 2022 and $0.6 million was invested in May 2022. As a result, noncontrolling interests increased $1.4 million and redeemable noncontrolling interests increased $0.1 million. Tongmei's ownership remained at 58.5% after the April 2022 and May 2022 equity investments. In July 2022, Tongmei and the minority investors further invested $0.8 million and $0.6 million in ChaoYang XinMei, respectively. This completed the investment obligations under the Capital Increase Agreement. As a result, noncontrolling interests increased $610,000 and redeemable noncontrolling interests increased $57,000. Tongmei's ownership remained at 58.5% after the July 2022 equity investment.

In April 2022, ChaoYang JinMei signed a joint venture agreement with a certain investor to fund a new company, ChaoYang ShuoMei, our consolidated subsidiary. The agreement calls for a total investment of approximately $4.4 million, of which ChaoYang JinMei will fund approximately $3.3 million for a 75 percent ownership of ChaoYang ShuoMei. In July and August 2022, ChaoYang JinMei completed the initial funding of $1.0 million in ChaoYang ShuoMei. In August 2022, the investor invested $334,000 in ChaoYang ShuoMei. As a result, noncontrolling interests increased $406,000 and redeemable noncontrolling interests increased $73,000.

In April 2022, Tongmei signed a joint venture agreement with certain investors to fund a new company, ChaoYang KaiMei. The agreement called for a total investment of approximately $7.6 million, of which Tongmei would fund approximately $3.0 million for a 40.0 percent ownership of ChaoYang KaiMei. In July 2022, the investors completed the initial funding of approximately $2.2 million. Tongmei's portion of the investment was approximately $0.9 million.

All activities for MaAnShan JinMei ceased during the first half of 2022 and the subsidiary was subsequently dissolved in May 2022. The dissolution of MaAnShan JinMei had a de minimis impact on the consolidated results.

During the quarter ended December 31, 2020, Tongmei entered into two sets of definitive transaction documents, each consisting of a capital increase agreement along with certain supplemental agreements in substantially the same form (collectively, the "Capital Increase Agreements"), with several private equity investors in China.

In preparation for Tongmei's application for a listing of shares in an initial public offering (the "IPO") on the Shanghai Stock Exchange's Sci-Tech innovAtion boaRd (the "STAR Market"), in late December 2020, we reorganized our entity structures in China. JinMei and BoYu and its subsidiaries were assigned to Tongmei and effectively merged with Tongmei although they retained their own respective legal entity status and are wholly owned subsidiaries of Tongmei. The 33% minority interest stakeholders of BoYu converted their ownership to a 7.59% minority interest in Tongmei. The 8.5% minority interest stakeholders, employees of JinMei, converted their ownership to a 0.38% minority interest in Tongmei. Further, a number of employees, key managers and contributors purchased a 0.4% minority interest in Tongmei. Additionally, Baoding Tongmei and ChaoYang Tongmei, were assigned to Tongmei as wholly owned subsidiaries. In 2020, the private equity funds (the "Investors") had transferred approximately $48.1 million of new capital to Tongmei. An additional investment of approximately $1.5 million of new capital was funded in January 2021. Under China regulations these investments must be formally approved by the appropriate government agency and are not deemed to be dilutive until such approval is granted. The government approved the approximately $49 million investment in its entirety on January 25, 2021, at which time the Investors owned a redeemable noncontrolling interest in Tongmei of 7.28%. As of September 30, 2022, Tongmei's noncontrolling interests and redeemable noncontrolling interests totaled approximately 14.5%. AXT remains the controlling stakeholder of Tongmei and holds a majority of the board of director positions of Tongmei. In June 2021, AXT sold AXT-Tongmei to Tongmei for $1. Since Tongmei is 85.5% owned by AXT, and the transaction was between common interest holders, the transaction was accounted for at net book value and resulted in an increase of $1.2 million to noncontrolling interests and $1.2 million to redeemable noncontrolling interests.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America ("U.S. GAAP") requires management to make estimates, judgments and assumptions. We believe that the estimates, judgments, and assumptions upon which management relies are reasonable based on information available at the time that these estimates, judgments, and assumptions are made. These estimates, judgments, and assumptions can affect the reported amounts of assets and liabilities as of the date of the consolidated financial statements as well as the reported amounts of revenues and expenses during the periods presented. To the extent there are material differences between these estimates and actual results, our consolidated financial statements would be affected.

Fair Value of Financial Instruments

The carrying amounts of certain of our financial instruments including cash and cash equivalents, restricted cash, short-term investments and long-term investments, accounts receivable, accounts payable, accrued liabilities and bank loans approximate fair value due to their short maturities. Certain cash equivalents and investments are required to be adjusted to fair value on a recurring basis. See Note 2.

Fair Value of Investments

ASC Topic 820, *Fair value measurement* ("ASC 820") establishes three levels of inputs that may be used to measure fair value.

Level 1 instruments represent quoted prices in active markets. Therefore, determining fair value for Level 1 instruments does not require significant management judgment, and the estimation is not difficult.

Level 2 instruments include observable inputs other than Level 1 prices, such as quoted prices for similar instruments in markets with insufficient volume or infrequent transactions (less active markets), issuer bank statements, credit ratings, non-binding market consensus prices that can be corroborated with observable market data, model-derived valuations in which all significant inputs are observable or can be derived principally from or corroborated with observable market data for substantially the full term of the assets or liabilities, or quoted prices for similar assets or liabilities. These Level 2 instruments require more management judgment and subjectivity compared to Level 1 instruments, including:

- Determining which instruments are most comparable to the instrument being priced requires management to identify a sample of similar securities based on the coupon rates, maturity, issuer, credit rating, and instrument type, and subjectively select an individual security or multiple securities that are deemed most similar to the security being priced.

- Determining which model-derived valuations to use in determining fair value requires management judgment. When observable market prices for similar securities or comparable securities are not available, we price our marketable debt instruments using non-binding market consensus prices that are corroborated with observable market data or pricing models, such as discounted cash flow models, with all significant inputs derived from or corroborated with observable market data.

Level 3 instruments include unobservable inputs to the valuation methodology that are significant to the measurement of fair value of assets or liabilities. The determination of fair value for Level 3 instruments requires the most management judgment and subjectivity.

We place short-term foreign currency hedges that are intended to offset the potential cash exposure related to fluctuations in the exchange rate between the United States dollar and Japanese yen. We measure the fair value of these foreign currency hedges at each month end and quarter end using current exchange rates and in accordance with generally accepted accounting principles. At quarter end any foreign currency hedges not settled are netted in “Accrued liabilities” on the consolidated balance sheets and classified as Level 3 assets and liabilities. As of December 31, 2022 and 2021, the net change in fair value from the placement of the hedge to settlement had a de minimis impact to the consolidated results.

Foreign Currency Translation

The functional currency of our Chinese subsidiaries is the renminbi, the local currency of China. Transaction gains and losses resulting from transactions denominated in currencies other than the U.S. dollar or in the functional currencies of our subsidiaries are included in “Other income, net” for the years presented. The transaction gain totaled $1.6 million for the year ended December 31, 2022. The transaction loss for the years ended December 31, 2021 and 2020 totaled $434,000 and $411,000, respectively. The assets and liabilities of the subsidiaries are translated at the rates of exchange on the balance sheet date. Revenue and expense items are translated at the average rate of exchange for the period. Gains and losses from foreign currency translation are included in “Other comprehensive income (loss)”, net of tax in the consolidated statements of comprehensive income (loss).

Revenue Recognition

We manufacture and sell high-performance compound semiconductor substrates including indium phosphide, gallium arsenide and germanium wafers, and our consolidated subsidiaries sell certain raw materials, including high purity gallium (6N and 7N Ga), pyrolytic boron nitride (pBN) crucibles and boron oxide (B2O3). After we ship our products, there are no remaining obligations or customer acceptance requirements that would preclude revenue recognition. Our products are typically sold pursuant to purchase orders placed by our customers, and our terms and conditions of sale do not require customer acceptance. We account for a contract with a customer when there is a legally enforceable contract, which could be the customer’s purchase order, the rights of the parties are identified, the contract has commercial terms, and collectibility of the contract consideration is probable. The majority of our contracts have a single performance obligation to transfer products and are short term in nature, usually less than six months. Our revenue is measured based on the consideration specified in the contract with each customer in exchange for transferring products that are generally based upon a negotiated formula, list or fixed price. Revenue is recognized when control of the promised goods is transferred to our customer, which is either upon shipment from our dock, receipt at the customer’s dock, or removal from consignment inventory at the customer’s location, in an amount that reflects the consideration we expect to be entitled to receive in exchange for those goods.

We have elected to account for shipping and handling as activities to fulfill the promise to transfer the goods. Shipping and handling fees billed to customers in a sales transaction are recorded as an offset to shipping and handling expenses. Sales taxes and value added taxes in foreign jurisdictions that are collected from customers and remitted to governmental authorities are accounted for on a net basis and, therefore, are excluded from revenue.

We do not provide training, installation or commissioning services. We provide for future returns based on historical data, prior experience, current economic trends and changes in customer demand at the time revenue is recognized. We do not recognize any asset associated with the incremental cost of obtaining revenue generating customer contracts. As such, sales commissions are expensed as incurred, given that the expected period of benefit is less than one year.

Contract Balances

We receive payments from customers based on a billing schedule as established in our contracts. Contract assets are recorded when we have a conditional right to consideration for our completed performance under the contracts. Accounts receivables are recorded when the right to this consideration becomes unconditional. We do not have any material contract assets as of December 31, 2022.

	December 31, 2022	December 31, 2021
Contract liabilities	$ 338	$ 946

During the three and twelve months ended December 31, 2022, the Company recognized $22,000 and $760,000 of revenue that was included in the contract balances as of December 31, 2021.

Disaggregated Revenue

In general, revenue disaggregated by product types and geography (See Note 14) is aligned according to the nature and economic characteristics of our business and provides meaningful disaggregation of our results of operations. Since we operate in one segment, all financial segment and product line information can be found in the consolidated financial statements.

Practical Expedients and Exemptions

We elected to use the following practical expedients: (i) not to adjust the promised amount of consideration for the effects of a significant financing component when we expect, at contract inception, that the period between our transfer of a promised product or service to a customer and when the customer pays for that product or service will be one year or less; (ii) to expense costs as incurred for costs to obtain a contract when the amortization period would have been one year or less; (iii) not to assess whether promised goods or services are performance obligations if they are immaterial in the context of the contract with the customer.

In addition, we do not disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less.

Accounting for Sales and Use Taxes

We record sales taxes collected on sales of our products and for amounts not yet remitted to tax authorities as accrued liabilities on our consolidated balance sheets.

Risks and Concentration of Credit Risk

Our business is very dependent on the semiconductor, lasers and optical industries which can be highly cyclical and experience downturns as a result of economic changes, overcapacity, and technological advancements. Significant technological changes in the industry or customer requirements, or the emergence of competitive products with new capabilities or technologies, could adversely affect our operating results. In addition, a significant portion of our revenues and net income is derived from international sales. Fluctuations of the United States dollar against foreign currencies and changes in local regulatory or economic conditions, particularly in an emerging market such as China, could adversely affect operating results.

We depend on a limited number of suppliers for certain raw materials, components and equipment used in manufacturing our products, including quartz tubing and polishing solutions. We generally purchase these materials through standard purchase orders and not pursuant to long-term supply contracts.

Financial instruments that potentially subject us to concentration of credit risk consist primarily of cash and cash equivalents, investments, and accounts receivable. We invest primarily in money market accounts, certificates of deposit and corporate bonds. The composition and maturities are regularly monitored by management. Such deposits are in excess of the amount of the insurance provided by the federal government on such deposits. We are exposed to credit risks in the event of default by the issuers to the extent of the amount recorded on the consolidated balance sheets.

We perform ongoing credit evaluations of our customers' financial condition, and limit the amount of credit extended when deemed necessary, but generally do not require collateral. The credit risk in our accounts receivable is mitigated by our credit evaluation process and the geographical dispersion of sales transactions. Two customers accounted for more than 10% of our accounts receivable as of December 31, 2022 and no customer accounted for more than 10% of our accounts receivable as of December 31, 2021.

One customer, Landmark, represented 15% and 11% of our revenue for the years ended December 31, 2022 and 2020, respectively. No customer represented 10% of our revenue for the year ended December 31, 2021. Our top five customers, although not the same five customers for each period, represented 34% of our revenue for the year 2022, 26% of our revenue for the year 2021 and 32% of our revenue for 2020.

For the year ended December 31, 2022, one third-party customer for the raw materials products from our consolidated subsidiaries accounted for over 10% of the revenue from raw materials sales. For the years ended December 31, 2021 and 2020, one third-party customer for the raw materials products from our consolidated subsidiaries accounted for over 10% of the revenue from raw materials sales. Our subsidiaries and raw material joint ventures are a key strategic benefit for us as they further diversify our sources of revenue.

Cash and Cash Equivalents

We consider investments in highly liquid instruments purchased with an original maturity of three months or less to be cash equivalents. Cash equivalents consist primarily of certificate of deposits. Cash and cash equivalents are stated at cost, which approximates fair value.

Restricted Cash

We maintain restricted cash in connection with cash balances temporarily restricted for regular business operations. In May 2022, Tongmei and the Bank of Beijing signed a credit facility for $3.4 million. As a condition of the credit facility we must maintain a time deposit at the Bank Of Beijing as collateral, and therefore we placed time deposits of $2.9 million and $1.0 million at the Bank Of Beijing in April 2022 and May 2022, respectively. In December 2022, we placed another time deposit of $2.5 million at the Bank of Beijing as collateral for a bank loan of $2.3 million received by Tongmei in January 2023. The bank loans have a term of 12 months, therefore the May 2022 bank loan and the time deposits are classified as short-term in our consolidated balance sheets. The time deposits have been excluded from the Company's cash and cash equivalents balance. As of December 31, 2022, $6.4 million was included in restricted cash in our consolidated balance sheets.

Short-Term and Long-Term Investments

We classify our investments in marketable securities as available-for-sale debt securities. Short-term and long-term investments are comprised of available-for-sale marketable securities, which consist primarily of certificates of deposit and corporate bonds. These investments are reported at fair value as of the respective balance sheet dates with unrealized gains and losses included in accumulated other comprehensive income (loss) within stockholders' equity on the consolidated balance sheets. The amortized cost of securities is adjusted for amortization of premiums and accretion of discounts to maturity. Such amortization is included in "Other income, net" in the consolidated statements of operations. Realized gains and losses and declines in value judged to be other than temporary on available-for-sale securities are also included in "Other income, net" in the consolidated statements of operations. The cost of securities sold is based upon the specific identification method.

Accounts Receivable and Allowance for Doubtful Accounts and Sales Returns

Accounts receivable are recorded at the invoiced amount and are not interest bearing. We periodically review the likelihood of collection on our accounts receivable balances and provide an allowance for doubtful accounts receivable primarily based upon the age of these accounts. We evaluate receivables from U.S. customers with an emphasis on balances in excess of 90 days and for receivables from customers located outside the U.S. with an emphasis on balances in excess of 120 days and establish a reserve allowance on the receivable balances if needed. The reason for the difference in the evaluation of receivables between foreign and U.S. customers is that U.S. customers have historically made payments in a shorter period of time than foreign customers. Foreign business practices generally require us to allow customer payment terms that are longer than those accepted in the United States. We assess the probability of collection based on a number of factors, including the length of time a receivable balance has been outstanding, our past history with the customer and their credit worthiness.

We exercise judgment when determining the adequacy of these reserves as we evaluate historical bad debt trends, general economic conditions in the United States and internationally, and changes in customer financial conditions. Uncollectible receivables are recorded as bad debt expense when all efforts to collect have been exhausted and recoveries are recognized when they are received. As of December 31, 2022 and 2021, our accounts receivable, net balance was $29.3 million and $34.8 million, respectively, which was net of an allowance for doubtful accounts of $307,000 and $130,000 as of December 31, 2022 and 2021, respectively. During 2022, we increased the allowance for doubtful accounts by $177,000 due to the poor financial condition of a customer. During 2021, we decreased the allowance for doubtful accounts by $87,000 due to the write-off of accounts receivable for a customer. If actual uncollectible accounts differ substantially from our estimates, revisions to the estimated allowance for doubtful accounts would be required, which could have a material impact on our financial results for the future periods.

As of December 31, 2022 and 2021, the sales returns reserve (included in accrued liabilities) balance was $112,000 and $48,000, respectively. During 2022, we utilized $112,000 and reserved an additional $176,000 and during 2021, we utilized $48,000 and reserved an additional $15,000.

Warranty Reserve

We maintain a warranty reserve based upon our claims experience during the prior twelve months and any pending claims and returns of which we are aware. Warranty costs are accrued at the time revenue is recognized. As of December 31, 2022 and 2021, accrued product warranties totaled $669,000 and $743,000, respectively. The decrease in accrued product warranties is primarily attributable to decreased claims for quality issues experienced by some of our customers. If actual warranty costs or pending new claims differ substantially from our estimates, revisions to the estimated warranty liability would be required, which could have a material impact on our financial condition and results of operations for future periods.

Inventories

Inventories are stated at the lower of cost (approximated by standard cost) or net realizable value. Cost is determined using the weighted average cost method. Our inventory consists of raw materials as well as finished goods and work-in-process that include material, labor and manufacturing overhead costs. We routinely evaluate the levels of our inventory in light of current market conditions in order to identify excess and obsolete inventory, and we provide a reserve for certain inventories to their estimated net realizable value based upon the age and quality of the product and the projections for sale of the completed products. When a reserve is recorded, a new lower cost basis for that inventory is established and subsequent changes in facts and circumstances do not result in the restoration or increase in the new cost basis.

Property, Plant and Equipment

Property, plant and equipment are stated at cost less accumulated depreciation computed using the straight-line method over the estimated economic lives of the assets, which vary from 1 to 39.5 years. Leasehold improvements are amortized using the straight-line method over the shorter of the estimated useful life or the term of the lease. We generally depreciate computer, software, office equipment, furniture and fixtures over 3 to 5 years, machinery and equipment over 1 to 20 years, automobiles over 5 to 10 years, leasehold and building improvements over 10 years, or the lease term if shorter, and buildings over 39.5 years. Repairs and maintenance costs are expensed as incurred.

Impairment of Long-Lived Assets

We evaluate property, plant and equipment and intangible assets for impairment. When events and circumstances indicate that long-lived assets may be impaired, we compare the carrying value of the long-lived assets to the projection of future undiscounted cash flows attributable to these assets. In the event that the carrying value exceeds the future undiscounted cash flows, we record an impairment charge against income equal to the excess of the carrying value over the assets' fair value. Fair values are determined based on quoted market values, discounted cash flows or internal and external appraisals, as applicable. We did not recognize any impairment charges of long-lived assets in 2022, 2021 and 2020.

Impairment of Investments

All available-for-sale debt securities are periodically reviewed for impairment. An investment is considered to be impaired when its fair value is less than its amortized cost basis and it is more likely than not that we will be required to sell the impaired security before recovery of its amortized cost basis. Factors considered in determining whether a loss is temporary include the magnitude of the decline in market value, the length of time the market value has been below cost (or adjusted cost), credit quality, and our ability and intent to hold the securities for a period of time sufficient to allow for any anticipated recovery in market value.

We also invest in equity instruments of privately-held companies in China for business and strategic purposes. Investments in our unconsolidated joint venture companies are classified as other assets and accounted for under either the equity or cost method, depending on whether we have the ability to exercise significant influence over their operations or financial decisions. We monitor our investments for impairment and record reductions in carrying value when events or changes in circumstances indicate that the carrying value may not be recoverable. Determination of impairment is highly subjective and is based on a number of factors, including an assessment of the strength of each company's management, the length of time and extent to which the fair value has been less than our cost basis, the financial condition and near-term prospects of the subsidiary, fundamental changes to the business prospects of the company, share prices of subsequent offerings, and our intent and ability to hold the investment for a period of time sufficient to allow for any anticipated recovery in our carrying value. We estimate fair value of our cost method investments considering available information such as pricing in recent rounds of financing, current cash positions, earnings (loss) and cash flow forecasts, recent operational performance and any other readily available market data. There were no impairment charges during the years ended December 31, 2022 and 2021.

Segment Reporting

We operate in one segment for the design, development, manufacture and distribution of high-performance compound and single element semiconductor substrates and sale of raw materials integral to these substrates. Our chief operating decision-maker has been identified as our Chief Executive Officer, who reviews operating results to make decisions about allocating resources and assessing our performance for the Company. We discuss revenue and capacity for both AXT and our joint ventures collectively, when determining capacity constraints and need for raw materials in our business, and consider their capacity when determining our strategic and product marketing and advertising strategies. While we consolidate our majority-owned or significantly controlled joint ventures, we do not allocate any portion of overhead, interest and other income, interest expense or taxes to them. We therefore have determined that our joint venture operations do not constitute an operating segment. Since we operate in one segment, all financial segment and product line information can be found in the consolidated financial statements.

Stock-Based Compensation

We have employee stock option plans, which are described more fully in Note 10—"Employee Benefit Plans and Stock-based Compensation". We account for stock-based compensation in accordance with the provisions of ASC Topic 718, *Compensation-Stock Compensation* ("ASC 718"). We utilize the Black-Scholes option pricing model to estimate the grant date fair value of stock options, which requires the input of highly subjective assumptions, including estimating stock price volatility and expected term. Stock-based compensation cost is measured at each grant date, based on the fair value of the award, and is recognized as expense and as an increase in additional paid-in capital over the requisite service period of the award.

Research and Development

Research and development costs consist primarily of salaries, including stock-based compensation expense and related personnel costs, depreciation, materials and product testing which are expensed as incurred. Tangible assets acquired for research and development purposes are capitalized if they have alternative future use.

Advertising Costs

Advertising costs, included in selling, general and administrative expenses, are expensed as incurred. Advertising costs for the years ended December 31, 2022, 2021 and 2020 were insignificant.

Income Taxes

We account for income taxes in accordance with ASC Topic 740, *Income Taxes* ("ASC 740"), which requires that deferred tax assets and liabilities be recognized using enacted tax rates for the effect of temporary differences between the book and tax bases of recorded assets and liabilities. ASC 740 also requires that deferred tax assets be reduced by a valuation allowance if it is more likely than not that a portion of the deferred tax asset will not be realized. The impact of ASC 740 is more fully described in Note 12.

Comprehensive Income

The components of other comprehensive income include unrealized gains and losses on marketable securities and foreign currency translation adjustments. Comprehensive income is presented in the consolidated statements of comprehensive income (loss). The balance of accumulated other comprehensive income is as follows (in thousands):

	As of December 31,	
	2022	2021
Accumulated other comprehensive income:		
Unrealized loss on investments, net	$ (303)	$ (65)
Cumulative translation adjustment	(3,042)	7,041
	(3,345)	6,976
Less: Cumulative translation adjustment attributable to noncontrolling interests and redeemable noncontrolling interests	(227)	674
Accumulated other comprehensive income (loss) attributable to AXT, Inc.	$ (3,118)	$ 6,302

Net Income (Loss) Per Share

Basic net income (loss) per share is computed using the weighted-average number of common shares outstanding during the periods less shares of common stock subject to repurchase and non-vested stock awards. Diluted net income (loss) per share is computed using the weighted-average number of common shares outstanding and potentially dilutive common shares outstanding during the periods. The dilutive effect of outstanding stock options and restricted stock awards is reflected in diluted earnings per share by application of the treasury stock method. Potentially dilutive common shares consist of common shares issuable upon the exercise of stock options and vesting of restricted stock awards. Potentially dilutive common shares are excluded from the computation of weighted-average number of common shares outstanding in net loss years, as their effect would be anti-dilutive to the computation.

Recent Accounting Pronouncements

In November 2021, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") 2021-10, Government Assistance (Topic 832): Disclosures by Business Entities about Government Assistance. ASU 2021-10 aims to provide increased transparency by requiring business entities to disclose information about certain types of government assistance they receive in the notes to the financial statements. The FASB broadly defined "government assistance" in Accounting Standards Codification ("ASC") 832 to ensure that assistance received from most types of governmental entities or other related organizations would be disclosed. Government assistance within the scope of ASC 832 includes assistance that is administered by domestic, foreign, local (such as city, town, county, or municipality), regional (such as state, provincial, or territorial), national (federal) governments, as well as entities related to those governments (such as departments, independent agencies, boards, commissions, or component units). ASC 832 also includes government assistance from intergovernmental organizations (for example, global organizations such as the United Nations, regional organizations such as the European Union, and economic organizations such as the World Trade Organization). The guidance is effective for fiscal years beginning after December 15, 2021, with early application permitted. Adoption of the new standard had a de minimis effect on our consolidated financial statements.

In March 2022, FASB pronouncement ASU 2022-02, Financial Instruments-Credit Losses (Topic 326): Troubled Debt Restructurings and Vintage Disclosures was issued as an amendment to Accounting Standards Update 2016-13, Financial Instruments-Credit Losses. ASU 2022-02 aims to modify disclosure requirements for certain loan refinancings and restructurings by creditors. The amendment also require that an entity disclose current-period gross write offs by year of origination for financing receivables and net investments in leases within the scope of Subtopic 326-20, Financial Instruments—Credit Losses—Measured at Amortized Cost. The guidance is effective for fiscal years beginning after December 15, 2022, including interim periods within those fiscal years. Adoption of the new standard will have an immaterial effect on our consolidated financial statements.

In September 2022, FASB issued Accounting Standards Update No. 2022-04, Liabilities—Supplier Finance Programs (Subtopic 405-50): Disclosure of Supplier Finance Program Obligations, to enhance the transparency about the use of supplier finance programs for investors. The amendments in this Update require that a buyer in a supplier finance program disclose sufficient information about the program to allow a user of financial statements to understand the program's nature, activity during the period, changes from period to period, and potential magnitude. The guidance is effective for fiscal years beginning after December 15, 2022, including interim periods within those fiscal years. Adoption of the new standard will have an immaterial effect on our consolidated financial statements.

Note 2. Cash, Cash Equivalents and Investments

Our cash and cash equivalents consist of cash and instruments with original maturities of less than three months. Our investments consist of instruments with original maturities of more than three months. As of December 31, 2022 and 2021, our cash, cash equivalents and debt investments are classified as follows (in thousands):

	December 31, 2022				December 31, 2021			
	Amortized Cost	Gross Unrealized Gain	Gross Unrealized (Loss)	Fair Value	Amortized Cost	Gross Unrealized Gain	Gross Unrealized (Loss)	Fair Value
Classified as:								
Cash and restricted cash	$ 41,348	$ —	$ —	$ 41,348	$ 36,763	$ —	$ —	$ 36,763
Cash equivalents:								
Certificates of deposit [1]	—	—	—	—	—	—	—	—
Total cash, restricted cash and cash equivalents	41,348	—	—	41,348	36,763	—	—	36,763
Investments (available-for-sale):								
Certificates of deposit [2]	6,440	—	(175)	6,265	6,680	—	(19)	6,661
Corporate bonds	5,320	—	(128)	5,192	8,380	—	(46)	8,334
Total investments	11,760	—	(303)	11,457	15,060	—	(65)	14,995
Total cash, restricted cash, cash equivalents and investments	$ 53,108	$ —	$ (303)	$ 52,805	$ 51,823	$ —	$ (65)	$ 51,758
Contractual maturities on investments:								
Due within 1 year [3]	$ 9,600			$ 9,339	$ 5,424			$ 5,419
Due after 1 through 5 years [4]	2,160			2,118	9,636			9,576
	$ 11,760			$ 11,457	$ 15,060			$ 14,995

1. *Certificate of deposit with original maturities of less than three months.*
2. *Certificate of deposit with original maturities of more than three months.*
3. *Classified as "Short-term investments" in our consolidated balance sheets.*
4. *Classified as "Long-term investments" in our consolidated balance sheets.*

We manage our debt investments as a single portfolio of highly marketable securities that is intended to be available to meet our current cash requirements. Certificates of deposit and corporate bonds are typically held until maturity.

Historically, the gross unrealized losses related to our portfolio of available-for-sale debt securities were immaterial, and primarily due to normal market fluctuations and not due to increased credit risk or other valuation concerns. Gross unrealized losses on our available-for-sale debt securities as of December 31, 2022 was $303,000, and historically, such gross unrealized losses have been temporary in nature and we believe that it is probable the principal and interest will be collected in accordance with the contractual terms. We review our debt investment portfolio at least quarterly, or when there are changes in credit risks or other potential valuation concerns, to identify and evaluate whether an allowance for credit losses or impairment would be necessary. Factors considered in determining whether a loss is temporary include the magnitude of the decline in market value, the length of time the market value has been below cost (or adjusted cost), credit quality, and our ability and intent to hold the securities for a period of time sufficient to allow for any anticipated recovery in market value.

The following table summarizes the fair value and gross unrealized losses related to available-for-sale debt securities, aggregated by investment category and length of time that individual debt securities have been in a continuous unrealized loss position as of December 31, 2022 (in thousands):

As of December 31, 2022	In Loss Position < 12 months		In Loss Position > 12 months		Total In Loss Position	
	Fair Value	Gross Unrealized (Losses)	Fair Value	Gross Unrealized (Losses)	Fair Value	Gross Unrealized (Losses)
Investments:						
Certificates of deposit	$ 2,118	$ (42)	$ 4,146	$ (133)	$ 6,264	$ (175)
Corporate bonds	—	—	4,842	(128)	4,842	(128)
Total in loss position	$ 2,118	$ (42)	$ 8,988	$ (261)	$ 11,106	$ (303)

The following table summarizes the fair value and gross unrealized losses related to available-for-sale debt securities, aggregated by investment category and length of time that individual debt securities have been in a continuous unrealized loss position as of December 31, 2021 (in thousands):

As of December 31, 2021	In Loss Position < 12 months		In Loss Position > 12 months		Total In Loss Position	
	Fair Value	Gross Unrealized (Loss)	Fair Value	Gross Unrealized (Loss)	Fair Value	Gross Unrealized (Loss)
Investments:						
Certificates of deposit	$ 6,181	$ (19)	$ —	$ —	$ 6,181	$ (19)
Corporate bonds	5,970	(42)	2,013	(4)	7,983	(46)
Total in loss position	$ 12,151	$ (61)	$ 2,013	$ (4)	$ 14,164	$ (65)

Investments in Privately-held Raw Material Companies

We have made strategic investments in private companies located in China in order to gain access at a competitive cost to raw materials that are critical to our substrate business (see Note 6). The investment balances for the non-consolidated companies, are accounted for under the equity method and included in “Other assets” in the consolidated balance sheets and totaled $14.6 million and $10.2 million as of December 31, 2022 and 2021, respectively. As of December 31, 2022 and 2021, there were six and five companies accounted for under the equity method, respectively.

Fair Value Measurements

We invest primarily in money market accounts, certificates of deposit, corporate bonds and notes, and government securities. ASC Topic 820, *Fair Value Measurements and Disclosures* (“ASC 820”), establishes three levels of inputs that may be used to measure fair value. Level 1 instrument valuations are obtained from real-time quotes for transactions in active exchange markets of the asset or identical assets. Level 2 instrument valuations are obtained from readily-available, observable pricing sources for comparable instruments. Level 3 instrument valuations are obtained from unobservable inputs in which there is little or no market data, which require us to develop our own assumptions. On a recurring basis, we measure certain financial assets and liabilities at fair value, primarily consisting of our short-term and long-term debt investments.

The type of instrument valued based on quoted market prices in active markets include our money market funds, which are generally classified within Level 1 of the fair value hierarchy. We classify our available-for-sale debt securities including certificates of deposit and corporate bonds as having Level 2 inputs. The valuation techniques used to measure the fair value of these financial instruments having Level 2 inputs were derived from bank statements, quoted market prices, broker or dealer statements or quotations, or alternative pricing sources with reasonable levels of price transparency. There were no changes in valuation techniques or related inputs in the year ended December 31, 2022.

There have been no transfers between fair value measurement levels during the years ended December 31, 2022 and 2021.

We place short-term foreign currency hedges that are intended to offset the potential cash exposure related to fluctuations in the exchange rate between the United States dollar and Japanese yen. We measure the fair value of these foreign currency hedges at each month end and quarter end using current exchange rates and in accordance with generally accepted accounting principles. At quarter end any foreign currency hedges not settled are netted in “Accrued liabilities” on the consolidated balance sheets and classified as Level 3 assets and liabilities. As of December 31, 2022, the net change in fair value from the placement of the hedge to settlement at each month end during the quarter had a de minimis impact to the consolidated results.

The following table summarizes our financial assets and liabilities measured at fair value on a recurring basis in accordance with ASC 820 as of December 31, 2022 (in thousands):

	Balance as of December 31, 2022	Quoted Prices in Active Markets of Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Investments:				
Certificates of deposit	$ 6,265	$ —	$ 6,265	$ —
Corporate bonds	5,192	—	5,192	—
Total	$ 11,457	$ —	$ 11,457	$ —

The following table summarizes our financial assets and liabilities measured at fair value on a recurring basis in accordance with ASC 820 as of December 31, 2021 (in thousands):

	Balance as of December 31, 2021	Quoted Prices in Active Markets of Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Investments:				
Certificates of deposit	$ 6,661	$ —	$ 6,661	$ —
Corporate bonds	8,334	—	8,334	—
Total	$ 14,995	$ —	$ 14,995	$ —

Items Measured at Fair Value on a Nonrecurring Basis

Certain assets that are subject to nonrecurring fair value measurements are not included in the table above. These assets include investments in privately-held companies accounted for by equity and cost method (See Note 6). We had no impairment charges for 2022, 2021 and 2020.

Note 3. Inventories

The components of inventory are summarized below (in thousands):

	December 31, 2022	December 31, 2021
Inventories:		
Raw materials	$ 46,476	$ 29,658
Work in process	39,956	32,605
Finished goods	3,197	3,649
	$ 89,629	$ 65,912

As of December 31, 2022 and 2021, carrying values of inventories were net of inventory reserves of $24.7 million and $19.6 million, respectively, for excess and obsolete inventory and $47,000 and $66,000, respectively, for lower of cost or net realizable value reserves.

Note 4. Related Party Transactions

ChaoYang Tongmei purchases raw materials from one of our equity investments, Donghai County Dongfang High Purity Electronic Materials Co., Ltd. for production in the ordinary course of business. As of December 31, 2022 and 2021, amounts payable of $103,000 and $112,000, respectively, were included in "Accounts payable" in our consolidated balance sheets.

In November 2017, our consolidated joint venture, BoYu, provided a personal loan of $291,000 to one of its executive employees. This loan bears interest at 2.75% per annum. Principal and accrued interest are due on November 30, 2020. In May 2019, BoYu provided another personal loan of $146,000 to the same executive employee. This loan bears interest at 2.75% per annum. Principal and accrued interest are due at such time BoYu pays a dividend to its shareholders. In March 2020, BoYu provided another personal loan of $141,000 to the same executive employee. This loan bears interest at 2.75% per annum. Principal and accrued interest are due on December 31, 2024. On December 25, 2020, the executive repaid the principal of $612,000 and interest of $35,000 of the personal loans to BoYu. As of December 31, 2022 and 2021, the balances, including both principal and accrued interest, were $0, and $0, respectively, and included in "Other assets" in our consolidated balance sheets.

In September 2021 and October 2021, our consolidated subsidiary, ChaoYang XinMei received funding from a minority investor of $0.9 million and $1.0 million, respectively. As of December 31, 2021, $1.9 million was included in short-term loan from noncontrolling interest in our consolidated balance sheets. In December 2021 and January 2022, the same subsidiary received funding from Tongmei of $1.4 million and $1.4 million, respectively. In January 2022, the China local government certified this additional funding in ChaoYang XinMei as an equity investment. As a result, noncontrolling interests increased $2.2 million and redeemable noncontrolling interests increased $0.2 million. Short-term loan from noncontrolling interest decreased to $0. In April 2022, Tongmei entered into the Capital Increase Agreement with minority investors to further invest $4.5 million in ChaoYang XinMei. In April 2022 and May 2022, ChaoYang XinMei received funding from Tongmei of $1.1 million and $0.8 million, respectively, as equity investments. In April 2022 and May 2022, the minority investors invested $0.7 million and $0.6 million, respectively. As a result, noncontrolling interests increased $1.4 million and redeemable noncontrolling interests increased $0.1 million. Tongmei's ownership remained at 58.5% after these equity investments. In July 2022, Tongmei and the minority investors further invested $0.8 million and $0.6 million in ChaoYang XinMei, respectively. This completed the investment obligations under the Capital Increase Agreement. As a result, noncontrolling interests increased $610,000 and redeemable noncontrolling interests increased $57,000. Tongmei's ownership remained at 58.5% after the July 2022 equity investment.

In September 2022, our consolidated subsidiary, ChaoYang LiMei completed the sale of land and its attached buildings to our equity investment entity, ChaoYang KaiMei, for a total consideration of $1.5 million. As of December 31, 2022, $1.5 million was included in "Prepaid expenses and other current assets" in our consolidated balance sheets.

Our Related Party Transactions Policy seeks to prohibit all conflicts of interest in transactions between related parties and us, unless they have been approved by our Board of Directors. This policy applies to all of our employees, directors, and our consolidated subsidiaries. Our executive officers retain board seats on the Board of Directors of the companies in which we have invested in our China joint ventures. See Note 6 for further details.

Note 5. Property, Plant and Equipment, Net

The components of our property, plant and equipment are summarized below (in thousands):

	December 31, 2022	December 31, 2021
Property, plant and equipment:		
Machinery and equipment, at cost	$ 62,797	$ 59,284
Less: accumulated depreciation and amortization	(38,477)	(40,292)
Building, at cost	118,550	108,782
Less: accumulated depreciation and amortization	(20,403)	(18,710)
Leasehold improvements, at cost	7,430	7,039
Less: accumulated depreciation and amortization	(5,559)	(5,352)
Construction in progress	36,679	31,664
	$ 161,017	$ 142,415

As of December 31, 2022, the balance of construction in progress was $36.7 million, of which $27.2 million was related to our buildings in our Dingxing and Kazuo locations, $5.4 million was for manufacturing equipment purchases not yet placed in service and $4.1 million was from our construction in progress for our other consolidated subsidiaries. As of December 31, 2021, the balance of construction in progress was $31.7 million, of which $22.7 million was related to our buildings in our Dingxing and Kazuo locations, $3.0 million was for manufacturing equipment purchases not yet placed in service and $6.0 million was from our construction in progress for our other consolidated subsidiaries.

Depreciation and amortization expense was $8.1 million, $7.1 million and $4.3 million for the years ended December 31, 2022, 2021 and 2020, respectively.

Note 6. Investments in Privately-held Raw Material Companies

We have made strategic investments in private companies located in China in order to gain access at a competitive cost to raw materials that are critical to our substrate business. These companies form part of our overall supply chain.

The investments are summarized below (in thousands):

Company	Investment Balance as of December 31, 2022	Investment Balance as of December 31, 2021	Accounting Method	Ownership Percentage *
Nanjing JinMei Gallium Co., Ltd.	$ 592	$ 592	Consolidated	**85.5 %
ChaoYang JinMei Gallium Co., Ltd.	1,820	1,820	Consolidated	**85.5 %
Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd.	1,346	1,346	Consolidated	**85.5 %
ChaoYang ShuoMei High Purity Semiconductor Materials Co., Ltd.	1,000	—	Consolidated	****75.0 %
ChaoYang XinMei High Purity Semiconductor Materials Co., Ltd.	7,331	1,814	Consolidated	***58.5 %
	$ 12,089	$ 5,572		
Donghai County Dongfang High Purity Electronic Materials Co., Ltd.	$ 1,887	$ 2,053	Equity	**46 %
Beijing JiYa Semiconductor Material Co., Ltd.	6,381	3,760	Equity	39 %
Xilingol Tongli Germanium Co., Ltd.	—	—	Equity	25 %
Xiaoyi XingAn Gallium Co., Ltd.	5,094	4,095	Equity	**25 %
ChaoYang KaiMei Quartz Co., Ltd.	827	—	Equity	*****40 %
Emeishan Jia Mei High Purity Metals Co., Ltd.	418	258	Equity	25 %
	$ 14,607	$ 10,166		

* These percentages reflect the ownership currently in effect upon the completion of the reorganization in China and the ownership in effect upon the completion of the new capital funding by private equity investors in January 2021.

** In preparation for Tongmei's application for a listing of shares in an IPO on the STAR Market, in late December 2020 we reorganized our entity structures in China. JinMei and BoYu and its subsidiaries, previously organized under AXT, Inc., were assigned to Tongmei and effectively merged with Tongmei although they retained their own respective legal entity status and are wholly owned subsidiaries of Tongmei. The 33% minority interest stakeholders of BoYu converted their ownership to a 7.59% minority interest in Tongmei. The 8.5% minority interest stakeholders, employees of JinMei, converted their ownership to a 0.38% minority interest in Tongmei. Further, a number of employees, key managers and contributors, purchased a 0.4% minority interest in Tongmei. In 2020, the Investors transferred approximately $48.1 million of new capital to Tongmei. An additional investment of approximately $1.5 million of new capital was funded in early January 2021. Under China regulations these investments must be formally approved by the appropriate government agency and are not deemed to be dilutive until such approval is granted. The government approved the approximately $49 million investment in its entirety on January 25, 2021 at which time the Investors owned a redeemable noncontrolling interest in Tongmei of 7.28%. As of December 31, 2022, Tongmei's noncontrolling interests and redeemable noncontrolling interests totaled approximately 14.5%. AXT remains the controlling stakeholder of Tongmei and holds a majority of the Board of Director positions of Tongmei.

*** In February 2021, Tongmei signed a joint venture agreement with certain investors to fund ChaoYang XinMei.

**** In April 2022, ChaoYang JinMei signed a joint venture agreement with certain investor to fund a new company, ChaoYang ShuoMei.

***** In April 2022, Tongmei signed a joint venture agreement with certain investors to fund a new company, ChaoYang KaiMei.

Before August 1, 2020, our ownership of ChaoYang JinMei was 100%. In August 2020, we sold an 8.5% ownership interest to current members of the ChaoYang JinMei management team for approximately $396,000. As a result, our ownership of ChaoYang JinMei decreased from 100% to 91.5%. As of August 2020, we referred to

ChaoYang JinMei as a significantly controlled subsidiary instead of a wholly owned subsidiary. Our Chief Executive Officer is chairman of the JinMei board and we have appointed two other representatives to serve on the JinMei board.

In December 2020, we purchased shares equivalent to 4% of BoYu from the same third-party investor for $1.6 million. As a result, our ownership of BoYu increased from 63% to 67%. We continue to consolidate BoYu as we have a controlling financial interest and have majority control of the board and accordingly no gain was recognized as a result of this equity transaction. Our Chief Executive Officer is chairman of the BoYu board and we have appointed two other representatives to serve on the board.

An additional step in the STAR Market IPO process involves certain entity reorganizations and alignment of assets under Tongmei. In this regard our two consolidated raw material companies, JinMei and BoYu and its subsidiaries, were assigned to Tongmei in December 2020. This will increase the number of customers and employees attributable to Tongmei as well as increase Tongmei's consolidated revenue.

Although we have representation on the board of directors of each of the privately held raw material companies, the daily operations of each of these companies are managed by local management and not by us. Decisions concerning their respective short-term strategy and operations, ordinary course of business capital expenditures and sales of finished product, are made by local management with regular guidance and input from us.

For AXT's minority investment entities that are not consolidated, the investment balances are included in "Other assets" in our consolidated balance sheets and totaled $14.6 million and $10.2 million as of December 31, 2022 and 2021, respectively. Our respective ownership interests in each of these companies are 46%, 40%, 39%, 25%, 25% and 25%. These minority investment entities are not considered variable interest entities because:

- all minority investment entities have sustainable businesses of their own;
- our voting power is proportionate to our ownership interests;
- we only recognize our respective share of the losses and/or residual returns generated by the companies if they occur; and
- we do not have controlling financial interest in, do not maintain operational or management control of, do not control the board of directors of, and are not required to provide additional investment or financial support to any of these companies.

Occasionally, one of our PRC subsidiaries or PRC raw material joint ventures declares and pays a dividend. These dividends generally occur when the PRC joint venture declares a dividend for all of its shareholders. Dividends paid to the Company are subject to a 10% PRC withholding tax. The Company is required to obtain approval from the State Administration of Foreign Exchange ("SAFE") to transfer funds in or out of the PRC. SAFE requires a valid agreement to approve the transfers, which are processed through a bank. Other than PRC foreign exchange restrictions, the Company is not subject to any PRC restrictions and limitations on its ability to distribute earnings from its businesses, including its PRC subsidiaries and PRC joint ventures, to the Company and its investors as well as the ability to settle amounts owed by the Company to its PRC subsidiaries and PRC joint ventures. If SAFE approval is denied the dividend payable to the Company would be owed but would not be paid.

For the years ended December 31, 2022, 2021 and 2020, the aggregate dividends paid to us, directly or to an intermediate entity within our corporate structure, by our PRC subsidiaries and PRC raw material joint ventures were approximately $2.9 million, $774,000 and $0, respectively. In June 2022, July 2022 and August 2022, we received a dividend of $1.3 million from BoYu, $1.5 million from one of our equity investments, Xiaoyi XingAn Gallium Co., Ltd. ("Xiaoyi XingAn") and $0.1 million from JiYa Semiconductor Material Co. Ltd., respectively. In June 2021, we received a dividend of $774,000, from one of our equity investments, Xiaoyi XingAn. For the years ended December 31, 2022 and 2021, the aggregate dividends paid to minority shareholders by our PRC subsidiaries and PRC raw material joint ventures were approximately $0 and $0, respectively. All of these distributions were paid to the PRC companies and the minority shareholders.

AXT's minority investment entities are not consolidated and are accounted for under the equity method. Excluding one fully impaired entity, the equity entities had the following summarized income information (in thousands) for the years ended December 31, 2022, 2021 and 2020, respectively:

	Year Ended December 31,			Our share for the Year Ended December 31,		
	2022	2021	2020	2022	2021	2020
Net revenue	$ 48,139	$ 35,939	$ 20,049	$ 15,031	$ 11,424	$ 6,252
Gross profit	27,000	17,465	4,907	8,229	5,482	1,504
Operating income	24,987	14,293	1,957	7,532	4,495	504
Net income	19,104	12,560	1,014	5,957	4,409	111

Excluding one fully impaired entity, these minority investment entities that are not consolidated, but rather are accounted for under the equity method, had the following summarized balance sheet information (in thousands) as of December 31, 2022 and 2021, respectively:

	As of December 31,	
	2022	2021
Current assets	$ 43,091	$ 27,503
Noncurrent assets	12,520	11,707
Current liabilities	10,552	5,799
Noncurrent liabilities	—	—

Our portion of the income and losses, including impairment charges, from these minority investment entities that are not consolidated and are accounted for under the equity method was an income of $6.0 million, $4.4 million and $0.1 million for the years ended December 31, 2022, 2021 and 2020, respectively. Excluding one fully impaired entity, undistributed retained earnings relating to our investments in these minority investment entities amounted to $9.2 million and $5.0 million as of December 31, 2022 and 2021, respectively.

Note 7. Balance Sheets Details

Other Assets

The components of other assets are summarized below (in thousands):

	As of December 31,	
	2022	2021
Equity method investments	$ 14,607	$ 10,166
Value added tax receivable, long term	1,632	959
Other intangible assets	1,926	2,107
Deferred tax assets	2,236	2,340
Other assets	1,230	2,369
	$ 21,631	$ 17,941

Accrued Liabilities

The components of accrued liabilities are summarized below (in thousands):

	As of December 31, 2022	As of December 31, 2021
Accrued compensation and related charges	$ 4,774	$ 5,115
Payable in connection with construction in progress	4,135	2,974
Preferred stock dividends payable	2,901	2,901
Accrued professional services	930	880
Other tax payable	867	392
Accrued income taxes	729	539
Accrued product warranty	669	743
Current portion of operating lease liabilities	485	488
Advances from customers	338	946
Other personnel-related costs	291	279
Accrual for sales returns	112	48
Other accrued liabilities	1,933	1,752
	$ 18,164	$ 17,057

Note 8. Bank Loans and Line of Credit

Our bank loans and credit facilities typically have a term of 12 months or less and are included in “Bank loan” in our consolidated balance sheets. The following table represents bank loans as of December 31, 2022 and 2021 (in thousands, except interest rate data):

Subsidiary	Bank	Loan Detail	Interest Rate	Start Date	Due Date	December 31, 2021	December 31, 2022
Tongmei	Bank of China (1)	$ 1,405	3.9 %	September-21	March-22	$ 1,573	$ -
		1,050	3.9 %	September-21	March-22	1,220	-
		3,935	4.6 %	January-22	January-23	-	4,059
		2,108	2.7 %	September-22	March-23	-	2,175
		1,405	4.2 %	April-22	April-23	-	1,450
	Bank of Communications (2)	2,811	4.0 %	September-21	September-22	3,144	-
		1,405	4.0 %	November-21	November-22	1,573	-
		1,405	3.3 %	January-22	January-23	-	1,450
		1,405	3.3 %	January-22	January-23	-	1,450
	Bank of Communications (5)	1,450	3.3 %	December-22	December-23	-	1,450
	China Merchants Bank (3)	1,405	3.6 %	December-21	December-22	1,573	-
	China Merchants Bank (5)	1,405	4.2 %	December-21	December-22	1,573	-
	Bank of Beijing (4)	3,192	4.2 %	May-22	May-23	-	3,292
	Industrial Bank (5)	5,621	4.4 %	June-22	June-23	-	5,798
		2,811	4.4 %	September-22	September-23	-	2,900
	NingBo Bank (5)	1,405	4.8 %	June-22	June-23	-	1,450
		1,405	4.8 %	August-22	August-23	-	1,450
		1,405	4.8 %	September-22	September-23	-	1,450
		1,406	4.5 %	November-22	November-23	-	1,450
		2,900	4.5 %	December-22	December-23	-	2,900
	Industrial and Commercial Bank of China (5)	5,621	3.2 %	September-22	July-23	-	5,800
	NanJing Bank (5)	2,811	4.3 %	September-22	September-23	-	2,899
		1,265	4.3 %	November-22	November-23	-	1,305
BoYu	Industrial and Commercial Bank of China (6)	1,405	3.9 %	December-21	December-22	1,573	-
		1,450	2.8 %	December-22	December-23	-	1,450
	NingBo Bank (5)	703	4.8 %	September-22	March-23	-	725
		1,406	3.6 %	November-22	May-23	-	1,450
		$ 725	4.8 %	December-22	June-23	-	725
	Loan Balance					$ **12,229**	$ **47,078**

Collateral for the above bank loans and line of credit

(1) Baoding Tongmei's land use rights and all of its buildings located at its facility in Dingxing, China.
(2) ChaoYang Tongmei's land use rights and all of its buildings located at its facility in Kazuo, China.
(3) Beijing Capital Financing Guarantee Co., Ltd. in exchange for the guarantee fee of 1.5% of the loan amount.
(4) AXT time deposit.
(5) Not collateralized.
(6) BoYu's land use rights and its building located at its facility in Tianjin, China and BoYu's accounts receivable. In addition, the December 2022 loan attracts a guarantee fee amounting to 1.78% of the loan amount.

Note 9. Stockholders' Equity and Stock Repurchase Program

Stockholders' Equity

The 883,000 shares of $0.001 par value Series A preferred stock issued and outstanding as of December 31, 2022 and 2021, valued at $3,532,000 are non-voting and non-convertible preferred stock with a 5.0% cumulative annual dividend rate payable when declared by the Board of Directors and $4 per share liquidation preference over common stock, and must be paid before any distribution is made to common stockholders. These preferred shares were issued to Lyte Optronics, Inc. stockholders in connection with the completion of our acquisition of Lyte Optronics, Inc. on May 28, 1999.

Changes in AXT, Inc.'s ownership interest in consolidated subsidiaries

The effects of changes in the Company's ownership interests in its less than 100% owned subsidiaries on the Company's equity are as follows:

	As of December 31,	
	2022	2021
Net income attributable to AXT, Inc.	$ 15,811	$ 14,575
Decrease in additional paid-in capital for:		
Investment in subsidiary with noncontrolling interest	(937)	—
Purchase of subsidiary shares from noncontrolling interests	—	(2,691)
Formation of new subsidiary with noncontrolling interests	—	(262)
Adjustment to noncontrolling interests in connection with the reorganization and alignment of assets under Tongmei	—	(1,229)
Changes in AXT, Inc.'s ownership interests in consolidated subsidiaries	—	(1,241)
Net transfers to noncontrolling interests	(937)	(5,423)
Change from net income attributable to AXT, Inc., net of transfers to noncontrolling interests	$ 14,874	$ 9,152

Stock Repurchase Program

On October 27, 2014, our Board of Directors approved a stock repurchase program pursuant to which we may repurchase up to $5.0 million of our outstanding common stock. These repurchases can be made from time to time in the open market and are funded from our existing cash balances and cash generated from operations. During 2015, we repurchased approximately 908,000 shares at an average price of $2.52 per share for a total purchase price of approximately $2.3 million under the stock repurchase program. No shares were repurchased during 2022, 2021 and 2020 under this program. As of December 31, 2022, approximately $2.7 million remained available for future repurchases under this program.

By the terms of the Series A preferred stock, so long as any shares of Series A preferred stock are outstanding, neither the Company nor any subsidiary of the Company shall redeem, repurchase or otherwise acquire any shares of common stock, unless all accrued dividends on the Series A preferred stock have been paid. During 2013 and 2015, we repurchased shares of our outstanding common stock. As of December 31, 2015, the Series A preferred stock had cumulative dividends of $2.9 million and we included this amount in "Accrued liabilities" in our consolidated balance sheets. In 2022, 2021 and 2020, we did not repurchase any of our outstanding common stock. If we are required to pay the cumulative dividends on the Series A preferred stock, our cash and cash equivalents would be reduced. We account for the cumulative year to date dividends on the Series A preferred stock when calculating our earnings per share.

Note 10. Employee Benefit Plans and Stock-based Compensation

Stock Option Plans and Equity Incentive Plans

In May 2007, our stockholders approved our 2007 Equity Incentive Plan (the “2007 Plan”), which provides for the grant of incentive and non-qualified stock options to our employees, consultants and directors. The 2007 Plan is a restatement of the 1997 Stock Option Plan which expired in 2007. The 1,928,994 share reserve of the 1997 Stock Option Plan became the reserve of the 2007 Plan, together with 1,300,000 additional shares approved for issuance under the 2007 Plan. In May 2013, the stockholders approved an additional 2,000,000 shares to be issued under the 2007 plan. Awards may be made under the 2007 Plan are stock options, stock appreciation rights, restricted stock, restricted stock units, performance shares, performance units, deferred compensation awards and other stock-based awards. Stock options and stock appreciation rights awarded under the 2007 Plan may not be repriced without stockholder approval. Stock options and stock appreciation rights may not be granted below fair market value. Stock options or stock appreciation rights generally shall not be fully vested over a period of less than three years from the date of grant and cannot be exercised more than 10 years from the date of grant. Restricted stock, restricted stock units, and performance awards generally shall not vest faster than over a three-year period (or a twelve-month period if vesting is based on a performance measure). In December 2008, the 2007 Plan was amended to comply with the applicable requirements under Section 409A of the Internal Revenue Code.

In May 2015, our stockholders approved our 2015 Equity Incentive Plan (the “2015 Plan”). The 2015 Plan is a replacement of the 2007 Plan. The 399,562 share reserve of the 2007 Plan became the reserve of the 2015 Plan, together with 3,000,000 additional shares approved for issuance under the 2015 Plan. In May 2019, our stockholders approved 1,600,000 of additional shares for issuance under the 2015 Plan. In May 2021, our stockholders approved 3,600,000 of additional shares for issuance under the 2015 Plan. Awards that may be made under the 2015 Plan are stock options, stock appreciation rights, restricted stock, restricted stock units, performance shares, performance units, deferred compensation awards and other stock-based awards. Stock options and stock appreciation rights awarded under the 2015 Plan may not be repriced without stockholder approval. Stock options and stock appreciation rights may not be granted below fair market value. Stock options or stock appreciation rights generally shall not be fully vested over a period of less than four years from the date of grant and cannot be exercised more than 10 years from the date of grant. Restricted stock, restricted stock units, and performance awards generally shall not vest faster than over a three-year period (or a twelve-month period if vesting is based on a performance measure). However, options granted to consultants and restricted stock awards granted to independent board members typically vest in one year and the 2015 Plan does allow for similar vesting to employees. As of December 31, 2022, approximately 2.8 million shares were available for grant under the 2015 Plan.

Stock Options

The following table summarizes the stock option transactions for each of the years ended December 31, 2020, 2021 and 2022 (in thousands, except per share data):

Stock Options	Number of Options Outstanding	Weighted-average Exercise Price	Weighted-average Remaining Contractual Life (in years)	Aggregate Intrinsic Value
Balance as of January 1, 2020	2,953	$ 4.00	5.95	$ 3,040
Granted	—	—		
Exercised	(905)	2.80		
Canceled and expired	(163)	5.85		
Balance as of December 31, 2020	1,885	$ 4.42	6.17	$ 9,713
Granted	—	—		
Exercised	(507)	3.30		
Canceled and expired	—	—		
Balance as of December 31, 2021	1,378	$ 4.83	5.60	$ 5,573
Granted	—	—		
Exercised	(172)	3.02		
Canceled and expired	—	—		
Balance as of December 31, 2022	1,206	$ 5.09	5.08	$ 630
Options vested as of December 31, 2022 and unvested options expected to vest, net of forfeitures	1,206	$ 5.09	5.08	$ 629
Options exercisable as of December 31, 2022	1,083	$ 5.32	4.87	$ 467

The options outstanding and exercisable as of December 31, 2022 were in the following exercise price ranges (in thousands, except per share data):

	Options Outstanding as of December 31, 2022			Options Vested and Exercisable as of December 31, 2022	
Range of Exercise Price	Shares	Weighted-average Exercise Price	Weighted-average Remaining Contractual Life	Shares	Weighted-Average Exercise Price
$ 2.14 - $ 2.14	8	$ 2.14	1.33	8	$ 2.14
$ 2.18 - $ 2.18	56	$ 2.18	2.83	56	$ 2.18
$ 2.36 - $ 2.36	1	$ 2.36	0.84	1	$ 2.36
$ 2.47 - $ 2.47	17	$ 2.47	1.84	17	$ 2.47
$ 2.56 - $ 2.56	11	$ 2.56	3.01	11	$ 2.56
$ 3.06 - $ 3.06	329	$ 3.06	6.85	206	$ 3.06
$ 5.21 - $ 5.21	355	$ 5.21	3.82	355	$ 5.21
$ 5.77 - $ 5.77	245	$ 5.77	5.85	245	$ 5.77
$ 7.95 - $ 7.95	60	$ 7.95	4.08	60	$ 7.95
$ 9.50 - $ 9.50	124	$ 9.50	4.82	124	$ 9.50
	1,206	$ 5.09	5.08	1,083	$ 5.32

There were 172,000, 507,000 and 905,000 options exercised in the years ended December 31, 2022, 2021 and 2020, respectively. The total intrinsic value of options exercised for the years ended December 31, 2022, 2021 and 2020, was $0.8 million, $3.7 million and $3.2 million, respectively.

As of December 31, 2022, the unamortized compensation costs related to unvested stock options granted to employees under our 2015 plan was approximately $0.2 million, net of estimated forfeitures of $16,000. These costs will be amortized on a straight-line basis over a weighted-average period of approximately 0.9 years and will be adjusted for subsequent changes in estimated forfeitures. We did not capitalize any stock-based compensation to inventory as of December 31, 2022 and 2021, as the amount was insignificant.

Restricted Stock Awards

A summary of activity related to restricted stock awards for the years ended December 31, 2020, 2021 and 2022 is presented below (in thousands, except per share data):

Stock Awards	Shares		Weighted-Average Grant Date Share Value
Non-vested as of January 1, 2020	939	$	5.02
Granted	443	$	5.94
Vested	(347)	$	5.44
Forfeited	(13)	$	5.54
Non-vested as of December 31, 2020	1,022	$	5.27
Granted	274	$	9.07
Vested	(407)	$	5.70
Forfeited	(14)	$	5.38
Non-vested as of December 31, 2021	875	$	6.26
Granted	513	$	4.67
Vested	(387)	$	6.01
Forfeited	(17)	$	5.34
Non-vested as of December 31, 2022	984	$	5.55

Total fair value of stock awards vested during the years ended December 31, 2022, 2021 and 2020 was $2.3 million, $3.8 million and $1.9 million, respectively. As of December 31, 2022, we had $4.8 million of unrecognized compensation expense related to restricted stock awards, which will be recognized over the weighted average period of 1.6 years.

At-Risk, Performance Shares

In February 2021 and 2022, the Company issued at-risk, performance shares classified as equity awards. Expense is recognized quarterly on a straight-line method over the requisite service period, based on the probability of achieving the specified financial performance metric, with changes in expectations recognized as an adjustment to earnings in the period of change. Compensation cost is not recognized for at-risk, performance shares that do not vest because service or performance conditions are not satisfied and any previously recognized compensation cost is reversed. At-risk, performance shares are eligible to receive dividend equivalents under the Company's 2015 Equity Incentive Plan (the “Plan”), as determined by the Board of Directors. The Company will recognize forfeitures as they occur.

The Company's at-risk, performance shares are classified as equity and contain performance and service conditions that must be satisfied for an employee to receive the shares. The financial performance metric for the at-risk, performance shares issued in February 2021 is based upon year-end 2020 actual results as compared to the Company’s year-end actual results in 2021. The financial performance metric for the at-risk, performance shares issued in February 2022 is based upon year-end 2021 actual results as compared to the Company’s year-end actual results in 2022. All performance shares, if earned, are still subject to annual vesting over a four-year period except that no shares are vested on the first anniversary because the performance measurement is based on year-end results for the year 2021 and 2022, respectively.

The fair value of the at-risk, performance shares is determined based on the closing price of the Company’s common stock on the first day after the public issuance of the Company’s earnings release for the most recent fiscal quarter, following the Compensation Committee and Board of Directors approval, which is considered the grant date. The fair value per share of the at-risk, performance shares classified as equity awards granted in February 2021 and 2022 was $15.37 and $7.83, respectively.

On February 17, 2021, the Compensation Committee recommended, and the Board approved, the grant to Dr. Morris Young, our Chief Executive Officer, of 113,130 at-risk, performance shares under the Plan. On February 17, 2021, the Compensation Committee approved the grant to Gary Fischer, our Chief Financial Officer and Corporate Secretary, of 38,475 at-risk, performance shares under the Plan. On March 14, 2022, the Compensation Committee met and certified that the year-over-year annual revenue growth rate achieved for fiscal year 2021, expressed as a percentage, was 44%. Therefore, all of the at-risk performance shares became eligible to vest.

On February 15, 2022, the Compensation Committee recommended, and the Board approved, the grant to Dr. Morris Young of 114,320 at-risk, performance shares under the Plan. On February 15, 2022, the Compensation Committee approved the grant to Gary Fischer of 32,100 at-risk, performance shares under the Plan. If the performance financial metric is less than 50% achieved these shares are forfeited. If the performance financial metric is between 50% and 200% achieved, then a corresponding pro rata portion of the 114,320 shares issued to Dr. Young would be eligible to vest and a corresponding pro rata portion of the 32,100 shares issued to Mr. Fischer would be eligible to vest. Any shares that are not eligible to vest are forfeited. If the target financial metric exceeds 200%, then the maximum number of at-risk performance shares that would be eligible to vest is 114,320 for Dr. Young and 32,100 for Mr. Fischer. On February 14, 2023, the Compensation Committee met and certified the year-over-year annual revenue growth rate achieved for fiscal year 2022, expressed as a percentage, was 2.7%. Therefore, none of the at-risk performance shares became eligible to vest.

A summary of the status of our unvested at-risk, performance shares as of December 31, 2022 is presented below (in thousands, except per share data):

Stock Awards	Shares		Weighted-Average Grant Date Share Value
Non-vested as of January 1, 2021	—	$	
Granted	152 *	$	15.37
Vested	(38)	$	15.37
Forfeited	—	$	—
Non-vested as of December 31, 2021	114	$	15.37
Granted	74	$	7.83
Vested	(76)	$	15.37
Forfeited	(74)	$	7.83
Non-vested as of December 31, 2022	38	$	15.37

**The number of share presented is based on achieving 150% of the targeted financial performance metric as defined in the at-risk, performance shares agreement.*

As of December 31, 2022, there was $0.5 million of unrecognized compensation expense related to unvested at-risk, performance shares that is expected to be recognized over a weighted-average period of 1.4 years.

Common Stock

The following number of shares of common stock were reserved and available for future issuance as of December 31, 2022 (in thousands, except per share data):

Options outstanding	1,206
Restricted stock awards outstanding	1,022
Stock available for future grant: 2015 Equity Incentive Plan	2,800
Total	5,028

Stock-based Compensation

We recorded $4.0 million, $4.5 million and $2.6 million of stock-based compensation in our consolidated statements of operations for the years ended December 31, 2022, 2021 and 2020, respectively. The following table summarizes compensation costs related to our stock-based compensation awards (in thousands, except per share data):

	Year Ended December 31,		
	2022	2021	2020
Cost of revenue	$ 379	$ 368	$ 116
Selling, general and administrative	2,947	3,514	2,000
Research and development	680	637	507
Net effect on net income	$ 4,006	$ 4,519	$ 2,623
Shares used in computing basic net income per share	42,104	41,367	40,152
Shares used in computing diluted net income per share	42,715	42,720	41,025
Effect on basic net income per share	$ 0.10	$ 0.11	$ 0.07
Effect on diluted net income per share	$ 0.09	$ 0.11	$ 0.06

We estimate the fair value of stock options using a Black-Scholes option pricing model. There were no stock options granted during 2022, 2021 and 2020.

The expected term for stock options is based on the observed historical option exercise behavior and post-vesting forfeitures of options by our employees, and the contractual term, the vesting period and the expected term of the outstanding options. Expected volatility is based on the historical volatility of our common stock. The dividend yield of zero is based on the fact that we have never paid cash dividends and have no present intention to pay cash dividends. The risk-free interest rates are taken from the Daily Federal Yield Curve Rates as of the grant dates as published by the Federal Reserve and represent the yields on actively traded Treasury securities for terms equal to the expected term of the options.

Retirement Savings Plan

We have a 401(k) Savings Plan ("Savings Plan") which qualifies as a thrift plan under Section 401(k) of the Internal Revenue Code. All full-time U.S. employees are eligible to participate in the Savings Plan after 90 days from the date of hire. Employees may elect to reduce their current compensation by up to the statutory prescribed annual limit and have the amount of such reduction contributed to the 401(k) Plan. We provide matching to employee contributions up to 4% of the employees' base pay if employees contribute at least 6% of their base pay. If the contribution rate is less than 6% of the base pay, the matching percentage is prorated. Our contributions to the Savings Plan were $191,000, $208,000 and $188,000 for the years ended December 31, 2022, 2021 and 2020, respectively.

Note 11. Guarantees

Indemnification Agreements

We have entered into indemnification agreements with our directors and officers that require us to indemnify our directors and officers against liabilities that may arise by reason of their status or service as directors or officers, other than liabilities arising from willful misconduct of a culpable nature; to advance their expenses incurred as a result of any proceeding against them as to which they could be indemnified; and to obtain directors' and officers' insurance if available on reasonable terms, which we currently have in place.

Product Warranty

We provide warranties for our products for a specific period of time, generally twelve months, against material defects. We provide for the estimated future costs of warranty obligations in cost of sales when the related revenue is recognized. The accrued warranty costs represent the best estimate at the time of sale of the total costs that we expect to incur to repair or replace product parts that fail while still under warranty. The amount of accrued estimated warranty costs are primarily based on historical experience as to product failures as well as current information on repair costs. On a quarterly basis, we review the accrued balances and update the historical warranty cost trends. The following table reflects the change in our warranty accrual which is included in “Accrued liabilities” on the consolidated balance sheets, during 2022 and 2021 (in thousands):

	Year Ended December 31,	
	2022	2021
Beginning accrued product warranty	$ 743	$ 609
Accruals for warranties issued	1,024	711
Adjustments related to pre-existing warranties including expirations and changes in estimates	(286)	(100)
Cost of warranty repair	(812)	(477)
Ending accrued product warranty	$ 669	$ 743

Note 12. Income Taxes

Consolidated income before provision for income taxes was income of $20.9 million, $17.6 million and $7.1 million for the years ended December 31, 2022, 2021 and 2020, respectively. We recorded a current tax provision of $2.2 million, $1.1 million and $2.0 million for the years ended December 31, 2022, 2021 and 2020, respectively. The components of the provision for income taxes are summarized below (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Current:			
Federal	$ 848	$ 223	$ —
State	34	91	15
Foreign	918	3,119	2,016
Total current	1,800	3,433	2,031
Deferred:			
Federal	(591)	(188)	—
State	(4)	(1)	
Foreign	980	(2,151)	—
Total deferred	385	(2,340)	—
Total provision for income taxes	$ 2,185	$ 1,093	$ 2,031

A reconciliation of the effective income tax rates and the U.S. statutory federal income tax rate is summarized below:

	Year Ended December 31,		
	2022	2021	2020
Statutory federal income tax rate	21.0 %	21.0 %	21.0 %
State income taxes, net of federal tax benefits	0.1	0.4	0.2
Valuation allowance	(19.3)	(25.4)	0.8
Stock-based compensation	0.7	(3.2)	(1.9)
Foreign tax rate differential	(2.6)	(8.6)	2.1
Foreign tax incentives	(3.5)	(3.2)	(3.8)
Foreign income inclusion	18.9	10.4	7.8
Gain from sale of IP	—	16.9	—
Tax effect in equity method loss or gain from unconsolidated affiliates	(3.0)	(2.6)	1.1
Other	(1.8)	0.5	1.4
Effective tax rate	10.5 %	6.2 %	28.7 %

Deferred tax assets and liabilities are summarized below (in thousands):

	As of December 31, 2022	As of December 31, 2021
Deferred tax assets:		
Net operating loss carryforwards	$ 9,571	$ 11,275
Accruals, reserves and other	4,053	6,056
Credit carryforwards	206	358
Operating lease liability	60	125
Gross deferred tax assets	13,890	17,814
Valuation allowance	(11,885)	(15,371)
Total deferred tax assets	2,005	2,443
Deferred tax liabilities:		
Operating lease right-of-use assets	(50)	(103)
Total net deferred tax assets (included in other assets)	$ 1,955	$ 2,340

As of December 31, 2022 we have federal net operating loss ("NOL") carryforwards of approximately $31.9 million, which will begin to expire in 2025. We have California net operating loss carryforwards of approximately $21,000 as of December 31, 2022.

The deferred tax assets valuation allowance as of December 31, 2022 is attributed to U.S. federal, and state deferred tax assets, which result primarily from future deductible accruals, reserves, NOL carryforwards, and tax credit carryforwards. We believe that, based on a number of factors, the available objective evidence creates sufficient uncertainty regarding the realizability of the deferred tax assets such that a full valuation allowance has been recorded. These factors include our history of losses related to domestic operations, and the lack of carryback capacity to realize deferred tax assets. The valuation allowance decreased for the years ended December 31, 2022 and 2021 by $3.5 million and $4.4 million, respectively.

The China Enterprise Income Tax Law ("EIT") imposes a single uniform income tax rate of 25% on all Chinese enterprises. Our subsidiaries in China have qualified for a preferential 15% tax rate that is available for High and New Technology Enterprises ("HTE"). In order to retain the preferential tax rate, we must meet certain operating conditions, satisfy certain product requirements, meet certain headcount requirements and maintain certain levels of research expenditures. We realized benefits from this 10% reduction in tax rate of $0.9 million, $1.0 million and $1.0 million for 2022, 2021 and 2020, respectively. As of December 31, 2022, the favorable tax rate is still valid for the Company and it will stay the same for next year if there is no change of the business nature. The preferential tax rate that we enjoy could be modified or discontinued altogether at any time, which could materially and adversely affect our financial condition and results of operations.

Our subsidiaries in China also qualify for reduction in their taxable income in China for research and development ("R&D") expenditures. Government pre-approval is required to claim R&D tax benefits. Any R&D claim is then submitted with the annual corporate income tax for the taxing authorities' approval. Historically, we didn't record such benefit until we received the tax refund from the Chinese government. Beginning in 2019, we record the tax benefit in the year it incurs the cost rather than in the year the tax benefit is received. This will better align the costs with the tax benefit. Our consolidated subsidiaries in China have enjoyed various tax holidays since 2000. Benefits under the tax holidays vary by jurisdiction.

Utilization of the NOL and R&D credit carryforwards may be subject to a substantial annual limitation due to ownership changes that might have occurred previously or that could occur in the future, as provided by Section 382 of the Internal Revenue Code of 1986 ("Section 382"), as well as similar state provisions. Ownership changes may limit the amount of NOL and tax credit carryforwards that can be utilized to offset future taxable income and tax, respectively. In general, an ownership change, as defined by Section 382, results from transactions increasing the ownership of certain shareholders or public groups in the stock of a corporation by more than 50 percentage points over a three-year period. If there is a change of control, utilization of our NOL or tax credit carryforwards would be subject to an annual limitation under Section 382. Any limitation may result in expiration of a portion of the NOL or research and development credit carryforwards before utilization. Subsequent ownership changes could further impact the limitation in future years. Until a Section 382 study for the year-ended December 31, 2022 is completed and any limitation known, no amounts are being presented as an uncertain tax position. The Company does not believe that per Section 382 there will be a limitation on the utilization of the net operating loss and tax credit carryforwards. A full valuation allowance has been provided against our NOL carryforwards and R&D credit carryforwards and, if an adjustment is required, this adjustment would be offset by an adjustment to the valuation allowance. Thus, there would be no net impact to the consolidated balance sheets or statements of operations if an adjustment were required.

During fiscal year 2022 and 2021, the amount of gross unrecognized tax benefits was $1.1 million as of December 31, 2022 and 2021. The Company recognizes interest and penalties related to uncertain tax positions as part of the provision for income taxes. To date, such interest and penalties have not been material. All of the unrecognized tax benefit would impact the effective tax rate in future periods if recognized.

We comply with the laws, regulations, and filing requirements of all jurisdictions in which we conduct business. We regularly engage in discussions and negotiations with tax authorities regarding tax matters in various jurisdictions.

We file income tax returns in the U.S. federal, various states and foreign jurisdictions. Currently, there is no tax audit in any of the jurisdictions and we do not expect there will be any significant change to this.

On December 27, 2020, a new $900 billion Coronavirus relief bill was signed into law by the President of the United States. The bill includes updates to the Coronavirus Aid, Relief, and Economic Security Act (“CARES Act”), the Employee Social Security Deferral and the Paycheck Protection Program. The Coronavirus relief bill had a de minimis effect on our consolidated financial statements.

On August 9, 2022, Congress passed the CHIPS Act of 2022 to strengthen domestic semiconductor manufacturing, design and research, fortify the economy and national security, and reinforce America’s chip supply chains. The CHIPS Act provides for a new 25% advanced manufacturing investment credit for investments in semiconductor manufacturing and for the manufacture of certain equipment required in the semiconductor manufacturing process. Since the Company has all its manufacturing in China, the Company will not qualify for the investment credit.

On August 16, 2022, President Biden signed the Inflation Reduction Act into law. The law is intended to address inflation by paying down the national debt, lower consumer energy costs, provide incentives for the production of clean energy and reduce health care costs. The new law imposes a 1% excise tax on corporate buybacks, based on Brown’s Stock Buyback Accountability Act. The Company currently has no plans to buy back its stock. Effective for tax years beginning after December 31, 2022, the act requires corporations with over $1 billion in profits to pay a minimum tax of 15% on their adjusted financial statement income. The Company does not qualify for the Inflation Reduction Act.

Note 13. Net Income (Loss) per Share

Basic net income (loss) per share is computed using the weighted average number of common shares outstanding during the periods less shares of common stock subject to repurchase and non-vested stock awards. Diluted net income (loss) per share is computed using the weighted-average number of common shares outstanding and potentially dilutive common shares outstanding during the periods. The dilutive effect of outstanding stock options and restricted stock awards is reflected in diluted earnings per share by application of the treasury stock method. Potentially dilutive common shares consist of common shares issuable upon the exercise of stock options. Potentially dilutive common shares are excluded in net loss periods, as their effect would be anti-dilutive.

A reconciliation of the numerators and denominators of the basic and diluted net income per share calculations is as follows (in thousands, except per share data):

	Year ended December 31,		
	2022	2021	2020
Numerator:			
Net income attributable to AXT, Inc.	$ 15,811	$ 14,575	$ 3,238
Less: Preferred stock dividends	(177)	(177)	(177)
Net income available to common stockholders	$ 15,634	$ 14,398	$ 3,061
Denominator:			
Denominator for basic net income per share - weighted-average common shares	42,104	41,367	40,152
Effect of dilutive securities:			
Common stock options	333	803	602
Restricted stock awards	278	550	271
Denominator for dilutive net income per common shares	42,715	42,720	41,025
Net income attributable to AXT, Inc. per common share:			
Basic	$ 0.37	$ 0.35	$ 0.08
Diluted	$ 0.37	$ 0.34	$ 0.07
Options excluded from diluted net income per share as the impact is anti-dilutive	220	21	862
Restricted stock excluded from diluted net income per share as the impact is anti-dilutive	291	118	161

Note 14. Segment Information and Foreign Operations

Segment Information

We operate in one segment for the design, development, manufacture and distribution of high-performance compound and single element semiconductor substrates and sale of raw materials integral to these substrates. In accordance with ASC Topic 280, *Segment Reporting,* our chief operating decision-maker has been identified as the Chief Executive Officer, who reviews operating results to make decisions about allocating resources and assessing performance for the Company. Since we operate in one segment, all financial segment and product line information can be found in the consolidated financial statements.

Product Information

The following table represents revenue amounts (in thousands) by product type:

	Year Ended December 31,		
	2022	2021	2020
Product Type:			
Substrates	$ 111,094	$ 103,026	$ 75,587
Raw materials and others	30,024	34,367	19,774
Total	$ 141,118	$ 137,393	$ 95,361

Geographical Information

The following table represents revenue amounts (in thousands) reported for products shipped to customers in the corresponding geographic region:

	Year Ended December 31, 2022	2021	2020
Geographical region:			
China	$ 55,414	$ 67,394	$ 35,150
Taiwan	28,780	16,841	16,485
Japan	11,724	10,112	7,624
Asia Pacific (excluding China, Taiwan and Japan)	4,188	7,540	5,458
Europe (primarily Germany)	20,592	23,069	19,673
North America (primarily the United States)	20,420	12,437	10,971
Total	$ 141,118	$ 137,393	$ 95,361

Long-lived assets consist primarily of property, plant and equipment, and operating lease right-of-use assets are attributed to the geographic location in which they are located. Long-lived assets, net of depreciation, by geographic region were as follows (in thousands):

	As of December 31, 2022	2021
Long-lived assets by geographic region, net of depreciation:		
North America	$ 346	$ 1,610
China	162,432	143,129
	$ 162,778	$ 144,739

Note 15. Other income (expense), net

The components of other income (expense), net are summarized below (in thousands):

	Year Ended December 31, 2022	2021	2020
Foreign exchange gain (loss)	$ 1,573	$ (434)	$ (411)
Income from local China government subsidy	1,710	1,125	3,800
Other income (expense)	204	(182)	(189)
	$ 3,487	$ 509	$ 3,200

Note 16. Commitments and Contingencies

Legal Proceedings

From time to time we may be involved in judicial or administrative proceedings concerning matters arising in the ordinary course of business. We do not expect that any of these matters, individually or in the aggregate, will have a material adverse effect on our business, financial condition, cash flows or results of operations.

Leases

We lease certain equipment, office space, warehouse and facilities under long-term operating leases expiring at various dates through July 2029. The majority of our lease obligations relate to our lease agreement for a nitrogen system to be used during the manufacturing process for our facility in Dingxing, China. The equipment lease became effective in August 2019 and will expire in July 2029. There are no variable lease payments, residual value guarantees or any restrictions or covenants imposed by the equipment lease. The remainder relate to our lease agreement for our facility in Fremont, California with approximately 19,467 square feet, which expires in 2020. Under the terms of the facility lease agreement, in May 2020, we were granted an extension to the term of the lease for an additional three years. There are no variable lease payments, residual value guarantees or any restrictions or covenants imposed by the facility lease. All other operating leases have a term of 12 months or less.

Leases are classified as either finance leases or operating leases. A lease is classified as a finance lease if any one of the following criteria are met: the lease transfers ownership of the asset by the end of the lease term, the lease contains an option to purchase the asset that is reasonably certain to be exercised, the lease term is for a major part of the remaining useful life of the asset or the present value of the lease payments equals or exceeds substantially all of the fair value of the asset. A lease is classified as an operating lease if it does not meet any one of these criteria. All of our leases are classified as operating leases and substantially all of our operating leases are comprised of equipment and office space leases. None of our leases are classified as, finance leases.

For all leases at the lease commencement date, a right-of-use asset and a lease liability are recognized. The right-of-use asset represents the right to use the leased asset for the lease term. The lease liability represents the present value of the lease payments under the lease.

The right-of-use asset is initially measured at cost, which primarily comprises the initial amount of the lease liability, plus any initial direct costs incurred, consisting mainly of brokerage commissions, less any lease incentives received. All right-of-use assets are reviewed for impairment. The lease liability is initially measured at the present value of the lease payments, discounted using the interest rate implicit in the lease or, if that rate cannot be readily determined, our secured incremental borrowing rate for the same term as the underlying lease.

Lease payments included in the measurement of the lease liability comprise the following: the fixed noncancelable lease payments, payments for optional renewal periods where it is reasonably certain the renewal period will be exercised, and payments for early termination options unless it is reasonably certain the lease will not be terminated early.

Lease expense for operating leases consists of the lease payments plus any initial direct costs, primarily brokerage commissions, and is recognized on a straight-line basis over the lease term.

We have elected not to recognize right-of-use assets and lease liabilities for short-term leases that have a term of 12 months or less. The effect of short-term leases on our right-of-use asset and lease liability was not material.

As of December 31, 2022, the maturities of our operating lease liabilities (excluding short-term leases) are as follows (in thousands):

Maturity of Lease Liabilities		
2023	$	559
2024		270
2025		270
2026		270
2027		270
Thereafter		425
Total minimum lease payments		2,064
Less: Interest		(257)
Present value of lease obligations		1,807
Less: Current portion, included in accrued liabilities		(485)
Long-term portion of lease obligations	$	1,322

The weighted average remaining lease term and the weighted-average discount rate for our operating leases are as follows:

	December 31, 2022	December 31, 2021
Weighted-average remaining lease term (years)	5.89	6.44
Weighted-average discount rate	4.61 %	4.61 %

Supplemental cash flow information related to leases where we are the lessee is as follows (in thousands):

	Year Ended December 31,	
	2022	2021
Cash paid for amounts included in the measurement of lease liabilities:		
Operating cash flows from operating leases	$ 574	$ 570

The components of lease expense are as follows (in thousands) within our consolidated statements of operations:

	Year Ended December 31,	
	2022	2021
Operating lease	$ 530	$ 533
Short-term lease expense	137	119
Total	$ 667	$ 652

Royalty Agreement

In 2020, we and a competitor entered into a cross license and covenant agreement (the “Cross License Agreement”), which has a term that began on January 1, 2020 and expires on December 31, 2029. The Cross License Agreement is a fixed-cost cross license and not a variable-cost cross license that is based on revenue or units. Under the Cross License Agreement, we are obligated to make annual payments over a 10-year period. For the years ended December 31, 2022 and 2021, the royalty expense under the Cross License Agreement was not considered material to our consolidated financial statements.

Land Purchase and Investment Agreement

We have established a wafer process production line in Dingxing, China. In addition to a land rights and building purchase agreement that we entered into with a private real estate development company to acquire our new manufacturing facility, we also entered into a cooperation agreement with the Dingxing local government. In addition to pledging its full support and cooperation, the Dingxing local government will issue certain credits or rebates to us as we achieve certain milestones. We, in turn, agreed to hire local workers over time, pay taxes when due and eventually demonstrate a total investment of approximately $90 million in value, assets and capital. The investment will include cash paid for the land and buildings, cash on deposit in our name at local banks, the gross value of new and used equipment (including future equipment that might be used for indium phosphide and germanium substrates production), the deemed value for our customer list or the end user of our substrates, for example, the end users of 3-D sensing VCSELs (vertical cavity surface emitting lasers), a deemed value for employment of local citizens, a deemed value for our proprietary process technology, other intellectual property, other intangibles and additional items of value. There is no timeline or deadline by which this must be accomplished, rather it is a good faith covenant entered into between AXT and the Dingxing local government. Further, there is no specific penalty contemplated if either party breaches the agreement. However, the agreement does state that each party has a right to seek from the other party compensation for losses. Under certain conditions, the Dingxing local government may purchase the land and building at the appraised value. We believe that such cooperation agreements are normal, customary and usual in China and that the future valuation is flexible. We have a similar agreement with the city of Kazuo, China, although on a smaller scale. The total investment targeted by AXT in Kazuo is approximately $15 million in value, assets and capital. In addition, BoYu has a similar agreement with the city of Kazuo. The total investment targeted by BoYu in Kazuo is approximately $8 million in value, assets and capital.

Note 17. Unaudited Quarterly Consolidated Financial Data

	Quarter			
	First	Second	Third	Fourth
	(in thousands, except per share data)			
2022:				
Revenue	$ 39,653	$ 39,487	$ 35,183	$ 26,795
Gross profit	13,308	15,435	14,782	8,596
Net income attributable to AXT, Inc.	3,165	5,546	5,759	1,341
Net income attributable to AXT, Inc. per share, basic	$ 0.07	$ 0.13	$ 0.14	$ 0.03
Net income attributable to AXT, Inc. per share, diluted	$ 0.07	$ 0.13	$ 0.13	$ 0.03
2021:				
Revenue	$ 31,350	$ 33,735	$ 34,576	$ 37,732
Gross profit	11,536	12,238	11,501	12,139
Net income (loss) attributable to AXT, Inc.	3,425	4,385	3,800	2,965
Net income (loss) attributable to AXT, Inc. per share, basic	$ 0.08	$ 0.11	$ 0.09	$ 0.07
Net income (loss) attributable to AXT, Inc. per share, diluted	$ 0.08	$ 0.10	$ 0.09	$ 0.07

Note 18. Redeemable Noncontrolling Interests

As discussed in Note 1, during the quarter ended December 31, 2020, Tongmei entered into the Capital Investment Agreements with Investors that invested approximately $48.1 million in the form of redeemable noncontrolling interests representing 7.06% of the outstanding shares of Tongmei. An additional investment of approximately $1.5 million of new capital was funded in early January 2021. Under China regulations these investments must be formally approved by the appropriate government agency and are not deemed to be dilutive until such approval is granted. The government approved the entire approximately $49 million investment on January 25, 2021, at which time the Investors owned a redeemable noncontrolling interest in Tongmei of 7.28%. The initial carrying amount of the redeemable noncontrolling interest was recorded at fair value on the date of issuance of Tongmei's common stock, net of issuance costs and presented in temporary equity on the consolidated balance sheets. This classification is due to the existence of certain contingencies that could result in potential redemption at the fixed purchase price as described below. We currently do not believe that this is probable thus no amortization of the issuance costs has been recorded.

Pursuant to the Capital Investment Agreements with the Investors, each Investor has the right to require AXT to redeem any or all Tongmei shares held by such Investor at the original purchase price paid by such Investor, without interest, in the event the IPO fails to pass the audit of the Shanghai Stock Exchange, is not approved by the Chinese Securities Regulatory Commission ("CSRC") or Tongmei cancels the IPO application. The aggregate redemption amount is approximately $49 million, subject to the foreign exchange rate variable at time of redemption.

Tongmei submitted its IPO application to the Shanghai Stock Exchange in December 2021 and it was formally accepted for review on January 10, 2022. The Shanghai Stock Exchange approved the IPO application on July 12, 2022. On August 1, 2022, the CSRC accepted for review Tongmei's IPO application. The STAR Market IPO remains subject to review and approval by the CSRC and other authorities. The process of going public on the STAR Market includes several periods of review and, therefore, is a lengthy process. Subject to review and approval by the CSRC and other authorities, Tongmei hopes to accomplish this goal in the coming months. The listing of Tongmei on the STAR Market will not change the status of AXT as a U.S. public company.

The components of the change in redeemable noncontrolling interests for the years ended December 31, 2022 and 2021 are presented in the following table (in thousands):

Balance as of January 1, 2021	$	47,563
Increase in redeemable noncontrolling interests due to issuance of Tongmei's common stock		1,514
Increase in redeemable noncontrolling interests due to transfer of subsidiary with noncontrolling interests		1,241
Increase in redeemable noncontrolling interests due to formation of new subsidiary with noncontrolling interests		132
Equity issuance costs incurred		(2,591)
Stock-based compensation attributable to redeemable noncontrolling interests		40
Net income attributable to redeemable noncontrolling interests		889
Effect of foreign currency translation attributable to redeemable noncontrolling interests		279
Effect of foreign currency translation on redeemable noncontrolling interests		1,318
Balance as of December 31, 2021		50,385
Investment in subsidiary with redeemable noncontrolling interest		471
Equity issuance costs incurred		(2,699)
Stock-based compensation attributable to redeemable noncontrolling interests		(36)
Net income attributable to redeemable noncontrolling interests		1,598
Effect of foreign currency translation on redeemable noncontrolling interests		(3,962)
Effect of foreign currency translation attributable to redeemable noncontrolling interests		(911)
Balance as of December 31, 2022	$	44,846

Note 19. Subsequent Events

In January 2023, our consolidated subsidiary, ChaoYang ShuoMei received $0.5 million funding from ChaoYang JinMei and $0.2 million funding from one of the minority investors. As a result, noncontrolling interests increased $0.2 million and redeemable noncontrolling interests increased $36,000. ChaoYang JinMei's ownership of ChaoYang ShuoMei remained at 75% after these equity investments.

In January 2023, Tongmei made an additional investment of $0.9 million to our equity investment entity, ChaoYang KaiMei. Concurrently, the majority shareholder made a payment of $1.1 million to ChaoYang KaiMei. Tongmei's ownership of ChaoYang KaiMei remained at 40% after these equity investments.

In January 2023, we obtained $15.7 million in new one-year bank loans with interest rates ranging from 2.35% to 4.50%. A portion of the new bank loans, $5.3 million, are collateralized by time deposits. The remaining balance of $10.4 million new loans are unsecured. We also repaid $10.8 million of existing loans in Q1 2023.

Item 16. ***Form 10-K Summary***

Not applicable.

AXT, Inc.

EXHIBITS

TO

FORM 10-K ANNUAL REPORT

For the Year Ended December 31, 2022

Exhibit Number	Description
3.1(1)	Restated Certificate of Incorporation
3.2(2)	Certificate of Amendment of Certificate of Incorporation
3.3(3)	Certificate of Amendment to the Restated Certificate of Incorporation
3.4(4)	Certificate of Designation, Preferences and Rights of Series A Preferred Stock (which is incorporated herein by reference to Exhibit 2.1 to the registrant's form 8-K dated May 28, 1999).
3.5(5)	Second Amended and Restated By Laws
3.6(6)	Amended and Restated Section 5.1 of Article V of the Second Amended and Restated Bylaws of AXT, Inc.
3.7(7)	Certificate of Amendment to By Laws
4.1	Description of Securities
10.1(8)*	Form of Indemnification Agreement for directors and officers
10.5(11)*	2007 Equity Incentive Plan (amended December 8, 2008)
10.6(12)*	Forms of agreements under the 2007 Equity Incentive Plan
10.7(13)*	Amended and Restated Employment Offer Letter between the Company and Dr. Morris S. Young dated December 4, 2012
10.8(14)*	Employment Letter Agreement between the Company and Mr. Gary L. Fischer
10.9(15)*	2015 Equity Incentive Plan
10.10(16)*	Executive Incentive Plan
10.11	Form of Capital Increase Agreement between Beijing Tongmei Xtal Technologies Co., Ltd. and certain investors
10.11(a)	Schedule identifying agreements substantially identical to the form of Capital Increase Agreement filed as Exhibit 10.11 hereto
10.12	Form of First Supplemental Agreement between Beijing Tongmei Xtal Technology Co., Ltd. and certain investors
10.12(a)	Schedule identifying agreements substantially identical to the form of First Supplemental Agreement filed as Exhibit 10.12 hereto
10.13	Form of Second Supplemental Agreement between Beijing Tongmei Xtal Technology Co., Ltd. and certain investors
10.13(a)	Schedule identifying agreements substantially identical to the form of Second Supplemental Agreement filed as Exhibit 10.13 hereto
10.14	Letter of Commitment on Share Lock-up
10.15	Letter of Commitment on the Shareholding Intention and Share Reduction Intention
10.16	Letter of Commitment on Plan for Stabilizing Tongmei's Stock Price within Three Years upon the Listing and the Restraint Measures
10.17	Letter of Commitment on Share Repurchase for Fraudulent Listing
10.18	Letter of Commitment on No False Records, Misleading Statements or Major Omissions in the Prospectus
10.19	Letter of Commitment on Filling the Diluted Spot Return
10.20	Letter of Commitment on Restraint Measures for Nonperformance of the Commitments
10.21	Letter of Commitment on Avoiding Horizontal Competition
10.22	Letter of Commitment on Regulating and Reducing Related Party Transactions

10.23	Letter of Commitment on Avoiding Illegal Guarantees
10.24	Statement and Letter of Commitment
10.25	Special Commitment Letter for Disclosure of Shareholders' Information and Verification of Retired Personnel of CSRC
21.1	List of Subsidiaries
23.1	Consent of Independent Registered Public Accounting Firm, BPM LLP
24.1	Power of Attorney (see signature page)
31.1	Certification by principal executive officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
31.2	Certification by principal financial officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
32.1 †	Certification by Chief Executive Officer Pursuant to 18 U.S.C. Section 1350, as adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
32.2 †	Certification by Chief Financial Officer Pursuant to 18 U.S.C. Section 1350, as adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
101.INS	Inline XBRL Instance.
101.SCH	Inline XBRL Taxonomy Extension Schema.
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase.
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase.
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase.
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase.
104	Cover Page Interactive Data File (formatted as inline XBRL and contained in Exhibit 101)

---

(1) Incorporated by reference to exhibit 3.1 to registrant's Form 10-K filed with the SEC on March 31, 1999.
(2) Incorporated by reference to exhibit 3.1 to registrant's Form 10-Q filed with the SEC on August 14, 2000.
(3) Incorporated by reference to exhibit 3.4 to registrant's Form 10-Q filed with SEC on August 5, 2004.
(4) Incorporated by reference to exhibit 3.1 to registrant's Form 8-K filed with the SEC on June 14, 1999.
(5) Incorporated by reference to exhibit 3.4 to registrant's Form 8-K filed with the SEC on May 30, 2001.
(6) Incorporated by reference to exhibit 99.2 to registrant's Form 8-K filed with the SEC on August 1, 2007.
(7) Incorporated by reference to exhibit 3.1 to registrant's Form 8-K filed with the SEC on October 26, 2010.
(8) Incorporated by reference to exhibit 10.1 to registrant's Form 8-K filed with the SEC on October 31, 2014.
(9) Incorporated by reference to exhibit 10.29 to registrant's Form 8-K filed with the SEC on January 5, 2009.
(10) Incorporated by reference to exhibit 10.30 to registrant's Form 8-K filed with the SEC on January 5, 2009.
(11) Incorporated by reference to exhibit 10.31 to registrant's Form 10-K filed with the SEC on March 31, 2009.
(12) Incorporated by reference to exhibit 10.20 to registrant's Form 10-K filed with the SEC on March 22, 2010.
(13) Incorporated by reference to exhibit 10.1 to registrant's Form 8-K filed with the SEC on December 4, 2012.
(14) Incorporated by reference to exhibit 10.1 to registrant's Form 8-K filed with the SEC on August 12, 2014.
(15) Incorporated by reference to appendix A to the registrant's Definitive Proxy Statement on Schedule 14A filed with the SEC on April 8, 2015.
(16) Incorporated by reference to exhibit 10.1 to registrant's Form 8-K filed with the SEC on February 26, 2016.
(17) Incorporated by reference to exhibit 10.1 registrant's Form 8-K filed with the SEC on November 9, 2018.

* Management contract or compensatory plan.

† The certifications attached as Exhibits 32.1 and 32.2 that accompany this Annual Report on Form 10-K are deemed furnished and not filed with the Securities and Exchange Commission and are not to be incorporated by reference into any filing of AXT, Inc. under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date of this Annual Report on Form 10-K, irrespective of any general incorporation language contained in such filing.

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, thereto duly authorized.

AXT, Inc.

By: /s/ GARY L. FISCHER
Chief Financial Officer and Corporate Secretary
(Principal Financial Officer)

Date: March 16, 2023

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below hereby constitutes and appoints Morris S. Young and Gary L. Fischer, and each of them, his true and lawful attorney-in-fact and agent, with full power of substitution, each with power to act alone, to sign and execute on behalf of the undersigned any and all amendments to this Report on Form 10-K, and to perform any acts necessary in order to file the same, with all exhibits thereto and other documents in connection therewith with the Securities and Exchange Commission, granting unto said attorney-in-fact and agent full power and authority to do and perform each and every act and thing requested and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorney-in-fact and agent, or their or his or her substitutes, shall do or cause to be done by virtue hereof.

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.

Signature	Title	Date
/s/ MORRIS S. YOUNG Morris S. Young	Chief Executive Officer and Chairman of the Board of Directors *(Principal Executive Officer)*	March 16, 2023
/s/ GARY L. FISCHER Gary L. Fischer	Chief Financial Officer and Corporate Secretary *(Principal Financial Officer and Principal Accounting Officer)*	March 16, 2023
/s/ JESSE CHEN Jesse Chen	Lead Independent Director	March 16, 2023
/s/ DAVID C. CHANG David C. Chang	Director	March 16, 2023
/s/ CHRISTINE RUSSELL Christine Russell	Director	March 16, 2023

DESCRIPTION OF THE REGISTRANT'S SECURITIES REGISTERED PURSUANT TO SECTION 12 OF THE SECURITIES EXCHANGE ACT OF 1934

DESCRIPTION OF CAPITAL STOCK

The following information describes our common stock and preferred stock, as well as certain provisions of our restated certificate of incorporation, as amended (the "certificate of incorporation"), and second amended and restated bylaws, as amended (the "bylaws"). This summary does not purport to be complete and is qualified in its entirety by the provisions of our certificate of incorporation and bylaws, copies of which have been filed as exhibits to this Annual Report on Form 10-K, as well as to the applicable provisions of the Delaware General Corporation Law.

General

Our authorized capital stock consists of 70,000,000 shares of common stock with a $0.001 par value per share (the "common stock") and 2,000,000 shares of preferred stock with a $0.001 par value per share (the "preferred stock"), 1,000,000 shares of which are designated as "Series A Preferred Stock" and 200,000 of which are designated as "Series B Preferred Stock." Our board of directors may establish the rights and preferences of the preferred stock from time to time.

Common Stock

Each holder of our common stock is entitled to one vote for each share on all matters to be voted upon by the stockholders. Subject to any preferential rights of any outstanding preferred stock, holders of our common stock are entitled to receive ratably the dividends, if any, as may be declared from time to time by the board of directors out of funds legally available therefor. We have never declared or paid any cash dividend on our capital stock and do not anticipate paying any cash dividends in the foreseeable future. If there is a liquidation, dissolution or winding up of our company, holders of our common stock would be entitled to share ratably in our assets remaining after the payment of liabilities and any preferential rights of any outstanding preferred stock.

Holders of our common stock have no preemptive or conversion rights or other subscription rights, and there are no redemption or sinking fund provisions applicable to the common stock. The outstanding shares of common stock are fully paid and non-assessable. The rights, preferences and privileges of the holders of our common stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Our common stock is listed on the NASDAQ Global Select Market under the symbol "AXTI." The transfer agent and registrar for the common stock is Computershare.

Preferred Stock

Our certificate of incorporation provides that we may issue up to 2,000,000 shares of preferred stock. As of March 16, 2023, 883,000 shares of our Series A Preferred Stock were issued and outstanding and are non-voting and non-convertible preferred stock with a 5.0% cumulative annual dividend rate payable when declared by the board of directors and $4 per share liquidation preference over common stock, and must be paid before any distribution is made to common stockholders. Other than the Series A Preferred Stock, no shares of preferred stock are currently outstanding.

Under the terms of our certificate of incorporation, our board of directors is authorized to issue shares of preferred stock in one or more series without stockholder approval. Our board of directors has the discretion to determine the rights, preferences, privileges and restrictions, including voting rights, dividend rights, conversion rights, redemption privileges and liquidation preferences, of each series of preferred stock. There are no restrictions presently on the repurchase or redemption of any shares of our preferred stock.

The issuance of shares of preferred stock will affect, and may adversely affect, the rights of holders of common stock. It is not possible to state the actual effect of the issuance of any shares of preferred stock on the rights of holders of common stock until our board of directors determines the specific rights attached to that preferred stock. The effects of issuing additional preferred stock could include one or more of the following:

- restricting dividends on the common stock;
- diluting the voting power of the common stock;
- impairing the liquidation rights of the common stock; or
- delaying or preventing changes in control or management of our company.

Preferred stock will be fully paid and nonassessable upon issuance.

Effect of Certain Provisions of our Certificate of Incorporation and Bylaws and the Delaware Anti-Takeover Statute

Some provisions of Delaware law and our certificate of incorporation and bylaws contain provisions that could make the following transactions more difficult:

- acquisition of us by means of a tender offer;
- acquisition of us by means of a proxy contest or otherwise; or
- removal of our incumbent officers and directors.

Those provisions, summarized below, are expected to discourage coercive takeover practices and inadequate takeover bids and to promote stability in our management. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors.

Certificate of Incorporation and Bylaws

Our certificate of incorporation and our bylaws provide for, among other things, the following:

- *Undesignated Preferred Stock.* The ability to authorize undesignated preferred stock makes it possible for our board of directors to issue one or more series of preferred stock with voting or other rights or preferences that could impede the success of any attempt to change control of our company. These and other provisions may have the effect of deferring hostile takeovers or delaying changes in control or management of our company.

- *Stockholder Meetings.* Our bylaws provide that in general a special meeting of stockholders may be called only by our board of directors, its chairman or our president.

- *Requirements for Advance Notification of Stockholder Nominations and Proposals.* Our bylaws establish advance notice procedures with respect to stockholder proposals and the nomination of candidates for election as directors, other than nominations made by or at the direction of our board of directors or a committee of the board of directors.

- *Board Classification.* Our board of directors is divided into three classes. The directors in each class are elected to serve for a three-year term, one class being elected each year by our stockholders. This system of electing and removing directors may tend to discourage a third party from making a tender offer or otherwise attempting to obtain control of us, because it generally makes it more difficult and time consuming for stockholders to replace a majority of the directors.

- *Limits on Ability of Stockholders to Act by Written Consent.* We have provided in our bylaws that our stockholders may not act by written consent. This limit on the ability of our stockholders to act by written consent may lengthen the amount of time required to take stockholder actions. As a result, a holder controlling a majority of our capital stock would not be able to amend our bylaws or remove directors without holding a meeting of our stockholders called in accordance with our bylaws.

- *Amendment of Certificate of Incorporation and Bylaws.* The amendment of the above provisions of our certificate of incorporation and bylaws requires approval by holders of at least two-thirds of our outstanding capital stock entitled to vote generally in the election of directors.

- *Election and Removal of Directors.* Our certificate of incorporation and bylaws contain provisions that establish specific procedures for appointing and removing members of our board of directors. Under our certificate of incorporation and bylaws, vacancies and newly created directorships on our board of directors may be filled only by a majority of the directors then serving on the board of directors. Under our certificate of incorporation and bylaws, directors may be removed, with or without cause, by the affirmative vote of the holders of a majority of the shares then entitled to vote at an election of directors.

- *No Cumulative Voting.* The Delaware General Corporation Law provides that stockholders are not entitled to the right to cumulate votes in the election of directors unless our certificate of incorporation provides otherwise. Our certificate of incorporation and bylaws do not expressly provide for cumulative voting. Without cumulative voting, a minority stockholder may not be able to gain as many seats on our board of directors as the stockholder would be able to gain if cumulative voting were permitted. The absence of cumulative voting makes it more difficult for a minority stockholder to gain a seat on our board of directors to influence our board of directors' decision regarding a takeover.

Delaware Anti-Takeover Statute

We are subject to the provisions of Section 203 of the Delaware General Corporation Law regulating corporate takeovers. In general, Section 203 prohibits a publicly-held Delaware corporation from engaging, under certain circumstances, in a business combination with an interested stockholder for a period of three years following the date the person became an interested stockholder unless:

- prior to the date of the transaction, the board of directors of the corporation approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder;
- upon completion of the transaction that resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding, but not for determining the outstanding voting stock owned by the interested stockholder, (i) shares owned by persons who are directors and also officers, and (ii) shares owned by employee stock plans in which employee participants do not have the right to determine confidentially whether shares held subject to the plan will be tendered in a tender or exchange offer; or
- at or subsequent to the date of the transaction, the business combination is approved by the board of directors of the corporation and authorized at an annual or special meeting of stockholders, and not by written consent, by the affirmative vote of at least 66-2/3% of the outstanding voting stock which is not owned by the interested stockholder.

Generally, a business combination includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. An interested stockholder is a person who, together with affiliates and associates, owns or, within three years prior to the determination of interested stockholder status, did own 15% or more of a corporation's outstanding voting stock.

Capital Increase Agreement
on
Beijing Tongmei Xtal Technology Co., Ltd.

Among

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.,

Beijing Tongmei Xtal Technology Co., Ltd.

and

AXT, INC.

January 2021

CONTENTS

CAPITAL INCREASE AGREEMENT

This CAPITAL INCREASE AGREEMENT (hereinafter referred to as the “Agreement”) is entered into as of [DD] [MM], 2021 in Beijing by and among:

Party A: Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.

Domicile: Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai

Legal Representative: Zhang Shuheng

Party B: Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as the “Target Company” or “the Company”)

Domicile: No. 4 East Second Street, Industrial Development Zone, Tongzhou District, Beijing, PRC

Legal Representative: Morris Young

Party C: AXT, INC.

Domicile: 4281 TECHNOLOGY DR FREMONT CA 94538

Authorized Representative: Morris Young

(Party A, Party B and Party C are collectively referred to as the “Parties” herein; each party or any party is referred to as the “Party”, as the context requires)

WHEREAS,

1. Party A is the investor of the Target Company, a limited partnership duly incorporated and validly existing in accordance with the laws of the People’s Republic of China, with its registered address at Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai, PRC.

2. Party B is the Target Company, a limited liability company incorporated and validly existing in accordance with the laws of the People's Republic of China, under the Unified Social Credit Code 91110000700004889C, with a registered capital of RMB 820.960319 million, and with its registered address at No. 4 East Second Street, Industrial Development Zone, Tongzhou District, Beijing, PRC. The legal representative of it is Morris Young.
3. Party C is an American company listed on NASDAQ (stock code: AXTI), with its address at 4281 TECHNOLOGY DR FREMONT CA 94538.
4. The Parties agree that Party A shall subscribe for Party B's newly increased registered capital in accordance with the terms and conditions specified in this Agreement.

NOW, THEREFORE, the Parties hereto agree as follows through friendly negotiation:

Article 1 Definitions and Interpretation

1.1 Unless otherwise specified in this Agreement, the following words and expressions shall have the following meanings:

Agreement	refers to this Capital Increase Agreement, including amendments and supplements made thereto from time to time;
Company, Target Company	refers to Beijing Tongmei Xtal Technology Co., Ltd.
Affiliates	refers to relevant companies whose financial statements shall be consolidated upon the current and subsequent reorganization of the Target Company in accordance with the *Accounting Standards for Business Enterprises* of PRC ;
Controlling Shareholder	refers to AXT, INC., a company listed on NASDAQ in the United States, with the stock code AXTI;
Articles of Association	refers to the Company's Articles of Association, including amendments and supplements made thereto from time to time;
Capital Increase	refers to the subscription of newly increased registered capital of the Target Company by Party A with the equivalent cash in RMB of USD 90742 in accordance with the terms and conditions of this Agreement among the proposed financing of USD 90742 (Party A shall make payment in RMB. The specific amount shall be calculated as per the middle rate of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Party A makes an investment of RMB 0.600758 million)

Capital Contribution	refers to the total amount of capital contributed by Party A to the Target Company to subscribe for the newly increased registered of the Target Company in accordance with the provisions of this Agreement, that is USD 90742. (Party A shall make the contribution in RMB, and the specific amount shall be calculated by referring to the middle rate of USD against RMB (i.e. 1 U.S. dollar = 6.6205 yuan) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Party A makes an investment of RMB 0.600758 million).
IPO	refers to the initial public offering and listing on domestic stock exchanges by the Target Company with the approval of the competent authorities;
Related Parties	The Company's related party refers to the natural person, legal person or any other organization in any of the following circumstances: 1) the natural, legal person or any other organization that controls the Company directly or indirectly; 2) the natural person holding more than 5% shares directly or indirectly; 3) the Company's director, supervisor or senior manager; 4) family members having close relations with the related natural person described in 1), 2) and 3), including spouse, spouse's sibling and the parents of children's spouse; 5) legal person or other organization that directly holds more than 5% shares of the Company; 6) director, supervisor, senior manager or other major leader of the legal person or other organization that controls the Company directly or indirectly; 7) legal person or other organization directly or indirectly controlled by the related legal person or natural person described in 1) – 6) or in which the aforesaid related natural person (except for chairman) acts as director or senior manager, unless it is the Company or its holding subsidiary; 8) legal person or other organization indirectly holding more than 5% shares of the Company; 9) other natural person, legal person or other organization that CSRC, Shanghai Stock Exchange or the Company judges having special relationship with the Company in accordance with the principle of substance over form, which may make the Company's interests incline towards it. Within the 12 months after the transaction date or upon the validity of relevant transaction agreement or implementation of relevant argument, the legal person or other organization or natural person in any of the circumstances described in the preceding paragraph shall be deemed as the Company's related party. The Company will not form an associated relationship with the legal person that the legal person or other organization listed in Paragraph 1 controls directly or indirectly or other organization that is under the control of the identical state-owned assets regulatory agency, except that legal representative, general manager, leader or over half of directors of the legal person or other organization double as the Company's director, supervisor or senior manager.

PRC	refers to the People's Republic of China, for the purpose of this Agreement, excluding Hong Kong Special Administrative Region, Macau Special Administrative Region and Taiwan.
Yuan	refers to Chinese Yuan, the statutory currency of PRC.
USD	refers to US dollar, the statutory currency of the United States.
Working Day	refers to the normal working day of banks in China (excluding Saturday, Sunday and statutory holidays of PRC).

1.2 Any reference to the terms and annexes in this Agreement refer to the terms and annexes of this Agreement (unless otherwise indicated). The annexes to this Agreement shall be deemed as an integral part of this Agreement.

1.3 Any reference to the documents in this Agreement shall include the modifications, combinations, supplements, updates and substitutions made thereto from time to time.

1.4 The terms of any law or regulation shall refer to the terms of the law or regulation revised from time to time (whether before or after the execution date of this Agreement).

1.5 The headlines are only for the convenience of reading, and shall not affect the interpretation of this Agreement.

1.6 Unless otherwise stated, if any date of implementation under this Agreement falls on a non-working day, such implementation shall be postponed to the first working day following the non-working day.

Article 2 Capital Increase

2.1 Capital Increase

Prior to the signature of this Agreement, the Target Company signed relevant capital increase agreements with Liaoning Haitong Innovation Securities Investment Co., Ltd. (hereinafter referred to as “Haitong Innovation Securities”), Liaoning Haitong New Kinetic Energy Equity Investment Fund Partnership (L.P.) (hereinafter referred to as “Haitong New Kinetic Energy”) and Liaoning Haitong New Energy Low-carbon Industry Equity Investment Fund Co., Ltd. (hereinafter referred to as “Haitong New Energy”). According to agreements, Haitong Innovation Securities, Haitong New Kinetic Energy and Haitong New Energy increased an investment in RMB equivalent to USD 10 million, USD 9 million and USD 3.5 million respectively to the Target Company based on the pre-investment valuation of USD 624 million (the specific amount shall be calculated as per the middle rate of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Haitong Innovation Securities makes an investment of RMB 66.205 million, Haitong New Kinetic Energy adds an investment of RMB 59.5845 million and Haitong New Energy adds an investment of RMB 23.17175 million respectively) (the above are collectively known as “Haitong capital increase”).

Prior to the signature of this Agreement, the Target Company signed relevant capital increase agreements with Fujian Province Anxin Industry Investment Fund Partnership (L.P.) (hereinafter referred to as Anxin Industry Investment), Jinggangshan Meicheng Equity Investment Partnership (L.P.)(hereinafter referred to as Jinggangshan Meicheng), Hefei Huadeng Phase 2 Integrated Circuit Industry Investment Partnership (L.P.)(hereinafter referred to as Huadeng Phase 2), Qingdao Xinxingyi Equity Investment Fund Partnership (L.P.)(hereinafter referred to as Qingdao Xinxing), Qiji (Hangzhou) Investment Co., Ltd.(hereinafter referred to as Hangzhou Qiji), Gongqingcheng Yihua Tongze Investment Partnership (L.P.)(hereinafter referred to as Gongqingcheng Yihua). According to agreements, Anxin Industry Investment, Jinggangshan Meicheng, Hefei Huadeng Phase 2, Qingdao Xinxing, Hangzhou Qiji and Gongqingcheng Yihua increased an investment in RMB equivalent to USD 6.797 million, USD 4.531 million , USD 5.287 million, USD 3.021 million, USD 3.021 million and USD 1.343 million respectively to the Target Company based on the pre-investment valuation of USD 624 million (the specific amount shall be calculated as per the middle rate of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Anxin Industry Investment makes an investment of RMB 45 million, Jinggangshan Meicheng adds an investment of RMB 30 million, Huadeng Phase 2 adds an investment of RMB 35 million, Qingdao Xinxing adds an investment of RMB 20 million, Hangzhou Qiji adds an investment of RMB 20 million and Gongqingcheng Yihua adds an investment of RMB 8.892 million respectively) (the above are collectively known as “Anxin capital increase”).

Prior to the signature of this Agreement, the Target Company signed relevant capital increase agreements with Sunrise Baoying (Ningbo) Investment Center (L.P.) (hereinafter referred to as Sunrise Baoying). According to agreements, Sunrise Baoying (Ningbo) Investment Center (L.P.) increased an investment in RMB equivalent to USD 1 million to the Target Company based on the pre-investment valuation of USD 624 million (the specific amount shall be calculated as per the middle rate of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Haitong Innovation Securities makes an investment of RMB 6.6205 million(the above are collectively known as “Sunrise capital increase”).

The Target Money under this Agreement agrees to attract financing of USD 90742. Party A agrees to subscribe the newly added capital of the Target Company with the equivalent cash in RMB of equivalent to USD 90742. (Party A shall make payment in RMB. The specific amount shall be calculated as per the middle rate of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Party A makes an investment of RMB 0.600758 million). After this round of capital increase, on the basis of considering Haitong capital increase, Anxin capital increase, Sunrise capital increase as well as the completion of equity financing of other two investors and not considering the subsequent equity financing, Party A holds a total of 0.0135% equities of the Target Company.

2.2 Purpose of Capital Contribution

All the capital contribution shall be used by Target Company for purposes related to its current main business or recombination (The specific meaning shall be subject to the supplementary agreement signed and concluded by the Parties). Except as described above, the Target Company shall not use the above capital contribution for other purposes without Party A's prior written consent.

2.3 Payment of Capital Contribution

(1) Party A shall make the payment of USD 90742 to Party B in a lump-sum within 10 working days upon the establishment of the following prerequisites: (Party A shall make the contribution in RMB, and the specific amount shall be converted by referring to the middle rate of USD against RMB announced by the People's Bank of China on November 13, 2020, i.e. RMB 0.600758 million).

① Party B agrees upon the resolution of board of shareholders on the capital increase and relevant capital increase agreements;

② Party C agrees upon the board resolution on the capital increase and relevant capital increase agreements;

(2) The details of the bank account used by the Target Company to receive the capital contribution are as follows:

Account Name: Beijing Tongmei Xtal Technology Co., Ltd.

Account Number: 32205600822-2

Bank Name: BOC Tongzhou Branch

2.4 Completion of Capital Increase

(1) The completion of the capital increase shall be subject to the completion of the registration of change in connection with to the capital increase with industry and commerce department and the acquisition of the renewed business license;

(2) Party A shall use its best efforts to actively cooperate with the Target Company in going through the procedures of change, filing and reporting with the applicable market supervision and management department (industry and commerce) and the competent commercial department for the capital increase.

Article 3 Undertakings, Representations and Warrants

3.1 Representations and Warranties of Party A:

(1) Party A is legally incorporated and validly existing in accordance with the laws of PRC; Party A and its shareholders are not included in the "three types of shareholders" of contractual private equity funds, asset management plans and trust plans; and Party A has obtained the qualifications of being shareholder required by laws and regulations.

(2) Party A has independent legal status and full civil capacity to enter into and perform this Agreement, and can independently act as a subject of litigation.

(3) Party A has acquired all the authorizations, approvals or filings required for the execution, delivery and performance of this Agreement and completion the transaction under this Agreement. The execution and performance of this Agreement by Party A will not violate the provisions of relevant laws and regulations and normative documents or the terms of major contractual documents that are binding upon it.

(4) Party A has prepared sufficient funds for this capital increase and the source of funds is true and legal.

3.2 Representations and Warranties of Party B and Party C:

(1) Party B and Party C have obtained internal approval and authorization for the execution and performance of this Agreement, and the authorization documents have been provided to Party A.

(2) Party B and Party C have independent legal status and full capacity for civil capacity to enter into and perform this Agreement, and can independently act as a subject of litigation.

(3) Party B and Party C undertake that they have obtained all authorizations and internal decision-making procedures necessary for the execution and performance of this Agreement and the completion of the transaction under this Agreement. The execution of this Agreement and the and performance of the obligations hereunder by Party B and Party C will not violate any agreement entered into individually or jointly as a party or the provisions of relevant laws, regulations and normative documents.

(4) As of the execution date of this Agreement, where Party C is subjected to any hostile acquisition or attempt to change Party C's control power initiated by any subject or person, without prejudice to director's loyalty, diligence and fiduciary duties under laws of the US, Party C's board of directors shall take actions such as issuing securities with voting rights or other priority rights in accordance with relevant provisions of applicable laws, certificate of incorporation, and articles of incorporation, so as to avoid the material change in Party C's equity structure, board of directors and management.

Article 4 Termination of Agreement

4.1 This Agreement can be terminated by the Parties by consensus.

4.2 In case of the following events, Party B and Party C are entitled to send a written notice of termination of this Agreement to Party A, and this Agreement shall be terminated as of the date of receipt of such written notice by Party A:

(1) Party A is in violation of this Agreement or any other transaction documents, and fails to rectify and remedy its default within a reasonable period as required by Party B and Party C in the written notice requesting for the rectification of such default;

(2) The representations and warranties made by Party A in this Agreement are untrue, inaccurate, or misleading, fraudulent or concealed in material respects.

4.3 In case of the following events, Party A is entitled to send a written notice of termination of this Agreement to Party B and Party C, and this Agreement shall be terminated as of the date of receipt of such written notice by Party B or Party C:

(1) Party B or Party C is in violation of this Agreement or any other transaction documents, and fails to rectify and remedy its default within a reasonable period as required by Party A in the written notice requesting for the rectification of such default;

(2) The representations and warranties made by Party B and Party C together or separately in this Agreement are untrue, inaccurate, or misleading, fraudulent or concealed in material respects.

(3) Party B and Party C fail to finish the relevant matters agreed in the written supplementary agreement by the parties.

4.4 Where this Agreement is cancelled prior to the completion of the capital increase, Party A does not need to pay any investment. Should Party A have affected the payment, Party B shall refund Party A within 10 working days upon the cancelation of this Agreement.

4.5 Upon the cancellation or termination of this Agreement, other transaction documents (if any) signed by the Parties regarding the capital increase shall be automatically cancelled or terminated with this Agreement.

4.6 Upon the termination of this Agreement, except for Article 5 (Liability for Default), Article 6 (Confidentiality), this paragraph, and Article 8 (Governing Law and Resolution of Disputes), the Parties shall neither enjoy the rights under this Agreement, nor shall assume the obligations and responsibilities under this Agreement, and nothing in this Agreement shall relieve any party from its liability for default of this Agreement incurred prior to the termination.

Article 5 Liability for Default

5.1 In case of any violation of this Agreement or any other transaction documents by any party, the breaching party shall compensate for the losses incurred thereby to other parties hereto (including related fees and expenses, interest, fines and attorney fees incurred by such default).

5.2 For the avoidance of doubt, the Parties agree that when the Agreement is terminated by the parties in accordance with relevant provisions under this Agreement, the provisions of the preceding paragraph on compensation for losses shall not affect Party A's right to request the Target Company to return the capital contribution made.

Article 6 Confidentiality

6.1 Except as otherwise provided in this Agreement, each party to this Agreement shall treat as strictly confidential all information contained in this Agreement or received or obtained through negotiation and/or signing of this Agreement, including but not limited to any information related to the following matters, and shall not disclose or make use of such information.

(1) The existence and terms of this Agreement;

(2) Negotiations related to this Agreement; or

(3) Business activities conducted by a party to this Agreement, the party or any of its related parties.

6.2 During the Term of this Agreement and before the relevant confidential information becomes public information (hereinafter referred to as the "Confidentiality Period"), without the prior written consent of other parties hereto, each party neither may use the confidential information of other parties for any purpose other than the execution and performance of this Agreement, nor disclose or provide such confidential information to any third party other than the Parties hereto, and shall take all necessary measures to ensure that its current and future directors, officers, employees and professional consultants such as lawyers, accountants, financial consultants, etc. comply with the above-mentioned confidentiality obligations during the confidentiality period, otherwise the party shall compensate other parties for their losses.

6.3 Provided that, under the following circumstances, this Article 6 shall not prohibit the disclosure or use of any information within the following scope:

(1) The disclosure or use required by applicable laws, any rules of the stock exchange where the shares of any party are listed, or any government agency;

(2) Disclosure or use required for the purpose of any legal proceedings caused by this Agreement or any other agreement signed under or pursuant to this Agreement, or the disclosure is related to the tax affairs of the disclosing party and made to the tax department;

(3) Disclosure made to any party's officers, directors, employees, lawyers, accountants, financial consultants and other agents or representatives who need to know the information for the completion of the transactions contemplated by this Agreement or any agreement entered into under this Agreement, provided that such persons promise to comply with the provisions of Article 6 with respect to such information as if they were a party to this Agreement;

(4) Such information can be acquired from public channels (except for acquisition by violation of the confidentiality agreement (if any) or this Agreement); or

(5) Prior written consent for disclosure or use has been given by other parties.

Article 7 Term

7.1 This Agreement shall become effective as of the date of execution by the Parties.

7.2 This Agreement will remain effective upon its commencement, unless it is cancelled or terminated in accordance with the provisions of this Agreement.

Article 8 Governing Law and Resolution of Disputes

8.1 The formation, validity, performance, alteration, termination, interpretation of this Agreement, as well as the settlement of disputes caused by or related to this Agreement, shall be governed by the laws of the PRC.

8.2 Any dispute arising from or in connection with this Agreement shall be resolved by the Parties hereto through friendly negotiation with their best efforts; the aforesaid negotiation shall commence immediately upon the notification of the dispute in writing by one party to other parties.

8.3 If the Parties cannot resolve the dispute through friendly negotiation within 30 days from the service of the notice mentioned in Article 9.2, any party is entitled to file an application with the China International Economic and Trade Arbitration Commission for arbitration applying the arbitration rules of the China International Economic and Trade Arbitration Commission in effect at the time of the arbitration. The arbitration proceedings shall be conducted in Chinese in Beijing. The arbitration award is final and binding upon the Parties.

8.4 In the event of any dispute or controversy during the arbitration period, except for the rights and obligations in connection with the dispute involved in such arbitration, each party shall continue to perform its other obligations under this Agreement (and shall be entitled to exercise its right under this Agreement).

Article 9 Notices

9.1 All notices, requests, claims, demands and other formal communications (hereinafter referred to as "Notices") under this Agreement shall be made in writing and signed or sealed by the sender or its authorized representative. Such notice shall be delivered by hand, registered airmail or fax and other electronic communication means to the following addresses designated by the Parties:

(1) If to Party A:

Party A: Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.

Address: Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai

E-mail: steven_zhang@lumentime.com

Fax: 021-61702388

Attention: Zhang Shuheng

(2) If to Party B:

Address: No. 4 East Second Street, Zhangjiawan Industrial Development Zone, Tongzhou District, Beijing, PRC

E-mail: ze.hao@axt.com

Fax: 010-61562245

Attention: Hao Ze

(3) If to Party C:

Address: 4281 Technology Drive, Fremont CA 94538-6339 USA

E-mail: gfischer@axt.com

Fax: (001-510) 583-5901

Attention: Gary Fischer

Any notice shall be addressed to relevant parties listed in this Article (or other recipients of other parties notified by relevant parties in accordance with the provisions of this Article).

9.2 Any notice delivered by hand, registered airmail or fax, and other electronic communication means shall be deemed to have been served:

(1) In the case of delivery by hand and obtaining of written receipt, if it is delivered before 17:00 on the working day of the place of service, the time when the written receipt is signed shall be the time of service; if it is delivered after 17:00 on the working day or at any time on the non-working day of the place of service, the notice shall be deemed as being served at 9:00 on the next working day of the place of service;

(2) If the registered airmail is domestic mail in China and is sent by express mail service with postage prepaid, it shall be deemed as being served on the fifth working day from the date of mailing;

(3) If the registered airmail is sent from or to any place outside of China and sent by international express mail service with postage prepaid, it shall be deemed to be served on the tenth working day from the date of mailing;

(4) In the case of delivery by fax or other electronic communication means, it shall be deemed as being served after sending, as evidenced by the sending report confirming the successful sending and the oral receipt confirmation (the sender shall record it in writing and sign it). Provided that, if the fax or other electronic communication is sent

after 17:00 on the working day or at any time on a non-working day of the place of service, it shall be deemed as being served at 9:00 on the next working day of the place of service.

Article 10 Miscellaneous

10.1 The Parties unanimously agree that from the date of completion of the change registration for the capital increase with the industry and commerce department, the Target Company's accumulated and newly increased undistributed profits over the years will be shared by the Target Company's new and old shareholders after the capital increase in proportion to their respective paid-up capital.

10.2 Unless otherwise specified, the failure or delay in the exercise of any right, power or privilege under this Agreement by any party shall not be deemed as a waiver of that right, power or privilege by such party; the exercise of any right, power or privilege in whole or in part shall not be regarded as the interference with the exercise of other rights, powers or privileges.

10.3 Without prejudice to the provisions of other terms of this Agreement, if any term or part of this Agreement is determined to be invalid, illegal or unenforceable under the laws of PRC, or violation of the public interest, the validity, legality and enforceability of the remaining of the Agreement shall not be affected or impaired in any way. The Parties shall conduct friendly negotiations to agree on the term satisfactory to the Parties to substitute the invalid term.

10.4 Unless otherwise agreed in this Agreement, each party shall respectively bear the legal and other expenses incurred by itself in the preparation, negotiation and conclusion of the Agreement and other transaction documents.

10.5 This Agreement and its annexes constitute a complete agreement among the Parties hereto. Unless otherwise agreed in this Agreement, the amendment, modification, waiver, cancellation or termination of the Agreement must be signed by the Parties in a written agreement.

10.6 Matters not covered in this Agreement shall be amicably negotiated by the Parties, and a written supplementary agreement shall be executed by the Parties by consensus. The supplementary agreement shall have the same legal effect as the Agreement.

10.7 No Party shall assign any of its rights or obligations under this Agreement, unless with the prior written consent of the Parties.

10.8 This Agreement is executed in sextuplicate with one copy for each party, and the rest shall be maintained by the Target Company for future use. Each copy has the same legal effect.

(The remainder of this page is intentionally left blank)

(No text on this page, and only for the signature of *Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd. (seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

Beijing Tongmei Xtal Technology Co., Ltd. (Seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

AXT, INC.

Authorized representative (signature):

Exhibit 10.11(a)

**Schedule identifying agreements substantially identical to
the form of Capital Increase Agreement filed as Exhibit 10.13 hereto**

**Subscribed Capital of Beijing
Tongmei Xtal Technology Co., Ltd.**

Investor	Purchase Price (RMB)	Capital %
Liaoning Haitong New Energy Equity Investment (Limited Partnership)	11,840,774	1.3373%
Liaoning Haitong New Energy Low-Carbon Industry Equity Investment Co., Ltd.	4,604,745	.5201%
Haitong Innovation Securities Investment Co., Ltd.	13,156,415	1.4859%
Fujian Province An Xin Industry Investment Fund Partnership (Limited Partnership)	8,942,416	1.01%
Jinggangshan Meicheng Equity Investment Partnership (Limited Partnership)	5,961,172	.6733%
Hefei Walden II IC Industry Investment Partnership (Limited Partnership)	6,955,797	.7856%
Qingdao Xinxingyi Equity Investment Fund Partnership (Limited Partnership)	3,974,553	.4489%
Qiji (Hangzhou) Investment Consulting Co., Ltd.	3,974,553	.4489%
Gongqingcheng Yi Hua Tong Ze Investment Partnership (Limited Partnership)	1,766,907	.1996%
Sunrise Baoying (Ningbo) Investment Center (Limited Partnership)	1,315,642	.1486%
Xiamen He Yong Zhi Cheng Equity Investment Partnership (Limited Partnership)	860,468	.0972%
Hangzhou Jingyue Technology Development Partnership (Limited Partnership)	993,611	.1122%

Supplementary Agreement

to

Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd.

Among

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.,

Beijing Tongmei Xtal Technology Co., Ltd.

and

AXT, INC.

January 2021

Supplementary Agreement to Capital Increase Agreement

The Supplementary Agreement to the Capital Increase Agreement (hereinafter referred to as the “Supplementary Agreement”) is entered into as of [DD] [MM], 2021 in Beijing by and among:

Party A: Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.,

Domicile: Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai

Legal Representative: Zhang Shuheng

Party B: Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as the “Target Company” or “the Company”)

Domicile: No.4, East Second Street, Industrial Development Zone, Tongzhou District, Beijing, PRC

Legal Representative: Morris Young

Party C: AXT, INC. (hereinafter referred to as “controlling shareholder”)

Domicile: 4281 TECHNOLOGY DR FREMONT CA 94538

Authorized Representative: Morris Young

(Party A, Party B and Party C are collectively referred to as the “Parties” and individually a “Party” in the Supplementary Agreement, as required by the context)

WHEREAS:

1. Party A is the investor of the Target Company, a limited partnership duly incorporated and validly existing in accordance with the laws of the People’s Republic of China, with its registered address at Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai, PRC.

2. Party B is the Target Company, a limited liability company incorporated and effectively existing pursuant to Chinese laws, with a unified social credit code of 91110000700004889C and a registered capital of RMB 820.960319 million, its registered address is No.4, East Second Street, Industrial Development Zone, Tongzhou District, Beijing, and its legal representative is Morris Young.

3. Party C is an American company (stock code: AXTI) listed on NASDAQ, with its address at 4281 TECHNOLOGY DR FREMONT CA 94538.

4. The Parties have entered into the *Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd.* (hereinafter referred to as the *Capital Increase Agreement*) on [DD] [MM], 2021. Party A consents to subscribe for the corresponding newly-increased registered capital of the Target Company in RMB cash equivalent to USD 90742 (Party A shall make payment in RMB. The specific amount shall be calculated as per the middle price of USD against RMB (i.e. 1 U.S. dollar = RMB 6.6205) announced by the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. Party A makes an investment of RMB 0.600758 million).

To further define the rights and obligations of the Parties in this round of capital increase of the Company, the Parties consent to enter into the Supplementary Agreement, and reach supplementary agreements to the *Capital Increase Agreement* as below:

ARTICLE 1 DEFINITION AND INTERPRETATION

1.1 Unless otherwise stated herein or otherwise defined in the context, definitions and interpretations in the Supplementary Agreement shall have the same meaning as those in the *Capital Increase Agreement*.

ARTICLE 2 INDUSTRIAL AND COMMERCIAL CHANGES

2.1 Upon the establishment of employee stock ownership platform, the Target Company shall go through the registration formality of industrial and commercial change regarding Party A's additional investment for the Target Company within ten working days after Party A finishes the capital increase or accepts the Company's equity. The formalities must be finished no later than March 31, 2021. Where the Company fails to finish the formalities within the due time, Party B shall notify Party A in written form and both parties can prolong the period appropriately via consultation.

ARTICLE 3 VALUATION OF TARGET COMPANY AND INVESTMENT PROPORTION OF PARTY A

3.1 The Parties agree and acknowledge that, subject to Article 5 (Restructuring of the Target Company) of the Supplementary Agreement, the pre-investment valuation of the Target Company prior to this round of capital increase is USD 624 million. The Target Company plans to attract financing of USD 90742 million from Party A. The after-investment valuation is USD 673 million (including USD 22.5 million corresponding to Haitong capital increase and USD 24 million corresponding to Anxin capital increase, USD 1 million corresponding to Sunrise capital increase and USD 1.409258 million corresponding to equity financing of other two investors).

3.2 The actual investment of Party A in this round of capital increase is USD 90742 million. Premised on the above valuation in Article 3.1, in light of that fact that the employee stock ownership platform of the Target Company has become a shareholder of the Target Company and Chaoyang Jinmei Gallium Co., Ltd. and the shareholder (s) other than Party C of Beijing Boyu Semiconductor Vessel Craftwork Technology Co., Ltd. have become the shareholders of the Target Company, and without considering other equity financing after this round of capital

increase, Party A's equity ratio in the Target Company after this round of capital increase should be no less than 0.0135%.

ARTICLE 4 DELIVERY

4.1 Within five working days from the completion of the change of the industrial and commercial registration of this round of capital increase, the Parties shall complete the delivery mentioned in Article 4.2 of the Supplementary Agreement at the Target Company or other places otherwise consented by the Parties (hereinafter referred to as "delivery"). The date of completion of such delivery is referred to as "date of delivery" in the Supplementary Agreement.

4.2 On the date of delivery, the Target Company shall deliver the following documents to Party A:

(a) The original capital verification report issued by an accounting firm registered in China on the increase of registered capital and paid-in situation of the Target Company;

(b) The original of capital contribution certificate signed by legal representative of the Target Company and affixed with the official seal of the Target Company, which lists the equities that all shareholders hold in the Target Company and the ratio; copy of the new business license with official seal of the Target Company; a copy (copies) of the updated register of shareholders of the Target Company, and the original for Party A to check. Party A has been registered as a shareholder of the Target Company in the register of shareholders.

ARTICLE 5 RESTRUCTURING OF THE TARGET COMPANY

After entering into the Supplementary Agreement, the Target Company shall launch the following restructuring with a view to ensure eligible listing (as defined below):

5.1 The Target Company shall, prior to March 31, 2021, complete the acquisition of all shares of Baoding Tongmei Xtal Manufacturing Co., Ltd., Chaoyang Tongmei Xtal Technology Co., Ltd., Chaoyang Jinmei Gallium Co., Ltd., Beijing Boyu Semiconductor Vessel Craftwork Technology Co., Ltd. (including two holding subsidiaries affiliated to it, i.e., Boyu (Tianjin) Semiconductor Materials Co., Ltd. and Boyu (Chaoyang) Semiconductor Technology Co., Ltd.) and Nanjing Jinmei Gallium Co., Ltd. (including 25% equities of Xiaoyi Xing'an Gallium Co., Ltd. it holds) and go through the registration of industrial and commercial changes. As a result, Baoding

Tongmei Xtal Manufacturing Co., Ltd., Chaoyang Tongmei Xtal Technology Co., Ltd., Chaoyang Jinmei Gallium Co., Ltd., Beijing Boyu Semiconductor Vessel Craftwork Technology Co., Ltd. and Nanjing Jinmei Gallium Co., Ltd. have become wholly-owned subsidiaries of the Target Company, and the Target Company has become the only subject for the control and IPO (in the future) that AXT, INC. (a crystal technology company in the US) implements in China.

5.2 The Target Company shall hold a wholly-owned subsidiary in the United States prior to March 31, 2021. The U.S. subsidiary shall assume responsibility for the sales of overseas customers, take over the personnel of the controlling shareholder- AXT, INC. and afford the personnel expenses (except for the personnel expenses required to maintain the controlling shareholder's listing status in the US), in order that the sales of the Target Company - AXT, INC. and its subsidiaries are all conducted via the Target Company and its subsidiaries, and the sales price of the Target Company and its subsidiaries shall be close to the consignment price of the controlling shareholder - AXT, INC.

ARTICLE 6 VALUATION ADJUSTMENT

6.1 The capital increase price of this round of capital increase is determined based on the assets, personnel and business size of the Target Company upon completion of the restructuring of the Target Company as specified in Article 5.1 of the Supplementary Agreement. If there is any change in the restructuring scope of the Target Company prescribed in Article 5.1 of the Supplementary Agreement, Party B shall inform Party A in written form within five working days from the date of change, and Party A shall be entitled to reasonably adjust the investment valuation in principle of good faith based on the assets, personnel and business size of the changed restructuring scope, and adjust the capital increase price accordingly. Adjusted price = price prior to adjustment * operating income of adjusted assets under the combined caliber/operating income of assets prior to adjustment under simulated consolidation scope. Adjustment methods include, without limitation, increasing Party A's shareholding ratio in the Target Company, giving equity or cash compensation to Party B and/or Party C, etc.

6.2 In the case that the change of the restructuring scope of the Target Company results in decrease of over 20% in the operating income under the consolidation scope or is not recognized by Party A, Party A shall be entitled to unilaterally decide to rescind the *Capital Increase Agreement*, and the Target Company shall return the investment funds actually paid by Party A.

ARTICLE 7 ARRANGEMENTS DURING TRANSITION PERIOD

7.1 The period from the date of entering into the *Capital Increase Agreement* to the completion for industrial and commercial change for the restructuring of the Target Company as specified in the Supplementary Agreement is referred to as “transition period”.

7.2 Party B and Party C undertake to ensure that the Target Company and its subsidiaries (including the companies that the Target Company intends to restructure as specified in Article 5.1 of this Agreement, similarly hereinafter) operate pursuant to the normal business operation mode that conforms to laws and past practices during the transition period.

7.3 During the transition period, when the business assets of the Target Company and its subsidiaries has a major unfavorable change described in 6.2, Party A shall be entitled to start the valuation adjustment mechanism pursuant to Article 6 of the Supplementary Agreement or cancel the Capital Increase Agreement unilaterally. In such case, the Target Company shall refund Party A the investment having been paid.

ARTICLE 8 EQUITY REPURCHASE

8.1 Qualified listing

The Parties shall do their utmost to urge the Target Company to complete the initial public offering of shares and be listed on the domestic stock exchange (hereinafter referred to as "eligible listing" or "IPO") prior to December 31, 2022 (or other date consented by the Parties through consensus and written consent, hereinafter referred to as “expected completion date of listing”).

With a view to complete the eligible listing of the Target Company, the Parties consent to cooperate with the Target Company in taking or urging other parties to take all essential and appropriate actions, making or urging other parties to do all essential or appropriate behaviors and offer all corresponding assistance and cooperation, including, without limitation, the revision, alteration and termination of relevant clauses of the Supplementary Agreement, in line with the review requirements of the stock exchange, China Securities Regulatory Commission and other regulatory authorities.

8.2 Equity Repurchase

Where the Target Company is under any of the following circumstances, Party C shall repurchase part or all of the equity of the Target Company held by Party A as required by Party A:

(1) Where the Company fails to achieve IPO by the expected date of completion. If the Company’s IPO declaration material has been formally accepted by the securities regulatory authority or stock exchange and is under audit, the repurchase launch occasion agreed in this provision shall be postponed to the date when the Company fails in the audit/registration in securities regulatory authority or stock exchange with respect to the IPO application or withdraws the IPO declaration materials.

(2) Equity repurchase under other circumstances:

1) There are major changes in the main business of the Target Company, which has resulted in substantial obstacles to the IPO listing of the Company;

2) The Target Company has an associated transaction or guarantee that may generate material adverse effect on Party A’s interests with associated parties by violating the articles of association;

3) Before the IPO of the Target Company, the controlling shareholder and its concerted actors control the equity ratio of the Target Company less than 51% or lose control of the Company in other ways;

4) Where Party C is subjected to any hostile acquisition or attempt to change Party C’s control power initiated by any subject or person, Party C’s Board of Directors, without prejudice to director's loyalty, diligence and fiduciary duties under laws of the US, fails to response to it by taking the actions (e.g. issuing securities with voting right or any other nature of priority rights) according to relevant provisions of applicable law, registered certificate and the articles of association, causing material changes in Party C’s shareholding structure, Board of Directors and management.

5) Party C or the Target Company and its subsidiaries have seriously dishonored their commitments and warranties or violated other obligations under the *Capital Increase Agreement* and the Supplementary Agreement,

and besides, they fail to correct and make up for their breach within the reasonable time limit indicated by the written notice sent by Party A which reasonably requires them to correct the breach.

(3) Party A shall submit a repurchase request to Party C in written form within fifteen (15) days from the date of the repurchase prescribed in this Article, in order that Party C are provided with sufficient time to make repurchase arrangements.

(4) Party C shall, within ninety (90) days after Party A raises the repurchase request in written form, enter into an equity transfer agreement with Party A, and fully pay the corresponding equity repurchase price within the period indicated in the relevant repurchase legal documents.

8.3 Calculation Method of Equity Repurchase Price

The equity repurchase price of the Target Company is the investment fund actually paid by Party A when it acquires the equity.

8.4 The Parties further consent that, in the case that the Target Company fails to complete the listing prior to the expected completion date of listing, Party C shall also be entitled to send a repurchase notice to Party A in written form, and repurchase all the equity of the Target Company held by Party A at the price prescribed in Article 8.3 of the Supplementary Agreement.

ARTICLE 9 EQUITY TRANSFER

9.1 Restrictions on Equity Transfer

(1) Under no circumstances shall Party A directly or indirectly transfer any corporate equity to an entity ("competitor") or its affiliated party that maintains a competitive relationship with the business of the Target Company unless it acquires the written consent of the Target Company ahead of time.

(2) Within one year after the eligible listing of the Target Company (or longer period provided by applicable laws and regulations), Party A shall not transfer or entrust others to manage the shares of the Target Company held by it in any form, nor propose that the Target Company repurchase the shares of the Target Company held by it. Upon expiration of the aforesaid time limit, the shares of the Target Company held by Party A can be traded in the relevant market, except for those prohibited from being sold in accordance with the mandatory provisions of applicable laws, and the transaction shall strictly follow laws, administrative regulations, departmental rules, normative documents and relevant regulations of regulatory authorities such as exchanges, and corresponding information disclosure obligations shall be fulfilled.

9.2 Preemptive Rights

In the case that the controlling shareholder plans to transfer all or part of the Company's equity to a third party after the capital increase is accomplished and prior to the IPO of the Target Company, the controlling shareholder shall inform Party A of the above transfer matters beforehand in writing, and Party A shall be entitled to the preemptive right under the same conditions.

Despite the foregoing agreement, (1) the equity transfer arising out of the employee incentive plan as implemented by the Target Company; (2) He Junfang's transfer of some equities of the Target Company he holds via its controlled Beijing Bomeilian Special Ceramics Co., Ltd. or other subject after the restructuring specified in the Supplementary Agreement (the transfer price of every RMB 1 registered capital shall be no lower than the RMB 1 registered capital price corresponding to the capital increase this time) is not subject to the aforesaid preemptive right. Party A agrees to waive the preemptive right.

9.3 Priority right to sell

In the case that the controlling shareholder, as the transferring shareholder, plans to transfer the corporate equity held by it to a third party (hereinafter referred to as the "transferee") other than the rest shareholders (except for transferring the corporate equity held by it incurred by the execution of the Company's employee incentive plan), and Party A does not exercise the preemptive right as indicated in Article 9.2 of the Supplementary Agreement, Party A shall be entitled to send a written notice (hereinafter referred to as the "notice of priority right to sell") to the controlling shareholder within twenty (20) working days upon receipt of the transfer notice, requiring to sell the Company's equities that Party A holds at the date thereof to a third party in priority at the same price and under the same terms and conditions as those of the controlling shareholder's transfer of equity to a third party (hereinafter referred to as "the priority right to sell"), and specify the proportion of the equity to be transferred to the registered capital in the notice of priority right to sell. In such case, the controlling shareholder shall promote the third party's agreement on the acceptance of Party A's equities.

In the event that Party A fails to issue a notice of priority right to sell within the above time limit, or exercises the preemptive right pursuant to Article 9.2 of the Supplementary Agreement, it shall be deemed that Party A has waived exercising the priority right to sell.

ARTICLE 10 ANTI-DILUTION

10.1 After the capital increase is accomplished, in the case that the Target Company increases its registered capital, under the same conditions, Party A shall be entitled to the priority to subscribe based on the proportion of its paid-in capital contribution at that time, except for the newly added/issued registered capital for implementing the employee incentive plan of the Target Company,.

10.2 Subject to the Supplementary Agreement, upon completion of this round of capital increase, if Party B increases in capital and share at a price lower than the price per share when Party A invests in Party B, Party A, according to the following agreement of this article, adjust the unit price of the Company's equities it holds by means of "generalized weighted average" ("adjusted price"), so that the price per share of all equity held by Party A in the Company shall not be higher than the price per share of the newly-added registered capital subscribed by the new investors in the rear round of financing ("anti-dilution adjustment"), and adjust the equity ratio obtained by the previous investment accordingly in accordance with 10.3 herein Party A's price per share shall be adjusted accordingly under the circumstances of share split, dividend payment, joint stock and restructuring.

Adjusted price = OCP * (OS + (NP/OCP))/(OS + NS)

Registered capital amount that Party A holds after the adjustment = Total price of shares that Party A obtains/adjusted price

OCP= Price of every RMB of registered capital to the Company's equities that Party A holds prior to anti-dilution adjustment

OS= Sum of the Company's registered capital before subsequent capital increase and the registered capital that can be obtained by exercising the option

NP= Corresponding total investment in the Company's subsequent capital increase

NS= Corresponding newly increased registered capital for the Company's subsequent capital increase

10.3 Upon completion of this round of capital increase and prior to the IPO of the Target Company, when it is necessary to make anti-dilution adjustment, Party A shall be entitled to require the Target Company and the controlling shareholder to compensate Party A's equity, and the measures that can be selected include: (i) under the premise permitted by law, Party A subscribes for the newly-increased registered capital of the Company at the nominal consideration of RMB 1 yuan or at the lowest price provided by law; (ii) under the premise permitted by law, the controlling shareholder transfers the equity required for adjustment to Party A at the nominal consideration of RMB 1 yuan or at the lowest price provided by law; (iii) equity compensation methods provided by other laws.

10.4 Where the Target Company has one or multiple rounds of subsequent financing after the accomplishment of capital increase and before IPO of the Company, it shall calculate the equity compensation proportion respectively as per 10.3 herein for every round of financing.

ARTICLE 11 RIGHT TO KNOW

11.1 Upon completion of the capital increase, Party A shall be entitled to consult the Articles of Association, minutes of Shareholders' meetings, resolutions of the Board of Directors and minutes of meetings, resolutions of the Board of Supervisors and minutes of meetings, and financial and accounting reports, provided that the capital increase complies with relevant domestic and foreign laws and regulations and regulatory rules.

ARTICLE 12 GOVERNANCE OF THE COMPANY

12.1 Upon completion of the capital increase, the Target Company shall hold a Directors' meeting and invite all Directors to attend as stipulated in the Articles of Association. The resolutions of the Board of Directors shall be approved by more than half of all Directors, including but not limited to the following contents:

(1) Formulation and modification of the Company's Articles of Association;

(2) Formulation of the Company's major business policy and investment plan;

(3) Formulation of the Company's annual financial budget and accounting plan;

(4) Formulation of the Company's profits distribution scheme and loss recovery plan;

(5)The Company's increase or decrease of its registered capital, issuance of bonds or other securities, and plans for listing;

(6) The Company's external acquisition, sale of material assets, annexation, merger, reorganization, overseas investment, establishment of a joint venture, dissolution or liquidation;

(7) Approval, modification and management of employee equity incentive plan or employee stock ownership plan in any other form;

(8) A single guarantee amount exceeds 10% of the Company's latest audited net assets;

(9) The total amount of external guarantee provided by the Company and its holding subsidiaries reaches or exceeds any guarantee provided after 50% of the Company's latest audited net assets;

(10) The guarantee provided for the guarantee object whose asset-liability ratio exceeds 70%;

(11) The guarantee provided for the Controlling Shareholder and its affiliates.

ARTICLE 13 COMMITMENTS, REPRESENTATIONS AND WARRANTIES

13.1 Representations and warranties of Party A:

(1) Party A is legally established and effectively exists in accordance with Chinese laws. Party A and its Shareholders are not classified as the “three types of shareholders” such as contractual private equity funds, asset management plans, and trust plans, and have the shareholder qualification stipulated by laws and regulations.

(2) Party A has independent legal status and full capacity for civil conduct to sign and perform the Supplementary Agreement and can act independently as a litigation subject.

(3) Party A has obtained all authorizations, approvals or registrations necessary for it to execute, deliver and perform the Supplementary Agreement and complete the transactions hereunder. The execution and performance hereof by Party A shall not violate the provisions of any relevant laws, regulations and normative documents or the clauses of any material contractual documents binding upon it.

(4) Party A has prepared sufficient funds for this capital increase and the source of funds is true and legal.

13.2 Representations and warranties of Party B and Party C (except for the circumstance having been disclosed to Party A):

(1) The execution and performance hereof by Party B and Party C have been internally approved and authorized, and such authorization document has been provided for Party A;

(2) Party B and Party C have independent legal status and full capacity for civil conduct to sign and perform the Supplementary Agreement and can act independently as a litigation subject.

(3) Party B and Party C commit that they have obtained all the authorization, approval or filing necessary for the execution and performance hereof and the completion of the transactions hereunder. The execution hereof by Party B and Party C and the performance of their obligations hereunder shall not violate any agreement entered into individually or jointly as a party or the provisions of any relevant laws, regulations and normative documents or the clauses of any material contractual documents binding upon them.

(4) As of the date of execution hereof, in the event that Party C is subjected to any hostile takeover or attempt to change Party C’s control right initiated by any entity or person, Party C’s Board of Directors, without prejudice to director's loyalty, diligence and fiduciary duties under laws of the US, shall response to it by taking the actions (e.g. issuing securities with voting right or any other nature of priority rights) according to relevant provisions of applicable law, registered certificate and the articles of association, so as to avoid material changes to Party C’s shareholding structure, Board of Directors and management..

(5) As of the date of execution hereof, Party C shall neither operate, directly or indirectly, or for others, any business that is identical to, similar to or in competition with the Company’s main business, nor cause an adverse impact on the Company’s completion of the IPO on account of the matters related to horizontal competition.

(6) As of the date of execution hereof, Party B and Party C shall further regulate and reduce affiliated transactions, and shall not cause an adverse impact on the Company’s completion of the IPO on account of such transactions.

(7) The Target Company has not provided guarantees, loans or loans in disguise to the Controlling Shareholder or its affiliates or any third party, and there is neither mortgage, pledge, lien or other forms of guarantee or counter-

guarantee for important assets such as equity, real estate, land use rights, trademarks and patents, or other forms of contingent debts, liabilities or obligations. The execution and performance hereof will not entitle the Creditors of the Target Company (including, but not limited to, the lending bank) to declare that the debt is maturing

prematurely or to demand guarantees or increased interest or otherwise to change the terms and conditions of the debt.

(8) The Target Company is not involved in any material claim, lawsuit, arbitration, judicial investigation, administrative investigation or punishment, and the Controlling Shareholder is not involved in any material claim, lawsuit, arbitration, judicial investigation, administrative investigation or punishment concerning the Target Company. The Directors and Senior Managers of the Target Company are not involved in any material claim, lawsuit, arbitration, judicial investigation, administrative investigation or punishment as a result of the acts of the Target Company, and the Controlling Shareholder is not involved in any material claim, lawsuit, arbitration, judicial investigation, administrative investigation or punishment concerning the Directors and Senior Managers of the Target Company.

(9) On the signing date and the closing date hereof, the important agreements (including business, lease, loan and mortgage agreements) being executed by the Target Company shall be legal, valid and binding upon the relevant Parties. The important and ongoing affiliated transaction agreements made and concluded by and among the Target Company and the affiliates have complied with legal procedures and been disclosed to Party A. There is no circumstance that may cause the Target Company to be liable for breach of contract or indemnify the other Party, and there is no breach of contract which may have a material adverse effect on the Target Company. The agreements and contracts between the Target Company and third parties have been or will be performed in full and legally, and there is no circumstance where the Target Company shall bear major liabilities to any third party for any of its acts prior to the date of execution hereof.

(10) The Target Company has duly submitted a true and complete tax return to the Chinese tax authorities. The Target Company and its affiliates have paid in full the taxes (including, but not limited to, enterprise income tax, business tax, value-added tax, etc.) payable prior to the date of execution hereof in accordance with applicable Chinese tax laws, regulations and normative documents. The Target Company does not receive any notice of challenge, investigation or punishment from the government authorities concerning tax matters.

(11) All rights and interests in the intellectual property rights owned by the Target Company are legal without infringing the intellectual property rights of others. The important intellectual property rights of the Target Company are not involved in dispute, claim or any mortgage, pledge or other guarantee rights or restrictions.

(12) The Target Company has established legal labor relations with its employees without any major disputes, as well as the corresponding arbitration or litigation procedures. The Target Company and its subsidiaries have paid the social insurance premium, housing provident fund and other fees payable by the employees in accordance with applicable laws prior to the date of execution hereof.

(13) The restructuring agreed in ARTICLE 5.1 hereof by the Target Company will not materially and adversely affect its business, assets, personnel integrity and independence.

(14) Within 4 months after the end of each financial year, Party B and Party C commit to submit to Party A the Target Company’s audit report of the previous year; the Target Company shall, within 15 days prior to the beginning of each financial year, provide Party A with the plans for annual operation, annual budget and investment of the following year; the annual audit of the Target Company shall be conducted by an accounting firm registered in China.

(15) This Agreement shall be legally binding up Party B and Party C once it comes into force,

ARTICLE 14 TERMINATION OF SPECIAL STIPULATIONS

14.1 The Supplementary Agreement shall terminate automatically on the date when the Target Company formally submits IPO application materials to China Securities Regulatory Commission (CSRC) or the stock exchange.

ARTICLE 15 MISCELLANEOUS

15.1 It is agreed by the Parties hereto that the Supplementary Agreement shall constitute an integral part of the *Capital Increase Agreement* and shall prevail in case of any inconsistency between the Supplementary Agreement and the *Capital Increase Agreement*. In case of any unfinished matters in the Supplementary Agreement, the provisions of the *Capital Increase Agreement* shall prevail.

15.2 The Supplementary Agreement shall take effect on the date of execution by the Parties hereto.

15.3 According to the needs of the change of business registration, the Parties agree to cooperate with each other to, in accordance with the format required by the industrial and commercial administration department, separately enter into a simplified Capital Increase

Agreement (the "Format Version") concerning the capital increase. In case of any conflict or inconsistency between the Format Version and the *Capital Increase Agreement* or the Supplementary Agreement, the provisions of the *Capital Increase Agreement* and the Supplementary Agreement shall prevail.

15.4 The Supplementary Agreement is made in triplicate, with each Party holding one copy. Each copy shall be equally authentic.

(The remainder of this page is intentionally left blank)

(No text on this page, and only for the signature of *Supplementary Agreement to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.)*

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., (Seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Supplementary Agreement to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

Beijing Tongmei Xtal Technology Co., Ltd. (Seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Supplementary Agreement to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

AXT, INC.

Authorized representative (signature):

Schedule identifying agreements substantially identical to the form of First Supplemental Agreement filed as Exhibit 10.14 hereto

Subscribed Capital of Beijing Tongmei Xtal Technology Co., Ltd.

Investor	Purchase Price (RMB)	Capital %
Liaoning Haitong New Energy Equity Investment (Limited Partnership)	11,840,774	1.3373%
Liaoning Haitong New Energy Low-Carbon Industry Equity Investment Co., Ltd.	4,604,745	.5201%
Haitong Innovation Securities Investment Co., Ltd.	13,156,415	1.4859%
Fujian Province An Xin Industry Investment Fund Partnership (Limited Partnership)	8,942,416	1.01%
Jinggangshan Meicheng Equity Investment Partnership (Limited Partnership)	5,961,172	.6733%
Hefei Walden II IC Industry Investment Partnership (Limited Partnership)	6,955,797	.7856%
Qingdao Xinxingyi Equity Investment Fund Partnership (Limited Partnership)	3,974,553	.4489%
Qiji (Hangzhou) Investment Consulting Co., Ltd.	3,974,553	.4489%
Gongqingcheng Yi Hua Tong Ze Investment Partnership (Limited Partnership)	1,766,907	.1996%
Sunrise Baoying (Ningbo) Investment Center (Limited Partnership)	1,315,642	.1486%
Xiamen He Yong Zhi Cheng Equity Investment Partnership (Limited Partnership)	860,468	.0972%
Hangzhou Jingyue Technology Development Partnership (Limited Partnership)	993,611	.1122%

Exhibit 10.13

Supplementary Agreement II

to

Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd.

Among

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.,

Beijing Tongmei Xtal Technology Co., Ltd.

And

AXT, INC.

January 2021

Supplementary Agreement II to Capital Increase Agreement

The Supplementary Agreement II to the Capital Increase Agreement (hereinafter referred to as the "Agreement") is made and entered into by and among the Parties below in Beijing on [DD] [MM], 2021.

Party A: Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd.,

Domicile: Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai

Legal Representative: Zhang Shuheng

Party B: Beijing Tongmei Xtal Technology Co., Ltd.

Domicile: No.4, East Second Street, Industrial Development Zone, Tongzhou District, Beijing, PRC

Legal Representative: Morris Young

Party C: AXT, INC.

Domicile: 4281 TECHNOLOGY DR FREMONT CA 94538

Authorized Representative: Morris Young

(Party A, Party B and Party C are collectively referred to as the "Parties" and individually a "Party" in the Agreement, as required by the context)

WHEREAS:

1. Party A is the investor of the Target Company, a limited partnership duly incorporated and validly existing in accordance with the laws of the People's Republic of China, with its registered address at Room 603, No. 15, Lane 218, Haiji No.6 Road, Nanhui New Town, Pudong New Area, Shanghai, PRC.

2. Party B is the Target Company, a limited liability company incorporated and effectively existing pursuant to Chinese laws, with a unified social credit code of

91110000700004889C and a registered capital of RMB 820.960319 million, its registered address is No.4, East Second Street, Industrial Development Zone, Tongzhou District, Beijing, PRC, and its legal representative is Morris Young.

3. Party C is a NASDAQ listed company (stock code: AXTI) with its address at 4281 TECHNOLOGY DR FREMONT CA 94538.

4. The Parties have signed and entered into the *Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd.* (hereinafter referred to as the "Capital Increase Agreement") and the *Supplementary Agreement to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd.* (hereinafter referred to as the "Supplementary Agreement") on [DD] [MM], 2021. Party A consents to subscribe for the corresponding newly-increased registered capital of the Target Company in RMB cash equivalent to USD 90742 in total (Party A makes payment in RMB, and the specific amount is calculated as per the central parity of the exchange rate of USD to RMB (i.e. 1 U.S. dollar = RMB 6.6205) of the People's Bank of China on 2:00 p.m., November 13, 2020, i.e. RMB 0.600758 million).

To further define the rights and obligations of the Parties in this round of capital increase of the Company, the Parties consent to make and enter into the Agreement, and reach supplementary agreements to the *Capital Increase Agreement* and *Supplementary Agreement* as below:

ARTICLE 1 DEFINITION AND INTERPRETATION

1.1 Unless otherwise stated herein or otherwise defined in the context, definitions and interpretations in the Agreement shall have the same meaning as those in the *Capital Increase Agreement* and *Supplementary Agreement*.

ARTICLE 2 EQUITY REPURCHASE

2.1 Qualified Listing

The Parties shall do their utmost to urge the Target Company to complete the initial public offering of shares and be listed on the domestic stock exchange (hereinafter referred to as “eligible listing” or “IPO”) prior to December 31, 2022 (or other date consented by the Parties through consensus and written consent, hereinafter referred to as “expected completion date of listing”). With a view to complete the eligible listing of the Target Company, the Parties consent that the provisions of Article 8 EQUITY REPURCHASE of the *Supplementary Agreement* shall terminate automatically upon formal submission of IPO application materials to the securities regulatory authority or the stock exchange by the Target Company.

2.2 Equity Repurchase

The Parties hereto further agree that if the Target Company fails or is unable to complete the qualified listing prior to the aforesaid expected date of listing, the provisions on repurchase set forth in Article 8 of the *Supplementary Agreement* shall take effect automatically and shall become effective retroactively as of the date of execution of the *Supplementary Agreement*, i.e.:

Where the Target Company is under any of the following circumstances, Party C shall repurchase part or all of the equity of the Target Company held by Party A as required by Party A:

(1) Where the Company fails to achieve IPO by the expected date of completion. If the Company’s IPO declaration material has been formally accepted by the securities regulatory authority or stock exchange and is under audit, the repurchase launch occasion agreed in this provision can be postponed to the date when the Company fails in the audit/registration in securities regulatory authority or stock exchange with respect to the IPO application or withdraws the IPO declaration materials.

(2) Equity repurchase under other circumstances:

1) There are major changes in the main business of the Target Company, which has resulted in substantial obstacles to the IPO listing of the Company;

2) The Target Company violates the provisions of the Articles of Association and conducts related transactions or guarantees with its affiliated parties that may have a material adverse impact on Party A's interests;

3) Before the IPO of the Target Company, the controlling shareholder and its concerted actors control the equity ratio of the Target Company less than 51% or lose control of the Company in other ways;

4) Where Party C is subjected to any hostile acquisition or attempt to change Party C's control power initiated by any subject or person, Party C's Board of Directors, without prejudice to director's loyalty, diligence and fiduciary duties under laws of the US, fails to response to it by taking the actions (e.g. issuing securities with voting right or any other nature of priority rights) according to relevant provisions of applicable law, registered certificate and the articles of association, causing material changes in Party C's shareholding structure, Board of Directors and management.

5) Party C or the Target Company and its subsidiaries have seriously dishonored their commitments and warranties or violated other obligations under the *Capital Increase Agreement* and the Agreement, and besides, they fail to correct and make up for their breach within the reasonable time limit indicated by the written notice sent by Party A which reasonably requires them to correct the breach.

(3) Party A shall submit a repurchase request to Party C in written form within fifteen (15) days from the date of the repurchase prescribed in this Article, in order that Party C are provided with sufficient time to make repurchase arrangements.

(4) Party C shall, within ninety (90) days after Party A raises the repurchase request in written form, enter into an equity transfer agreement with Party A, and fully pay the corresponding equity repurchase price within the period indicated in the relevant repurchase legal documents.

2.3 Calculation Method of Equity Repurchase Price

The equity repurchase price of the Target Company is the investment fund actually paid by Party A when it acquires the equity.

2.4 The Parties further consent that, in the case that the Target Company fails to complete the listing prior to the expected completion date of listing, Party C shall also be entitled to send a repurchase notice to Party A in written form, and repurchase all the equity of the Target Company held by Party A at the price prescribed in Article 2.3 of the Agreement.

ARTICLE 3 COMMITMENTS, REPRESENTATIONS AND WARRANTIES

The commitments, representations and warranties made by the Parties under the *Capital Increase Agreement* and *Supplementary Agreement* shall apply to the Agreement.

ARTICLE 4 MISCELLANEOUS

4.1 It is agreed by the Parties hereto that the Agreement shall constitute an integral part of the *Capital Increase Agreement* and the *Supplementary Agreement*, and shall prevail in case of any inconsistency there between. In case of any unfinished matters in the Agreement, the provisions of the *Capital Increase Agreement* and the *Supplementary Agreement* shall prevail.

4.2 The Agreement shall take effect on the date of signature by the Parties hereto.

4.3 The Agreement is made in triplicate, with each Party holding one copy. Each copy shall be equally authentic.

(The remainder of this page is intentionally left blank)

(No text on this page, and only for the signature of *Supplementary Agreement II to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., (Seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Supplementary Agreement II to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

Beijing Tongmei Xtal Technology Co., Ltd. (Seal)

Legal representative or authorized representative (signature):

(No text on this page, and only for the signature of *Supplementary Agreement II to Capital Increase Agreement on Beijing Tongmei Xtal Technology Co., Ltd. among Guangshuo Semiconductor Equipment (Shanghai) Co., Ltd., Beijing Tongmei Xtal Technology Co., Ltd. and AXT, INC.*)

AXT, INC.

Authorized Representative (signature):

Schedule identifying agreements substantially identical to the form of Second Supplemental Agreement filed as Exhibit 10.15 hereto

Subscribed Capital of Beijing Tongmei Xtal Technology Co., Ltd.

Investor	Purchase Price (RMB)	Capital %
Liaoning Haitong New Energy Equity Investment (Limited Partnership)	11,840,774	1.3373%
Liaoning Haitong New Energy Low-Carbon Industry Equity Investment Co., Ltd.	4,604,745	.5201%
Haitong Innovation Securities Investment Co., Ltd.	13,156,415	1.4859%
Fujian Province An Xin Industry Investment Fund Partnership (Limited Partnership)	8,942,416	1.01%
Jinggangshan Meicheng Equity Investment Partnership (Limited Partnership)	5,961,172	.6733%
Hefei Walden II IC Industry Investment Partnership (Limited Partnership)	6,955,797	.7856%
Qingdao Xinxingyi Equity Investment Fund Partnership (Limited Partnership)	3,974,553	.4489%
Qiji (Hangzhou) Investment Consulting Co., Ltd.	3,974,553	.4489%
Gongqingcheng Yi Hua Tong Ze Investment Partnership (Limited Partnership)	1,766,907	.1996%
Sunrise Baoying (Ningbo) Investment Center (Limited Partnership)	1,315,642	.1486%
Xiamen He Yong Zhi Cheng Equity Investment Partnership (Limited Partnership)	860,468	.0972%
Hangzhou Jingyue Technology Development Partnership (Limited Partnership)	993,611	.1122%

关于股份锁定的承诺函

Letter of Commitment on Share Lock-up

鉴于北京通美晶体技术股份有限公司（以下简称“发行人”）拟首次公开发行股票并在科创板上市（以下简称“本次发行上市”），本企业作为发行人的控股股东，现就所持发行人股份的锁定及减持事项承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Issuer”) plans to make an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as “this Listing”), our enterprise, as the controlling shareholder of the Issuer, hereby undertakes as follows with respect to the lock-up and reduction matters <u>of the Issuer’s shares held by it:</u>

一、 自发行人股票上市之日起36个月内，不转让或者委托他人管理本企业直接和间接持有的发行人本次发行上市前已发行的股份（以下简称“首发前股份”），也不提议由发行人回购该部分股份。

I. Within 36 months from the Issuer’s stock listing date, our enterprise shall not transfer or entrust others to manage the shares, which are directly and indirectly held by our enterprise and have been issued by the Issuer before this Listing, (hereinafter referred to as “the shares before IPO”), and shall not suggest that the Issuer should repurchase such shares.

二、 发行人上市后6个月内若发行人股票连续20个交易日的收盘价低于发行人本次发行上市时的股票发行价（以下简称“发行人股票发行价”），或者上市后6个月期末收盘价低于发行人股票发行价，本企业持有发行人股份的锁定期自动延长6个月。若发行人已发生派息、送股、资本公积转增股本、增发新股等除权、除息事项，则上述发行价指发行人股票经调整后的价格。

II. If the closing price of the Issuer’s stocks is lower than the stock issue price at the time of this Listing of the Issuer (hereinafter referred to as “the Issuer’s stock issue price”) for 20 consecutive trading days within 6 months after the Issuer is listed, or if the closing price at the end of 6 months after the listing is lower than the Issuer’s stock issue price, the lock-up period of the Issuer’s shares held by our enterprise shall be automatically extended for six months. If the Issuer has carried out the ex-right and ex-dividend matters such as dividend payout, stock dividend, conversion of capital reserve into share capital and additional issuance of new stocks, then the above issue price shall refer to the adjusted price of the Issuer’s stocks.

三、 发行人存在《上海证券交易所科创板股票上市规则》第十二章第二节规定的重大违法情形，触及退市标准的，自相关行政处罚决定或者司法裁判作出之日起至发行人股票终止上市前，本企业将不会减持发行人股份。

III. If the Issuer is involved in major circumstances against the laws stipulated in Section II, Chapter XII of *Rules of Shanghai Stock Exchange for Stock Listing on the Science and Technology Innovation Board* and meets the delisting standards, our enterprise will not reduce the Issuer's shares from the date when the relevant administrative penalty or judicial judgment is made to the termination of the Issuer's stock listing.

四、 本企业在锁定期届满后减持首发前股份的，将严格遵守法律、行政法规、部门规章、规范性文件及上海证券交易所的相关规定，并履行相应的信息披露义务。

IV. If our enterprise reduces the shares before IPO upon the expiration of the lock-up period, our enterprise will strictly observe the laws, administrative regulations, departmental rules, normative documents and relevant stipulations of Shanghai Stock Exchange, and will perform the corresponding information disclosure obligation.

五、 本企业将及时向发行人报告本企业持有的发行人股份及其变动情况。

V. Our enterprise will timely report the Issuer's shares held by our enterprise and the changes to the Issuer.

六、 如本企业违反上述承诺减持发行人股份的，则出售该部分发行人股份所取得的实际收益（如有）归发行人所有。

VI. If our enterprise reduces the Issuer's shares in violation of the above commitment, then the actual incomes (if any) made from selling such Issuer's shares shall belong to the Issuer.

（本页以下无正文）

(There is not text below this page)

（本页无正文，为《关于股份锁定的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Share Lock-up*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于持股意向及减持意向的承诺函

Letter of Commitment on the Shareholding Intention and Share Reduction Intention

鉴于北京通美晶体技术股份有限公司（以下简称“公司”）拟申请首次公开发行股票并在科创板上市（以下简称“本次发行上市”），本企业作为公司的控股股东，现就所持公司股份的持股意向及减持意向承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Company”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as “this Listing”), our enterprise, as the controlling shareholder of the Company, hereby undertakes as follows with respect to its intentions to hold and reduce the Company’s shares held by it:

一、 在持有公司股份的锁定期届满后，本企业将根据实际需要和二级市场情况决定是否减持及减持数量。

I. Upon the expiration of the lock-up period of the Company’s shares held by our enterprise, our enterprise will decide whether to reduce the shares and the amount of shares to be reduced according to the actual needs and the conditions of the secondary market.

二、 本企业拟减持公司本次发行上市前已发行的股份（以下简称“首发前股份”）的，将严格遵守中国证券监督管理委员会、上海证券交易所关于股东减持的相关规定，审慎制定股份减持计划，并将事先明确并披露公司的控制权安排，保证公司持续稳定经营；本企业在持有公司股份锁定期届满后两年内拟减持公司股份的，减持价格将不低于公司首次公开发行股票的发行价（若公司在本次发行上市后发生派息、送股、资本公积转增股本、增发新股等除权、除息事项的，减持价格按照监管规则的规定作相应调整），并通过公司在减持前三个交易日或相关法律法规规定的期限内予以公告。

II. If our enterprise plans to reduce the shares issued by the Company before this Listing (hereinafter referred to as “the shares before IPO”), our enterprise will strictly observe the relevant stipulations on share reduction by shareholder of China Securities Regulatory Commission and Shanghai Stock Exchange and prudently formulate the share reduction plan, and will make clear and disclose the arrangement for the right to control the Company in advance to ensure the Company’s continuous and stable operation. If our enterprise plans to reduce the Company’s shares held by it within two years upon the expiration of the lock-up period of the Company’s shares held by it, the share reduction price shall be no lower than the issue price of the Company’s IPO (if the Company carries out the ex-right and ex-dividend matters such as dividend payout, stock dividend, conversion of capital reserve into share capital and additional issuance of new stocks, the share reduction price shall be adjusted according to the stipulations of regulatory rules), and shall be announced through the Company within three trading days before the share reduction or the term stipulated in relevant laws and regulations.

三、 本企业在锁定期届满后减持公司首发前股份的，减持方式、程序等将严格遵守《中华人民共和国公司法》《中华人民共和国证券法》及其他适用的法律、行政法规、部门规章、规范性文件及相关监管规则关于股份减持及信息披露的规定。

III. If our enterprise reduces the Company's shares before IPO upon the expiration of the lock-up period, the share reduction and procedure shall strictly observe the *Company Law of the People's Republic of China*, the *Securities Law of the People's Republic of China* and other applicable laws, administrative regulations, departmental rules and normative documents as well as the stipulations on share reduction and information disclosure in the relevant regulatory rules.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于持股意向及减持意向的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on the Shareholding Intention and Share Reduction Intention*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于上市后三年内稳定公司股价的预案及约束措施的承诺函

Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures

为维护北京通美晶体技术股份有限公司（以下简称"公司"）股票上市后股价的稳定，充分保护公司股东特别是中小股东的权益，公司特制定《北京通美晶体技术股份有限公司上市后三年内稳定公司股价的预案》（以下简称"《稳定股价的预案》"）。根据中国证券监督管理委员会（以下简称"中国证监会"）《关于进一步推进新股发行体制改革的意见》的要求，公司及其控股股东、在公司领取薪酬和/或津贴的董事（独立董事除外，下同）和高级管理人员承诺将严格遵守下述稳定公司股价的预案：

In order to maintain the stable stock price after the stocks of Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as "the Company") are listed and fully protect the rights and interests of the Company's shareholders and especially the small and medium shareholders, the Company hereby formulates the *Plan of Beijing Tongmei Xtal Technology Co., Ltd. for Stabilizing the Company's Share Price within Three Years upon the Listing* (hereinafter referred to as the "*Plan for Stabilizing the Stock Price*"). According to the requirements of the *Opinions on Further Promoting the Reform of New Stock Issue System* of China Securities Regulatory Commission (hereinafter referred to as "CSRC"), the Company and its controlling shareholder, directors (except independent directors, the same below) and senior executives receiving the remunerations and/or allowances from the Company shall undertake to strictly observe the following plan for stabilizing the Company's stock price:

一、 启动和停止股价稳定措施的条件

I. Conditions for starting and stopping the measures for stabilizing the stock price

（一） 启动条件：如果公司首次公开发行股票并在科创板上市后三年内股价出现连续20个交易日收盘价均低于公司上一个会计年度经审计的每股净资产（每股净资产=合并财务报表中归属于母公司普通股股东权益合计数/年末公司股份总数，如果公司股票发生派息、送股、资本公积金转增股本、增发新股等除权、除息事项或者因其他原因导致公司净资产或股份总数发生变化的，则相关的计算对比方法按照证券交易所的有关规定或者其他适用的规定做调整处理，下同）的情况时，公司将按照顺序采取以下措施中的一项或多项稳定公司股价：（1）公司回购股票；（2）控股股东增持股票；（3）董事和高级管理人员增持股票。

(I) Conditions for starting the measures: if the closing stock price is lower than the audited net assets per share (net assets per share = the total number of rights and interests attributable to the common shareholders of the parent company in the consolidated financial statements/the total number of the Company's shares at the year end, in case of any change in the net assets or total shares of the Company due to ex-right and ex-dividend matters such as dividend payout, stock dividend, conversion of capital reserve into share capital and additional issuance of new stocks in the Company's stocks or for other reasons, then the relevant calculation and comparison methods shall be adjusted according to the relevant stipulations of the stock exchange or other applicable stipulations, the same below) of the Company in the previous accounting year for 20 consecutive trading days within three years after the Company makes the IPO and is listed on the Science and Technology Innovation Board, the Company will take one or multiple measures as follows in sequence to stabilize the Company's stock price: (1) the Company repurchases the shares; (2) the controlling shareholder increases the shares; (3) directors and senior executives increase the shares.

（二） 停止条件：在以下稳定股价具体措施的实施期间内，如公司股票连续20个交易日收盘价均高于公司上一个会计年度经审计的每股净资产时，或继续回购和/或增持公司股份将导致公司股权分布不符合上市条件，将停止实施股价稳定措施。

(II) Conditions for stopping the measures: within the implementation period of the following specific measures for stabilizing the stock price, if the Company's closing stock price is higher than the audited net assets per share of the Company in the previous accounting year for 20 consecutive trading days, or if the continued repurchase and/or increase of the Company's shares will cause the Company's equity distribution to fail to meet the listing conditions, the Company will stop implementing the measures for stabilizing the stock price.

二、 稳定股价的措施

II. Measures for stabilizing the stock price

（一） 公司稳定股价的措施

(I) The Company's measures for stabilizing the stock price

当触发上述股价稳定措施的启动条件时，在确保公司股权分布符合上市条件以及不影响公司正常生产经营的前提下，公司应依照《中华人民共和国公司法》《上市公司回购社会公众股份管理办法（试行）》《关于上市公司以集中竞价交易方式回购股份的补充规定》等法律、行政法规、部门规章、规范性文件、证券交易所相关规定、公司章程及公司内部治理制度的规定，及时履行相关法定程序后，向社会公众股东回购股份。

When the conditions for starting the above measures for stabilizing the stock price are triggered, in the premise of ensuring the compliance of the Company's equity distribution with the listing conditions and not influencing the Company's normal production or operation, the Company shall repurchase the shares from the social public shareholders after it timely performs the relevant legal procedures according to the laws such as the *Company Law* *of the People's Republic of China*, *Measures for Management of the Repurchase of Social Public Shares by the Listed Companies (Trial)* and *Supplementary Provisions on Share Purchase by the Listed Companies in the Way of Centralized Competitive Price Transaction*, administrative regulations, departmental rules, normative documents, relevant stipulations of stock exchange, the Articles of Association and the stipulations of the corporate internal governance system.

公司应在触发稳定股价措施日起10个交易日内召开董事会审议公司回购股份的议案，议案须经公司董事会全体董事过半数表决通过，并在董事会做出决议后的2个交易日内公告董事会决议、有关议案及召开股东大会的通知。回购股份的议案应包括拟回购股份的价格或价格区间、股份数量、回购期限以及届时有效的法律、行政法规、部门规章、规范性文件以及证券交易所相关规定应包含的其他信息。公司股东大会对回购股份的议案做出决议，须经出席股东大会的股东所持表决权三分之二以上通过，公司控股股东承诺就该等回购事宜在股东大会中投赞成票。公司应在股东大会审议通过该等方案后的5个交易日内启动稳定股价具体方案的实施。回购的股份将被依法注销并及时办理公司减资程序。

The Company shall hold a board meeting within 10 trading days from the date when the conditions for measures for stabilizing the stock price are triggered, to deliberate the Company's proposal on the share repurchase, and the proposal shall be approved by voting of more than half of all directors of the Board of Directors of the Company, and the resolution and related proposal of the board meeting and the notice on holding the shareholders' meeting shall be announced within 2 trading days after the board meeting makes the resolution. The proposal on the share repurchase shall include the price or price range of shares planning to be repurchased, the share quantity, the repurchase term as well as other information to be contained by the effective laws, administrative regulations, departmental rules, normative documents and relevant stipulations of the stock exchange at that time. The proposal on share repurchase shall be resolved at the shareholders' meeting of the Company, which shall be approved by more than two thirds of the voting power held by the shareholders attending the shareholders' meeting. The Company's controlling shareholder undertakes to vote in favor of such repurchase matters at the shareholders' meeting. The Company shall start implementing the specific scheme for stabilizing the stock price within 5 trading days after such scheme is deliberated and approved at the shareholder's meeting. The shares repurchased will be cancelled according to law, and the Company's capital reduction procedure will be timely handled.

公司为稳定股价之目的通过回购股份议案的，回购公司股份的数量、金额应当符合以下条件：

If the Company approves the share repurchase proposal for the purpose of stabilizing the stock price, the quantity and amount of the Company's shares repurchased shall meet the following conditions:

1、 单次用于回购股份的资金金额不低于上一个会计年度经审计的归属于公司股东净利润的10%，但不高于上一个会计年度经审计的归属于公司股东净利润的20%；

1. The amount of funds used for a single share repurchase shall be no less than 10% of the audited net profit attributable to the Company’s shareholders in the previous accounting year but shall be no more than 20% of the audited net profit attributable to the Company’s shareholders in the previous accounting year;

2、 同一会计年度内用于稳定股价的回购资金合计不超过上一个会计年度经审计的归属于公司股东净利润的50%。

2. The total repurchase funds used to stabilize the stock price within a same accounting year shall not exceed 50% of the audited net profit attributable to the Company’s shareholders in the previous accounting year.

超过上述标准的，有关稳定股价措施在当年度不再继续实施。但如下一年度继续出现需启动稳定股价措施的情形时，公司将继续按照上述原则执行稳定股价预案。

If the above standards are exceeded, the relevant measures for stabilizing the stock price shall not be continued any longer in the current year. However, in case of the circumstances for which the measures for stabilizing the stock price need to be started again in the next year, the Company will continue to implement the plan for stabilizing the stock price according to the above principles.

（二） 控股股东稳定股价的措施

(II) Controlling shareholder’s measures for stabilizing the stock price

当公司回购股份方案实施期限届满之日后公司股票连续20个交易日的收盘价均低于公司上一个会计年度经审计的每股净资产时，或无法实施公司回购股份的股价稳定措施时，公司控股股东应启动通过二级市场以竞价交易方式增持公司股份的方案：

When the Company’s closing stock price is lower than the audited net assets per share of the Company in the previous year for 20 consecutive trading days upon the expiration date of the implementation term of the Company’s share repurchase scheme, or when the Company’s stock price stabilization measure by repurchasing the shares is unable to be implemented, the Company’s controlling shareholder shall start the scheme for increasing the Company’s shares in the way of competitive price transaction through the secondary market:

1、 公司控股股东应在符合《上市公司收购管理办法》《上海证券交易所科创板股票上市规则》等法律、行政法规、部门规章、规范性文件、证券交易所相关规定的条件和要求的前提下，对公司股票进行增持，并承诺就公司稳定股价方案以其所拥有的全部表决票数在股东大会上投赞成票。

1. The Company's controlling shareholder shall increase the Company's shares in the premise of meeting the conditions and requirements of the laws such as the *Measures for Management of the Acquisition of Listed Companies* and the *Rules of Shanghai Stock Exchange for Stock Listing on the Science and Technology Innovation Board*, administrative regulations, departmental rules, normative documents and relevant stipulations of the stock exchange, and shall undertake to vote in favor of the Company's scheme for stabilizing the stock price with all its votes at the shareholders' meeting.

2、 控股股东应在触发稳定股价措施日起10个交易日内，将其增持公司股份的具体计划书面通知公司并由公司公告。控股股东应在稳定股价方案公告后的5个交易日内启动稳定股价具体方案的实施。

2. The controlling shareholder shall notify the Company of its specific plan for increasing the Company's shares in writing and have the Company announce it within 10 trading days from the date when the conditions for measures for stabilizing the stock price are triggered. The controlling shareholder shall start implementing the specific scheme for stabilizing the stock price within 5 trading days after the scheme for stabilizing the stock price is announced.

3、 公司控股股东为稳定股价之目的增持公司股份的，增持公司股份的数量、金额应当符合以下条件：

3. If the Company's controlling shareholder increases the Company's shares for the purpose of stabilizing the stock price, the quantity and amount of the Company's shares increased shall meet the following conditions;

（1） 连续12个月内控股股东增持公司股份的累计资金金额不低于其上一年度获得的公司税后现金分红金额的30%，不超过控股股东上一年度获得的公司税后现金分红总额；

(1) The accumulated amount of funds used by the controlling shareholder to increase the Company's shares in 12 consecutive months shall be no less than 30% of the after-tax cash dividend amount obtained by it from the Company in the previous year and shall not exceed the total amount of after-tax cash dividend obtained by the controlling shareholder in the previous year;

（2） 连续12个月内累计增持股份数量不超过公司股份总数的2%。若本项要求与第（1）项矛盾的，以本项为准。

(2) The accumulated quantity of shares increased in 12 consecutive months shall not exceed 2% of the total quantity of the Company's shares. If this requirement conflicts with (1), this requirement shall prevail.

超过上述标准的，有关稳定股价措施在当年度不再继续实施。但如下一年度继续出现需启动稳定股价措施的情形时，其将继续按照上述原则执行稳定股价预案。

If the above standards are exceeded, the relevant measures for stabilizing the stock price shall not be continued any longer in the current year. However, in case of the circumstances for which the measures for stabilizing the stock price need to be started again in the next year, the controlling shareholder will continue to implement the plan for stabilizing the stock price according to the above principles.

（三） 董事、高级管理人员稳定股价的措施

(III) Measures of directors and senior executives for stabilizing the stock price

当公司启动股价稳定措施并且控股股东增持股份方案实施期限届满之日后公司股票连续20个交易日的收盘价均低于公司上一个会计年度经审计的每股净资产时，或无法实施控股股东增持股份的股价稳定措施时，董事、高级管理人员应启动通过二级市场以竞价交易方式增持公司股份的方案：

When the Company's closing stock price is lower than the audited net assets per share of the Company in the previous accounting year for 20 consecutive trading days upon the expiration date of the implementation term for the controlling shareholder's scheme for share increase when the Company starts the measures for stabilizing the stock price, or when the controlling shareholder's stock price stabilization measure by increasing the shares is unable to be implemented, the directors and senior executive shall start the scheme for increasing the Company's shares in the way of competitive price transaction through the secondary market:

1、 董事、高级管理人员应在符合《上市公司收购管理办法》《上市公司董事、监事和高级管理人员所持本公司股份及其变动管理规则》等法律、行政法规、部门规章、规范性文件、证券交易所相关规定的条件和要求的前提下，对公司股票进行增持，并承诺就公司稳定股价方案以其董事身份（如有）在董事会上投赞成票。

1. Directors and senior executives shall increase the Company's shares in the premise of meeting the conditions and requirements of the laws such as the *Measures for Management of the Acquisition of Listed Companies* and the *Rules for Management of the Companies' Shares Held by the Directors, Supervisors and Senior Executives of Listed Companies and Their Changes*, administrative regulations, departmental rules, normative documents and relevant stipulations of the stock exchange, and shall undertake to vote in favor of the Company's scheme for stabilizing the stock price at the board meeting with their identity of director (if any).

2、 上述负有增持义务的董事、高级管理人员应在触发稳定股价措施日起10个交易日内，将其增持公司股份的具体计划书面通知公司并由公司公告。该等董事、高级管理人员应在稳定股价方案公告后的5个交易日内启动稳定股价具体方案的实施。

2. The above directors and senior executives bearing the share increase obligation shall notify the Company of their specific plans for increasing the Company's shares in writing and have the Company announce the plans within 10 trading days from the date when the conditions for measures for stabilizing the stock price are triggered. Such directors and senior executives shall start implementing the specific schemes for stabilizing the stock price within 5 trading days after the schemes for stabilizing the stock price are announced.

3、 除不可抗力外，上述负有增持义务的董事、高级管理人员为稳定股价之目的增持公司股份的，增持公司股份的数量、金额应当符合以下条件：

3. Except for the force majeure, if the directors and senior executives bearing the above share increase the Company's shares for the purpose of stabilizing the stock price, the quantity and amount of the Company's shares increased shall meet the following conditions:

自上述股价稳定措施启动条件成就之日起一个会计年度内，董事、高级管理人员增持公司股票的资金金额不低于其上年度从公司领取的税后现金分红（如有）、薪酬和津贴合计金额的10%，但不超过30%。

Within one accounting year from the conditions for starting the above stock price stabilization measures are met, the amount of funds used by directors and senior executives to increase the Company's shares shall be no less than 10% of total amount of after-tax cash dividends (if any), remunerations and allowances received by them from the Company in the previous year but shall not exceed 30%.

超过上述标准的，有关稳定股价措施在当年度不再继续实施。但如下一年度继续出现需启动稳定股价措施的情形时，其将继续按照上述原则执行稳定股价预案。

If the above standards are exceeded, the relevant measures for stabilizing the stock price shall not be continued any longer in the current year. However, in case of the circumstances for which the measures for stabilizing the stock price need to be started again in the next year, the directors and senior executives will continue to implement the plan for stabilizing the stock price according to the above principles.

4、 在《稳定股价的预案》有效期内，新聘任的符合上述条件的董事和高级管理人员应当遵守《稳定股价的预案》关于公司董事、高级管理人员的义务及责任的规定。公司及公司控股股东、现有董事、高级管理人员应当促成新聘任的该等董事、高级管理人员遵守《稳定股价的预案》，并在其获得书面提名前签署相关承诺。

4. Within the valid term of the *Plan for Stabilizing the Stock Price*, the newly-employed directors and senior executives in line with the above conditions shall observe the stipulations on the obligations and responsibilities of the Company's directors and senior executives in the *Plan for Stabilizing the Stock Price*. The Company and the

Company's controlling shareholder, existing directors and senior executives shall facilitate such newly-employed directors and senior executives to observe the *Plan for Stabilizing the Stock Price* and sign the relevant commitments before they are nominated in writing.

（四） 其他稳定股价的措施

(IV) Other measures for stabilizing the stock price

1、 符合法律、行政法规、部门规章、规范性文件以及证券交易所相关规定并保证公司经营资金需求的前提下，经董事会、股东大会审议同意，公司可通过实施利润分配或资本公积金转增股本的方式稳定公司股价；

1. In the premise of complying with the laws, administrative regulations, departmental rules, normative documents and relevant provisions of the stock exchange and guaranteeing the Company's operation fund demand, upon the deliberation and consent of the Board of Directors and General Meeting of Shareholders, the Company may stabilize the Company's stock price through profit allocation or conversion of capital reserve into share capital;

2、 符合法律、行政法规、部门规章、规范性文件以及证券交易所相关规定前提下，公司可通过削减开支、限制高级管理人员薪酬、暂停股权激励计划等方式提升公司业绩、稳定公司股价；

2. In the premise of complying with the laws, administrative regulations, departmental rules, normative documents and relevant provisions of the stock exchange, the Company may promote the Company's performance and stabilize the Company's stock price by means of reducing the expenditures, limiting the senior executives remuneration and suspending the equity incentive plan;

3、 法律、行政法规、部门规章、规范性文件规定的以及中国证监会、证券交易所认可的其他稳定股价的措施。

3. Other measures for stabilizing the stock price stipulated by laws, administrative regulations, departmental rules and normative documents and recognized by CSRC and the Stock Exchange.

三、 约束措施

III. Restraint measures

（一） 公司未履行稳定股价承诺的约束措施

(I) Restrain measures for the Company's failure to perform the commitment of stabilizing the stock price

如公司未能履行或未按期履行稳定股价承诺，需在股东大会及中国证监会指定的披露媒体上公开说明具体原因。如非因不可抗力导致，给投资者造成损失的，公司将向投资者依法承担赔偿责任，并按照

法律、行政法规及相关监管机构的要求承担相应的责任；如因不可抗力导致，应尽快研究将投资者利益损失降低到最小的处理方案，并提交股东大会审议，尽可能地保护公司投资者利益。

If the Company fails to perform or does not perform the commitment of stabilizing the stock price on schedule, it shall explain the specific reasons publicly at the shareholders' meeting and in the disclosure media designated by CSRC. If for the reasons other than the force majeure, the Company will be liable for compensating the investors for the losses caused to the investors, and shall bear the corresponding responsibilities according to the laws, administrative regulations and the requirements of relevant regulators; in case of force majeure, the Company shall study the disposal scheme for minimizing the losses to the investors' benefits as soon as possible and submit it to the shareholders' meeting for deliberation, so as to protect the benefits of the Company's investors as far as possible.

（二） 控股股东未履行稳定股价承诺的约束措施

(II) Restraint measures for the controlling shareholder's failure to perform the commitment of stabilizing the stock price

如控股股东未能履行或未按期履行稳定股价承诺，需在股东大会及中国证监会指定的披露媒体上公开说明具体原因。如非因不可抗力导致，应同意在履行完毕相关承诺前暂不领取公司分配利润中归属于控股股东的部分，给投资者造成损失的，依法赔偿投资者损失；如因不可抗力导致，尽快研究将投资者利益损失降低到最小的处理方案，尽可能地保护投资者利益。

If the controlling shareholder fails to perform or does not perform the commitment of stabilizing the stock price on schedule, it shall explain the specific reasons publicly at the shareholders' meeting and in the disclosure media designated by CSRC. If for the reasons other than the force majeure, it shall agree not to receive the part attributable to the controlling shareholder in the profit allocated by the Company for the time being before completing the performance of relevant commitments, and shall compensate the investors for the losses caused to the investors according to law; in case of force majeure, the controlling shareholder shall study the disposal scheme for minimizing the losses to the investors' benefits as soon as possible, so as to protect the benefits of the investors as far as possible.

（三） 董事、高级管理人员未履行稳定股价承诺的约束措施

(III) Restraint measures for failure of directors and senior executives to perform the commitment of stabilizing the stock price

如上述负有增持义务的董事、高级管理人员未能履行或未按期履行稳定股价承诺，需在股东大会及中国证监会指定的披露媒体上公开说明具体原因。如非因不可抗力导致，应调减或停发董事、高级管理

人员薪酬和/或津贴，给投资者造成损失的，依法赔偿投资者损失；如因不可抗力导致，应尽快研究将投资者利益损失降低到最小的处理方案，尽可能地保护投资者利益。

If the above directors and senior executives bearing the share increase obligation fail to perform or do not perform the commitment of stabilizing the stock price on schedule, they shall explain the specific reasons publicly at the shareholders' meeting and in the disclosure media designated by CSRC. If for the reasons other than the force majeure, the remunerations and/or allowances of the directors and senior executives shall be reduced or suspended, and the directors and senior executives shall compensate the investors for the losses caused to the investors according to law; in case of force majeure, such directors and senior executives shall study the disposal scheme for minimizing the losses to the investors' benefits as soon as possible, so as to protect the benefits of the investors as far as possible.

本承诺函自公司首次公开发行股票并在科创板上市之日起生效。

This letter of commitment shall take effect from the date when the Company makes the IPO and is listed on the Science and Technology Innovation Board.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

北京通美晶体技术股份有限公司

Beijing Tongmei Xtal Technology Co., Ltd.

（盖章）

(Sealed)

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

控股股东：

Controlling shareholder:

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事长：

Chairman:

MORRIS SHEN-SHIH YOUNG

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事、总经理：

Director and General Manager:

VINCENT WENSEN LIU（刘文森）

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事、财务负责人：

Director and Financial Administrator

____

郝泽

(Hao Ze)

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事、副总经理：

Director and Deputy General Manager:

王育新

Wang Yuxin

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事、副总经理：

Director and Deputy General Manager:

郭涛

Guo Tao

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于上市后三年内稳定公司股价的预案及约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Plan for Stabilizing the Company's Stock Price within Three Years upon the Listing and the Restraint Measures*)

董事会秘书：

Board Secretary:

宋晶

Song Jing

日期：年月日

Date: MM/DD/YY

关于欺诈发行上市的股份购回的承诺函

Letter of Commitment on Share Repurchase for Fraudulent Listing

鉴于北京通美晶体技术股份有限公司（以下简称“公司”）拟申请首次公开发行股票并在科创板上市（以下简称“本次发行上市”），公司及公司控股股东承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Company”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as “this Listing”), the Company and the Company’s controlling shareholder undertake as follows:

一、 保证公司本次发行上市不存在任何欺诈发行的情形。

I. To guarantee that there is no fraud in this Listing of the Company.

二、 如公司不符合发行上市条件，以欺骗手段骗取发行注册并已经发行上市的，公司及公司控股股东将在中国证券监督管理委员会等有权部门认定并生效（如涉及诉讼的，以司法机关最终判决为准）后5个工作日内启动股份回购程序，回购公司本次公开发行的全部新股，具体回购责任承担以中国证券监督管理委员会等有权部门最终认定为准。

II. If the Company does not meet the listing conditions, but fraudulently obtains the issuance registration and has been listed, the Company and the Company’s controlling shareholder will start the share repurchase procedure within 5 working days upon the effective affirmation made by the authorities such as China Securities Regulatory Commission (if any litigation is involved, the final judgment made by the juridical authority shall prevail) to repurchase all new stocks issued by the Company publicly this time. Assumption of specific repurchase responsibilities shall be subject to the final affirmation made by the authorities such as China Securities Regulatory Commission.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于欺诈发行上市的股份购回的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Share Repurchase for Fraudulent Listing*)

北京通美晶体技术股份有限公司

Beijing Tongmei Xtal Technology Co., Ltd.

（盖章）

(Sealed)

日期：年月日

Date: MM/DD/YY

（本页无正文，为《关于欺诈发行上市的股份购回的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Share Repurchase for Fraudulent Listing*)

控股股东：

Controlling shareholder:

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于招股说明书不存在虚假记载、误导性陈述或者重大遗漏的承诺函

Letter of Commitment on No False Record, Misleading Statement or Major Omission in the Prospectus

鉴于北京通美晶体技术股份有限公司（以下简称“发行人”）拟申请首次公开发行股票并在科创板上市（以下简称“本次发行上市”），本企业作为发行人的控股股东，特此承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Issuer”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as “this Listing”), our enterprise, as the controlling shareholder of the Issuer, hereby undertakes as follows:

一、 发行人本次发行上市的招股说明书及其他信息披露资料不存在虚假记载、误导性陈述或者重大遗漏，本企业对其真实性、准确性、完整性承担个别和连带的法律责任。

I. There is no false record, misleading statement or major omission in the prospectus for this Listing and other information disclosure materials, and our enterprise shall bear individual and joint and several legal liabilities for their authenticity, accuracy and integrity.

二、 若中国证券监督管理委员会（以下简称“中国证监会”）、上海证券交易所或其他有权部门认定招股说明书所载内容存在虚假记载、误导性陈述或者重大遗漏之情形，且该等情形对判断发行人是否符合法律规定的发行条件构成重大、实质影响的，则本企业承诺将依据《中华人民共和国公司法》《中华人民共和国证券法》的规定购回本企业已转让的原限售股份（如有）。

II. If China Securities Regulatory Commission (hereinafter referred to as “CSRC”), Shanghai Stock Exchange or other authorities affirm that there is circumstance of false record, misleading statement or major omission in the prospectus and that such circumstance constitutes the major and material impact on judging whether the Issuer complies with the issuance conditions stipulated by laws, then our enterprise shall undertake to repurchase the original restricted shares, which have been transferred by our enterprise (if any), in accordance with the *Company Law of the People's Republic of China* and the *Securities Law of the People's Republic of China*.

三、 如发行人招股说明书及其他信息披露资料有虚假记载、误导性陈述或者重大遗漏，致使投资者在证券发行和交易中遭受损失的，本企业将依法赔偿投资者损失。

III. If there is false record, misleading statement or major omission in the Issuer's prospectus and other information disclosure materials, causing the losses to the investors in the securities issuance and transactions, our enterprise will compensate the investors for the losses according to law.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于招股说明书不存在虚假记载、误导性陈述或者重大遗漏的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on No False Record, Misleading Statement or Major Omission in the Prospectus*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于填补被摊薄即期回报的承诺函

Letter of Commitment on Filling the Diluted Spot Return

鉴于北京通美晶体技术股份有限公司（以下简称“发行人”）拟申请首次公开发行股票并在科创板上市，本企业作为发行人的控股股东，现依据相关法律、法规和中国证券监督管理委员会的有关规定，就填补被摊薄即期回报事项作出如下承诺：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Issuer”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board, our enterprise, as the controlling shareholder of the Issuer, hereby undertakes as follows with respect to the matter of filling the diluted spot return according to the relevant laws, regulations and relevant stipulations of China Securities Regulatory Commission:

本企业将督促发行人切实履行填补被摊薄即期回报的措施，并承诺：本企业或本企业提名的董事将在权限范围内参与发行人经营管理活动，尽最大努力维护发行人及其股东的合法利益。

Our enterprise will supervise and urge the Issuer to practically perform the measures for filling the diluted spot return, and shall undertake: our enterprise or the directors nominated by our enterprise will participate in the Issuer’s operation and management activities within the scope of authority and will try the best to safeguard the legal rights and interests of the Issuer and its shareholders.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于填补被摊薄即期回报的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Filling the Diluted Spot Return*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于未履行承诺的约束措施的承诺函

Letter of Commitment on Restraint Measures for Nonperformance of the Commitments

鉴于北京通美晶体技术股份有限公司（以下简称“发行人”）拟申请首次公开发行股票并在科创板上市（以下简称“本次发行上市”），本企业作为发行人的控股股东，承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Issuer”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as “this Listing”), our enterprise, as the controlling shareholder of the Issuer, undertakes as follows :

一、 本企业保证将严格履行在发行人上市招股说明书中所披露的全部公开承诺事项中的各项义务和责任。

I. Our enterprise shall guarantee to strictly perform all obligations and responsibilities in all public commitments disclosed in the Issuer’s listing prospectus.

二、 如本企业非因不可抗力原因导致未能完全或有效地履行公开承诺事项的，则本企业承诺将视具体情况采取以下措施予以约束：

II. If our enterprise fails to fully or effectively perform the public commitments due to force majeure, and then our enterprise shall undertake to take the following measures for restraint according t to the specific conditions:

1、 本企业将在股东大会及中国证券监督管理委员会（以下简称“中国证监会”）指定的披露媒体上公开说明未履行承诺的具体原因；

1. Our enterprise will explain the specific reasons for nonperformance publicly at the shareholders’ meeting and in the disclosure media designated by China Securities Regulatory Commission (hereinafter referred to as “CSRC”);

2、 若因本企业未能履行公开承诺事项导致投资者在证券交易中遭受损失的，本企业将依法赔偿投资者由此遭受的损失；

2. If our enterprise’s nonperformance of public commitments causes losses to the investors in the securities transactions, our enterprise will compensate the investors for the losses caused thereby according to law;

3、 在本企业完全消除因本企业未履行相关承诺事项所导致的所有不利影响之前，本企业将暂不收取发行人所分配之红利或派发之红股；

3. Before our enterprise completely eliminates the adverse impact caused by our enterprise’s nonperformance of relevant commitments, our enterprise will not receive the dividend allocated by or bonus shares distributed by the Issuer for the time being;

4、 如本企业因未能履行公开承诺事项而获得经济收益的，该等收益归发行人所有，本企业应当在获得该等收益之日起五个工作日内将其支付至发行人指定账户。

4. If our enterprise obtains the economic gains due to its nonperformance of the public commitments, such gains shall belong to the Issuer, and our enterprise shall pay such gains to the account designated by the Issuer within five working days from the date when it obtains such gains.

三、 如本企业因不可抗力原因导致未能履行公开承诺事项的，需提出新的承诺（相关承诺需按法律法规、发行人章程的规定履行相关审批程序）并接受如下约束措施，直至新的承诺履行完毕或相应补救措施实施完毕：

III. If our enterprise fails to perform the public commitments due to force majeure, our enterprise shall propose the new commitments (for the relevant commitments, the relevant examination and approval procedures shall be performed according to the laws and regulations as well as the stipulations in the Issuer's Articles of Association) and accept the restraint measures as follows, until the new commitments are completed or the corresponding remedial measures are completed:

1、 在股东大会及中国证监会指定的披露媒体上公开说明未履行的具体原因；

1. Explain the specific reasons for nonperformance publicly at the shareholders' meeting and in the disclosure media designated by China Securities Regulatory Commission.

2、 尽快研究将投资者利益损失降低到最小的处理方案，尽可能地保护投资者利益。

2. Study the disposal scheme for minimizing the losses to the investors' benefits as soon as possible, so as to protect the benefits of the investors as far as possible.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于未履行承诺的约束措施的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Restraint Measures for Nonperformance of the Commitments*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于避免同业竞争的承诺函

Letter of Commitment on Avoiding Horizontal Competition

鉴于北京通美晶体技术股份有限公司（以下简称"发行人"）拟申请首次公开发行股票并在科创板上市（以下简称"本次发行上市"），本企业作为发行人的控股股东，现依据相关法律、行政法规和中国证券监督管理委员会的有关规定，就避免与发行人的主营业务产生同业竞争事项作出如下承诺：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as "the Issuer") plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board (hereinafter referred to as "this Listing"), our enterprise, as the controlling shareholder of the Issuer, hereby undertakes as follows with respect to the matter of avoiding the horizontal competition with the Issuer in its main business according to the relevant laws, administrative regulations and relevant stipulations of China Securities Regulatory Commission:

1、 本企业（含本企业控制的除发行人及其控股企业以外的其他企业，下同）目前未以任何形式从事与发行人（含发行人直接或间接控制的企业，下同）主营业务构成竞争关系的业务或活动；发行人的资产完整，其资产、业务、人员、财务及机构均独立于本企业。

1. At present, our enterprise (including other enterprises controlled by our enterprise except the Issuer and its holding enterprises, the same below) has not been engaged in the businesses or activities constituting the competition relationship with the main business of the Issuer (including the enterprises directly or indirectly controlled by the Issuer, the same below) in any form; the Issuer has the complete assets, and its assets, businesses, personnel and finance are independent from our enterprise.

2、 自本函出具之日起，本企业不会以任何形式从事与发行人主营业务构成竞争关系的业务或活动，或以任何形式支持除发行人以外的其他企业从事与发行人主营业务构成竞争关系的业务或活动。

2. From the date when this letter is issued, our enterprise will not be engaged in the businesses or activities constituting the competition relationship with the main business of the Issuer in any form or support other enterprises except the Issuer to be engaged in the businesses or activities constituting the competition relationship with the main business of the Issuer in any form.

3、 自本函出具之日起，如本企业将来不可避免地从事与发行人构成竞争关系的业务或活动，本企业将主动或在发行人提出异议后，及时转让或终止前述业务或活动，发行人对该等业务享有优先受让权。

3. From the date when this letter is issued, if our enterprise will be inevitably engaged in the businesses or activities constituting the competition relationship with the Issuer in the future, our enterprise will timely transfer or terminate the above-mentioned businesses or activities actively or after the Issuer proposes an objection, and the Issuer shall have the priority to accept the transfer of such businesses.

4、 上述承诺在本企业作为发行人控股股东期间持续有效。

4. The above commitment shall be effective continuously during the period when our enterprise acts as the Issuer's controlling shareholder.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于避免同业竞争的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Avoiding Horizontal Competition*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于规范并减少关联交易的承诺函

Letter of Commitment on Standardizing and Reducing the Related Transactions

鉴于北京通美晶体技术股份有限公司（以下简称“发行人”）拟申请首次公开发行股票并在科创板上市，本企业作为发行人的控股股东，为保证发行人业务的持续发展、规范关联交易行为，特此承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “the Issuer”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board, and in order to guarantee the continuous development of the Issuer’s business and standardize the related transaction acts, our enterprise, as the Issuer’s controlling shareholder, hereby undertakes as follows:

1、 在不对发行人及其他股东的利益构成不利影响的前提下，本企业将采取措施规范并尽量减少与发行人发生关联交易。

1. In the premise of not constituting the adverse impact on the benefits of the Issuer and other shareholders, our enterprise will take measures to standardize and minimize the related transactions with the Issuer.

2、 对于正常经营范围内或存在其他合理原因确需发生或无法避免的关联交易，本企业及本企业控制的其他企业将与发行人依法签订交易协议，并按照有关法律、行政法规、部门规章、规范性文件和届时有效的《北京通美晶体技术股份有限公司章程》的规定履行批准程序，并保证该等关联交易均将基于公允定价的原则实施。

2. For the indeed necessary or inevitable related transactions within the scope of normal operation or for other reasonable reasons, our enterprise and other enterprises controlled by our enterprise will sign the transaction agreements with the Issuer according to law and perform the approval procedure according to the relevant laws, administrative regulations, departmental rules, normative documents and effective *Articles of Association of Beijing Tongmei Xtal Technology Co., Ltd.* at that time, and shall guarantee that such related transactions shall be implemented based on the principle of fair pricing.

3、 本企业将严格按照相关规定履行必要的关联方回避表决等义务，履行批准关联交易的法定审批程序和信息披露义务。

3. Our enterprise will perform necessary obligations such as vote avoidance by related parties strictly according to the relevant stipulations, and perform the legal examination and approval procedure for related transactions and information disclosure obligation.

4、 保证不利用关联交易非法转移发行人的资金、利润或从事其他损害发行人及其他股东、债权人利益的行为。

4. Our enterprise guarantees not to utilize the related transactions to illegally transfer the Issuer's capitals, profits or be engaged in other acts damaging the benefits of other shareholders and creditors.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于规范并减少关联交易的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Standardizing and Reducing the Related Transactions*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

关于避免资金占用和违规担保的承诺函

Letter of Commitment on Avoiding the Capital Occupation and Illegal Guarantee

鉴于北京通美晶体技术股份有限公司（以下简称"发行人"）拟申请首次公开发行股票并在科创板上市，本企业作为发行人的控股股东，现依据相关法律、行政法规和中国证券监督管理委员会的有关规定，为维护发行人及其他股东的合法权益，本企业确认及承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as "the Issuer") plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board, and in order to safeguard the legal rights and interests of the Issuer and other shareholders, our enterprise, as the controlling shareholder of the Issuer, hereby confirms and undertakes as follows according to the relevant laws, administrative regulations and relevant stipulations of China Securities Regulatory Commission:

一、 截至本函出具之日，不存在发行人或其控股企业的资金被本企业及本企业控制的其他企业非经营性占用的情况，也不存在发行人或其控股企业为本企业及本企业控制的其他企业违规提供担保的情形。

I. As of the date when this letter is issued, the capitals of the Issuer or its holding enterprises are not occupied by our enterprise or other enterprises controlled by our enterprise for the non-operational purpose, and the Issuer or its holding enterprises do not illegally provide guarantee for our enterprise and other enterprises controlled by our enterprise.

二、 本企业承诺依法行使股东权利，不滥用股东权利损害发行人或发行人其他股东的合法利益，本企业及本企业控制的其他企业不会以借款、代偿债务、代垫款项或其他方式非法占用发行人或其控股企业的资金，不会要求发行人或其控股企业违规提供担保。

II. Our enterprise undertakes that it will exercise the shareholder's rights according to law and will not abuse the shareholder's rights to damage the legal rights and interests of the Issuer or other shareholders of the Issuers, and that our enterprise and other enterprises controlled by our enterprise will not illegally occupy the capitals of the Issuer or its holding enterprises with loan, compensatory debt and advanced payment or by other means and will not require the Issuer or its holding enterprises to provide the guarantee illegally.

（本页以下无正文）

(There is no text below this page)

（本页无正文，为《关于避免资金占用和违规担保的承诺函》的签署页）

(Without text, this page is a signing page of *Letter of Commitment on Avoiding the Capital Occupation and Illegal Guarantee*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

声明与承诺函

Statement and Letter of Commitment

鉴于北京通美晶体技术股份有限公司（以下简称“北京通美”或“公司”）拟申请首次公开发行股票并在科创板上市，本企业作为北京通美的控股股东，就以下事项声明和承诺如下：

In view that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as “Beijing Tongmei” or “the Company”) plans to apply for an IPO (initial public offering) and be listed on the Science and Technology Innovation Board, our enterprise, as the controlling shareholder of Beijing Tongmei, hereby states and undertakes as follows:

一、 本企业认缴或受让公司注册资本对应的投资款均系本企业自有或自筹资金，来源合法合规。

I. The corresponding investment funds when our enterprise subscribes or accepts the transfer of the Company’s registered capital are the owned or self-raised funds with the sources in line with laws and regulations.

二、 本企业所持有的公司股权为本企业真实持有，权属清晰，不存在委托持股、信托持股或其他特殊安排情形。

II. The Company’s equity held by our enterprise is really held by our enterprise, with the clear ownership, and there is no entrusted shareholding, trust shareholding or other special arrangements.

三、 截至本函出具日，本企业与公司其他股东之间不存在一致行动关系、表决权委托/代理等任何特殊安排。

III. As of the date when this letter is issued, there is no concerted action relationship, voting power entrustment/agency and any other special arrangements between our enterprise and other shareholders of the Company.

四、 2018年1月1日至本函出具日，本企业任意单一股东均无法基于其所持表决权股份单独决定本企业股东大会的审议事项，本企业任意单一董事或股东均无法对董事会决议产生决定性影响。本企业不存在实际控制人。

IV. From January 1, 2018 to the date when this letter is issued, no single shareholder of our enterprise can independently decide the matters to be deliberated at the shareholders’ meeting of our enterprise based on the voting shares held by such shareholder, and no single director and shareholder of our enterprise can generate the decisive impact on the resolution made by the Board of Directors. Our enterprise does not have the actual controller.

五、 截至本函出具日，本企业所持有的公司股份不存在被质押、冻结、查封或设定其他第三者权益的情况，亦未涉及任何争议纠纷或潜在纠纷。

V. As of the date when this letter is issued, the Company's shares held by our company have not been pledged, frozen or sealed up, or have not had other third-party rights and interests set on them, and have not been involved in any disputes or potential disputes as well.

六、　2020年11月至2021年1月，本企业与公司及相关方签署《增资协议之补充协议》《增资协议之补充协议二》，约定公司未在2022年12月31日（或各方协商一致并书面同意的其他日期）前实现IPO，或其他特定情形下投资方有权要求本企业回购投资方所持有的全部或部分公司股权。除上述条款外，还存在股权转让限制、优先购买、优先出售、反稀释等特殊权利条款；《增资协议之补充协议》自公司向中国证监会或证券交易所正式提交IPO申请材料之日起自动终止；如公司未在2022年12月31日（或各方协商一致并书面同意的其他日期）前完成合格上市，则回购条款自动恢复效力且追溯至《增资协议之补充协议》签署之日起即有效力。

VI. From November 2020 to January 2021, our company signed the *Supplementary Agreement to Capital Increase Agreement* and the *Supplementary Agreement II to Capital Increase Agreement* with the Company and the interested parties, agreeing that if the Company fails to realize the IPO before December 31, 2022 (or other dates uniformly negotiated and agreed in writing by the parties), or in other specific circumstances, the investors shall have the right to require our enterprise to repurchase all or part of the Company's equity held by the investors. In addition to the above clause, there are also special right provisions, such as equity transfer restriction, preemption, sales in priority and anti-dilution; the *Supplementary Agreement to Capital Increase Agreement* shall be automatically terminated from the date when the Company formally submits the IPO application materials to CSRC or the Stock Exchange; if the Company fails to complete the qualified listing before December 31, 2022 (or other dates uniformly negotiated and agreed in writing by the parties), then the repurchase clause shall resume its effectiveness automatically and be effective retroactively from the signing date of the *Supplementary Agreement to Capital Increase Agreement*.

除上述情形外，截至本函出具日，本企业与公司和/或公司其他股东不存在任何有效的、以书面或口头形式达成的任何涉及和/或可能涉及的投资者投资回报承诺、公司经营业绩承诺、与公司上市有关的相关承诺、补偿条款、股份回购、对赌等事项的约定或承诺。

Except the above circumstances, as of the date when this letter is issued, there has been no effective, written or oral commitment on the investors' ROI, commitment on the Company's operation performance, relevant commitments related to the Company's listing, and agreements or commitments on the matters such as compensation clause, share repurchase and gambling involved/possibly involved between our enterprise and the Company and/or other shareholders of the Company.

七、 2018年1月1日至本函出具日，本企业不存在贪污、贿赂、侵占财产、挪用财产或者破坏社会主义市场经济秩序的刑事犯罪，不存在涉嫌欺诈发行、重大信息披露违法或其他涉及国家安全、公共安全、生态安全、生产安全、公众健康安全等领域的重大违法行为，不存在被立案调查或者被司法机关立案侦查，尚未结案的情形；本企业不存在尚未了结的或可以合理预见的重大诉讼、仲裁或行政处罚案件。

VII. Since January 1, 2018 till the date when this letter is issued, our enterprise has not been involved in the criminal offences such as corruption, bribery, embezzlement of property, misappropriation of property or destruction of the order of socialist market economy, has not been involved in fraudulent issuance, illegal disclosure of major information or other major illegal acts involving the fields such as the state security, public security, ecological security, production security and public health security, and has not been registered and surveyed or been registered and investigated by a judicial authority but the case has not been closed yet; our enterprise has not been involved in any pending or reasonably foreseeable major litigation, arbitration or administrative penalty cases.

八、 截至本函出具日，除附件所列情形外，本企业在公司的主要客户或供应商中未直接或间接占有任何权益；本企业与北京通美本次申请首次公开发行股票并在科创板上市相关的中介机构（指海通证券股份有限公司、北京市金杜律师事务所、安永华明会计师事务所（特殊普通合伙），下同）以及该等单位的实际控制人、股东/合伙人、董事、监事、高级管理人员、经办人之间不存在关联关系。

VIII. As of the date when this letter is issued, except the circumstances listed in the annex, our enterprise has not directly or indirectly occupied any rights and interests in the Company’s major clients or suppliers; there has been no association relationship between our company and the intermediaries (refer to Haitong Securities Co., Ltd., Beijing King & Wood Mallesons and Ernst & Young Hua Ming (Special General Partnership), the same below) related to Beijing Tongmei’s application of IPO and listing on the Science and Technology Innovation Board this time as well as actual controllers, shareholders/partners, directors, supervisors, senior executives and handlers of such units.

九、 本企业就公司本次申请首次公开发行股票并在科创板上市向公司及其中介机构提供的所有原始书面材料、副本材料、复印材料、口头信息或证言是真实、完整和准确的，且无任何虚假、隐瞒、遗漏或误导之处；本企业所提供的副本或复印件与正本或原件内容一致，所有文件上的印章与签名都是

真实的。如违反前述承诺，本企业将向公司及其中介机构依法赔偿其因此遭受的全部损失；如未来发生与本企业提供的资料和信息不一致的情形，本企业将立即通知公司及其中介机构。

IX. All original written materials, duplicates, copies, oral information or testimonies provided by our company for the Company and its intermediaries in terms of the Company's application of IPO and listing on the Science and Technology Innovation Board this time are true, complete and accurate, without any false, concealed, omitted or misleading content; the duplicates or copies provided by our enterprise are consent with the originals, and the seals and signatures on all documents are true. In case of violating the above-mentioned commitments, our enterprise will compensate the Company and its intermediaries for all the losses caused to them according to law; in case of any circumstances inconsistent with the materials and information provided by our enterprise in the future, our enterprise will immediately notify the Company and its intermediaries.

特此声明承诺。

Hereby state and undertake.

（以下无正文）

(There is no text below)

（本页无正文，为《声明与承诺函》的签署页）

(Without text, this page is a signing page of *Statement and Letter of Commitment*)

AXT, Inc.
（盖章）
(Sealed)

签署：
Signed by:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: authorized representative

日期：年月日
Date: MM/DD/YY

附件：本企业在北京通美的客户或供应商中的持股情况

Annex: Shareholding of Our Enterprise in the Clients or Suppliers of Beijing Tongmei

公司名称 **Name of the Company**	**持股比例(%)** **Shareholding proportion (%)**
北京吉亚半导体材料有限公司 Beijing JiYa Semiconductor Material Co., Ltd.	58.2096
峨眉山嘉美高纯材料有限公司 Emeishan Jiamei High Pure Materials Co., Ltd.	25
锡林郭勒通力锗业有限责任公司 XiLinGol Tongli Ge Refine Co., Ltd.	25

关于股东信息披露及证监会离职人员核查事项之专项承诺函

Special Commitment Letter for Disclosure of Shareholders' Information and Verification of Retired Personnel of CSRC

鉴于北京通美晶体技术股份有限公司（以下简称"公司"或"北京通美"）申请首次公开发行股票并在科创板上市（以下简称"本次发行上市"），根据中国证监会《监管规则适用指引—关于申请首发上市企业股东信息披露》《监管规则适用指引——发行类第2号》以及上海证券交易所的相关规定，本企业作为北京通美的股东，特此作出如下声明和承诺：

Given that Beijing Tongmei Xtal Technology Co., Ltd. (hereinafter referred to as "the Company" or "Beijing Tongmei") applied for initial public offering of shares and listing in the science and technology innovation board (hereinafter referred to as "This Offering and Listing"), in accordance with the *Guidelines for the Application of Regulatory Rules - Disclosure of Information on Shareholders of Enterprises Applying for Initial Public Offerings* and *Guidelines for the Application of Regulatory Rules - Offering No. 2* issued by China Securities Regulatory Commission and the relevant regulations of the Shanghai Stock Exchange, the Company, as a shareholder of Beijing Tongmei, hereby makes the following statement and commitment:

一、关于股份代持。本企业持有北京通美的股份系本企业真实持有，权属清晰，持股至今不存在委托持股、信托持股或其他特殊安排情形。

I. Shares held by agency. The shares held by the Company in Beijing Tongmei are truly held by the Company, and the ownership is clear. So far, there is no entrusted shareholding, trust shareholding or other special arrangements.

二、关于入股价格异常。本企业历次入股的背景和原因、入股形式、资金来源、支付方式、入股价格及定价依据详见本专项承诺函附件，不存在本企业入股价格明显异常的情形。

II. Abnormal share purchasing price. Please refer to the appendix of this special commitment letter for the details of the background and reasons, forms of shares, sources of funds, payment methods, share prices and pricing basis of the previous shares of the Company, and there is no obvious abnormality in the share purchasing price of the Company.

三、关于股东适格性。本企业及向上追溯的各级股东、合伙人和出资人均具备法律、法规规定的股东资格，不存在法律、法规规定禁止持股的主体直接或间接持有北京通美股份的情形。本企业及向上追溯的各级股东、合伙人和出资人与本次发行中介机构（指海通证券股份有限公司、北京市金杜律师事务所、安永华明会计师事务所（特殊普通合伙））及其负责人、高级管理人员、经办人员不存在亲属关系、关联关系、委托持股、信托持股或其他利益输送安排。本企业不存在以北京通美股权进行不当利益输送的情形。

III. Eligibility of shareholders. The Company and its shareholders, partners and investors at all levels retrospectively have the shareholder qualifications stipulated by laws and regulations, and there is no situation that the subject prohibited by laws and regulations from holding shares directly or indirectly holds shares in Beijing Tongmei. The Company and its shareholders, partners and investors at all levels retrospectively have no kinship, association, entrusted shareholding, trust shareholding or other benefit transfer arrangements with the intermediary institutions (Haitong Securities Co., Ltd, King & Wood Mallesons, Ernst & Young Hua Ming LLP) and their responsible persons, senior managers and managers. There is no improper transfer of benefits by equity of Beijing Tongmei in the Company.

四、本企业向北京通美及其本次发行上市的中介机构所提供的所有资料及信息均真实、完整、准确、有效，不存在任何虚假陈述、重大遗漏或可能产生误导的信息。自本承诺函出具之日起，如本承诺函所述事项发生任何变更，本企业将立即书面告知北京通美及中介机构。

IV. All the materials and information provided by the Company to Beijing Tongmei and its intermediaries for this issuance and listing are true, complete, accurate and effective, and there are no false statements, major omissions or information that may lead to misleading. From the date of issuance of this commitment letter, if there is any change in the matters mentioned in this commitment letter, the Company will immediately inform Beijing Tongmei and intermediary agencies in writing.

特此声明承诺。

The Company hereby declares the above.

（本页以下无正文）

(The remainder of this page is intentionally left blank.)

（本页无正文，为《关于股东信息披露及证监会离职人员核查事项之专项承诺函》的签署页）

(The remainder of this page is intentionally left blank. It is the signature page of the *Special Commitment Letter for Disclosure of Shareholders' Information and Verification of Retired Personnel of CSRC*)

AXT, Inc.
（盖章）
(Seal)

签署：
Signature:
姓名：MORRIS SHEN-SHIH YOUNG
Name: MORRIS SHEN-SHIH YOUNG
职务：授权代表
Title: Authorized Representative

日期：　　年　　月　　日
Date:

附件：

Appendix:

<table>
<tr><th rowspan="2">序号
S.N.</th><th rowspan="2">取得股份时间
Time of Share acquisition</th><th rowspan="2">股权变动
Changes in equity</th><th rowspan="2">入股背景和原因
Background and reasons for shareholding</th><th colspan="2">持股比例
Ownership ratio</th><th rowspan="2">每注册资本价格
Price per registered capital</th><th rowspan="2">定价依据
Pricing basis</th><th rowspan="2">资金来源
Sources of funds</th></tr>
<tr><th>增资/转让后金额
Amount after capital increase/transfer</th><th>持股比例
Ownership ratio</th></tr>
<tr><td>1</td><td>1998年9月
September 1998</td><td>设立
Establishment</td><td>看好行业发展
Optimistic about the development of the industry</td><td>302.94万美元
$3,029,400</td><td>99.00%</td><td>1美元
One dollar</td><td>注册资本
Registered capital</td><td>自有资金
Own funds</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">2000年8月
August 2000</td><td>第一次股权转让
First equity transfer</td><td rowspan="2">北京通美经营发展需要资金投入
Beijing Tongmei’s business development needs capital investment</td><td>306万美元
$3.06 million</td><td>100.00%</td><td>1美元
One dollar</td><td rowspan="2">注册资本
Registered capital</td><td rowspan="2">自有资金
Own funds</td></tr>
<tr><td>第一次增资
First capital increase</td><td>506万美元
$5.06 million</td><td>100.00%</td><td>1美元
One dollar</td></tr>
<tr><td>3</td><td>2001年5月
May 2001</td><td>第二次增资
Second capital increase</td><td>北京通美经营发展需要资金投入
Beijing Tongmei’s business development needs capital investment</td><td>1506万美元
$15.06 million</td><td>100.00%</td><td>1美元
One dollar</td><td>注册资本
Registered capital</td><td>自有资金
Own funds</td></tr>
<tr><td>4</td><td>2002年10月
October 2002</td><td>第三次增资
Third capital increase</td><td>北京通美经营发展需要资金投入
Beijing Tongmei’s business development needs capital investment</td><td>2306万美元
$23.06 million</td><td>100.00%</td><td>1美元
One dollar</td><td>注册资本
Registered capital</td><td>资本公积和未分配利润转增
Capital reserve and undistributed profit increase</td></tr>
<tr><td>5</td><td>2006年9月
September 2006</td><td>第四次增资
Fourth capital increase</td><td>北京通美经营发展需要资金投入
Beijing Tongmei’s business development needs capital investment</td><td>2534万美元
$25.34 million</td><td>100.00%</td><td>1美元
One dollar</td><td>注册资本
Registered capital</td><td>未分配利润转增
Increase in undistributed profits</td></tr>
<tr><td>6</td><td>2007年12月
December 2007</td><td>第五次增资
Fifth capital increase</td><td>北京通美经营发展需要资金投入
Beijing Tongmei’s business development</td><td>3013万美元
$30.13 million</td><td>100.00%</td><td>1美元
One dollar</td><td>注册资本
Registered capital</td><td>未分配利润转增
Increase in undistributed profits</td></tr>
</table>

序号 S.N.	取得股份时间 Time of Share acquisition	股权变动 Changes in equity	入股背景和原因 Background and reasons for shareholding	持股比例 Ownership ratio		每注册资本价格 Price per registered capital	定价依据 Pricing basis	资金来源 Sources of funds
				增资/转让后金额 Amount after capital increase/transfer	持股比例 Ownership ratio			
			needs capital investment					
7	2012年5月 May 2012	第六次增资 Sixth capital increase	北京通美经营发展需要资金投入 Beijing Tongmei's business development needs capital investment	3913万美元 $39.13 million	100.00%	1美元 One dollar	注册资本 Registered capital	自有资金 Own funds
8	2020年12月 December 2020	第七次增资 Seventh capital increase	为解决同业竞争，整合境内业务资源，通美进行重组 In order to solve the competition among peers and integrate domestic business resources, Tongmei reorganized	75224.6378万元人民币 752,246,378 yuan	91.6300%	1.36元人民币 RMB 1.36	协商确定 Determined through negotiation	子公司股权 Subsidiary equity
9	2021年1月 January 2021	第二次股权转让 Second equity transfer	看好北京通美所处行业发展前景以及后续发展潜力 Optimistic about the development prospects and subsequent development potential of the industry where Beijing Tongmei is located	75715.3721万元人民币 757.153721 million yuan	85.5129%	5.03元人民币 RMB 5.03	协商确定 Determined through negotiation	自有资金 Own funds

COMPUTATION OF RATIO OF EARNINGS TO FIXED CHARGES

	Year Ended December 31,				
	2021	2020	2019	2018	2017
	(in thousands)				
Earnings:					
Income (loss) before income taxes	$ 17,602	$ 7,072	$ (1,026)	$ 11,947	$ 10,853
Less: Equity in loss (earnings) of investees	(4,409)	(111)	1,876	1,080	1,694
Less: Pre-tax net (income) loss attributable to noncontrolling interest and redeemable noncontrolling interests	(1,934)	(1,803)	(1,012)	(1,355)	87
Add: Distributions paid by equity investees	—	—	—	—	—
Fixed charges and preferred stock dividends, as calculated below	721	533	358	283	278
Total earnings	**$ 11,980**	**$ 5,691**	**$ 196**	**$ 11,955**	**$ 12,912**
Computation of fixed charges and preferred stock dividends:					
Interest expense	$ 422	$ 222	$ 94	$ —	$ —
Preferred stock dividends(1)	177	177	177	177	177
Interest component of rent expense(2)	122	134	87	106	101
Total combined fixed charges and preferred stock dividends	$ 721	$ 533	$ 358	$ 283	$ 278
Ratio of earnings to combined fixed charges and preferred stock dividends(3)	16.62	10.68	0.55	42.24	46.45
Deficiency of earnings to combined fixed charges and preferred stock dividends	N/A	N/A	N/A	N/A	N/A

(1) Dividends accrue on our outstanding Series A preferred stock at the rate of $0.20 per annum per share of Series A preferred stock. We have not paid any dividends on preferred stock. 883,000 shares of our preferred stock were issued and outstanding for all of the periods presented.

(2) Effective January 1, 2019 and onwards, interest is calculated consistent with guidance under ASC 842, where an estimate for the Company's incremental borrowing rate of 4.6% is used to calculate the interest component of rent expense. The borrowing rate is calculated using a weighted average for the interest rate on the Company's revolving line of credit of 4.4% and credit facility with the Bank of China of 4.7%. For the years prior to 2019, represents one-third of total rent expense which we believe is a reasonable estimate of the interest component of rent expense.

(3) For periods in which there is a deficiency of earnings available to cover combined fixed charges and preferred stock dividends, the ratio information is not applicable.

Exhibit 21.1

AXT, Inc. Subsidiaries

Subsidiaries of the registrant*	State or Other Jurisdiction of Incorporation
Beijing Tongmei Xtal Technology Co., Ltd.	China
Nanjing Jin Mei Gallium Co., Ltd.	China
Beijing BoYu Semiconductor Vessel Craftwork Technology Co., Ltd.	China

* *As of December 31, 2022. Pursuant to Item 601(b)(21)(ii) of Regulation S-K, the names of other AXT, Inc. subsidiaries are omitted because, considered in the aggregate, they would not constitute a significant subsidiary as of December 31, 2022.*

Exhibit 23.1

Consent of Independent Registered Public Accounting Firm

We hereby consent to the incorporation by reference in the Registration Statements on Form S-3 (No. 333-258196) and Form S-8 (Nos. 333-258267, 333-231744, 333-204478, 333-188788, 333-67297, 333-38858 and 333-143366) of AXT, Inc. of our reports dated March 16, 2023 relating to the consolidated financial statements and internal control over financial reporting, which appear in this Annual Report on Form 10-K.

/s/ BPM LLP

San Jose, California
March 16, 2023

Exhibit 31.1

CERTIFICATION PURSUANT TO 18 U.S.C. RULE 13a-14(a)/15d-14(a)

AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Morris S. Young, certify that:

1. I have reviewed this annual report on Form 10-K of AXT, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects, the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

March 16, 2023

/s/ MORRIS S. YOUNG

Morris S. Young
Chief Executive Officer
(Principal Executive Officer)

Exhibit 31.2

CERTIFICATION PURSUANT TO 18 U.S.C. RULE 13a-14(a)/15d-14(a)
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Gary L. Fischer, certify that:

1. I have reviewed this annual report on Form 10-K of AXT, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects, the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant’s other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant’s disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant’s internal control over financial reporting that occurred during the registrant’s most recent fiscal quarter (the registrant’s fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant’s internal control over financial reporting; and

5. The registrant’s other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant’s auditors and the audit committee of the registrant’s board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant’s ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant’s internal control over financial reporting.

March 16, 2023

/s/ GARY L. FISCHER

Gary L. Fischer
Chief Financial Officer and Corporate Secretary
(Principal Financial Officer and
Principal Accounting Officer)

Exhibit 32.1

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of AXT, Inc. (the “Company”) on Form 10-K for the year ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), the undersigned hereby certifies, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to the best of my knowledge:

(1) The Report fully complies with the requirements of section 13(a) of the Securities Exchange Act of 1934 (15 U.S.C. 78m); and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: March 16, 2023

By: /s/ MORRIS S. YOUNG
Morris S. Young
Chief Executive Officer
(Principal Executive Officer)

Exhibit 32.2

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report of AXT, Inc. (the "Company") on Form 10-K for the year ended December 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned hereby certifies, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to the best of my knowledge:

(1) The Report fully complies with the requirements of section 13(a) of the Securities Exchange Act of 1934 (15 U.S.C. 78m); and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: March 16, 2023

By: /s/ GARY L. FISCHER

Gary L. Fischer
Chief Financial Officer and
Corporate Secretary
(Principal Financial Officer and
Principal Accounting Officer)