

**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
- 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 000-30941

AXCELIS TECHNOLOGIES, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction
of incorporation or organization)

34-1818596
(IRS Employer Identification No.)

108 Cherry Hill Drive
Beverly, Massachusetts 01915
(Address of principal executive offices) (zip code)

(978) 787-4000
(Registrant's telephone number, including area code)

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, \$.001 par value	ACLS	Nasdaq Global Select Market

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

None

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

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

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

Indicate by checkmark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T 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 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 check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes No

Aggregate market value of the voting stock held by non-affiliates of the registrant as of June 30, 2022: \$1,780,356,471

Number of shares outstanding of the registrant's Common Stock, \$0.001 par value, as of February 21, 2023: 32,714,062

Documents incorporated by reference:

Portions of the definitive Proxy Statement for Axcelis Technologies, Inc.'s Annual Meeting of Stockholders to be held on May 10, 2023 are incorporated by reference into Part III of this Form 10-K.

Item 1. Business.

Overview of Our Business

Axcelis Technologies, Inc. (“Axcelis,” the “Company,” “we,” “us,” or “our”) designs, manufactures and services ion implantation and other processing equipment used in the fabrication of semiconductor chips. We believe that our Purion family of products offers the most innovative implanters available on the market today. We sell to leading semiconductor chip manufacturers worldwide. The ion implantation business represented 97.6% of our revenue in 2022, with the remaining 2.4% of revenue derived from aftermarket sales associated with other legacy processing systems. In addition to equipment, we provide extensive aftermarket lifecycle products and services, including used tools, spare parts, equipment upgrades, maintenance services and customer training.

Axcelis’ business commenced in 1978 and its current corporate entity was incorporated in Delaware in 1995. We are headquartered in Beverly, Massachusetts and maintain an internet site at www.axcelis.com. On or through our website, investors may access, free of charge, 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 Exchange Act as soon as reasonably practicable after we electronically file such material with, or furnish it to, the Securities and Exchange Commission. Our website and the information contained therein or connected thereto shall not be deemed to be incorporated into this Form 10-K.

2022 was an exceptional year for Axcelis despite logistical challenges brought on by the geo-political environment and the COVID-19 pandemic. As a result of the strength of the overall electronics market and the continued growth of the Purion product family in 2022, we delivered record full year revenue, operating profit and gross margin since our first full year as a public company in 2001. Revenue for 2022 was \$920.0 million, an increase of 38.9% from 2021 revenue of \$662.4 million. Systems revenue for 2022 was \$692.1 million, compared to \$454.6 million in 2021. Operating profit was \$401.8 million in 2022, compared to \$127.3 million in 2021. Gross margin for the year was 43.7% compared to 43.2% in 2021. Net income for the year was \$183.1 million, an increase of 85.6% following a 97.4% increase in revenue from the prior year.

The Company is in a strong competitive position as we participated in a period of extended industry growth in 2021 and 2022. A focused strategy on ion implant, combined with the hard work and dedication of our employees and the encouragement and support of our customers and suppliers, enabled us to achieve numerous critical milestones in our drive to market leadership. Axcelis had a number of important accomplishments in 2022:

- Axcelis’ revenue grew 39% year over year;
- Our full year revenue, gross margins and operating profit were all at record levels since our first full year as a public company in 2001;
- The market for mature semiconductor devices grew rapidly, producing greater than 80% of our systems shipments, and within that total, the electrification of the automotive market drove the power device market to contribute approximately 39% of our systems shipments;
- Our global footprint in growing markets continued to expand, including through multiple evaluation units at key customers in memory, mature process technologies and advanced logic, sales of our Purion product extensions into the Silicon Carbide market, follow-on orders for our Purion products in Japan, and device qualification for leading edge CMOS Image Sensor processes; and
- Rapid growth of our manufacturing capabilities through solid execution, strong supply chain partnerships and bringing online new capacity at both our Beverly, Massachusetts facility and Axcelis Asia Operations Center in South Korea.

We continue to work diligently to ensure that manufacturing and operating expense levels remain well aligned to business conditions. We believe that the most fundamental interest of our stockholders is consistent, profitable financial performance, which we expect to continue to deliver in 2023. Our performance is subject to risks and uncertainties discussed below under Item 1A, Risk Factors.

Industry Overview

Semiconductor chips, also known as integrated circuits, are used in a continuously evolving range of consumer and industrial products, including for example, personal computers, mobile devices, automobiles, sensors and controllers for the “internet of things” and data storage servers. Types of semiconductor chips include dynamic random-access memory (“DRAM”) and “Not AND” (“NAND”) Flash memory; logic devices to process information; and “system on chip” devices (which have both logic and memory features). The demand for chips continues to increase, as a result of the electrification of vehicles, the evolution of digital communications (including the introduction of 5G mobile networks and the growth in the Internet of Things), and the increasing complexity of device features. These chips are used in power management, data input, such as image sensors, which are often manufactured using mature processing technologies, as well as for memory to support the storage of data, internet streaming and “cloud computing” data analytics.

Most semiconductor chips are built on silicon wafers of either 200mm (8 inches) or 300mm (12 inches) in diameter. Each semiconductor chip is made up of millions of tiny transistors or “switches” to control the functions of the device. Transistors are created in the silicon wafer by introducing various precisely placed impurities into the silicon in specific patterns.

Semiconductor chip manufacturers own or manage wafer fabrication facilities (often referred to as “fabs”), which utilize many different types of equipment in the making of integrated circuits. Over 300 process steps utilizing over 50 different types of process tools are required to make a single device like a microprocessor. Semiconductor chip manufacturers seek device performance benefits through new products and technology enhancements and productivity improvements through increased throughput, equipment utilization and higher manufacturing yields. Capacity is added by increasing the amount of manufacturing equipment in existing fabrication facilities and by constructing new fabrication facilities.

We have different types of customers, which impacts the timing of purchases and technology requirements. Some customers are integrated electronics manufacturers, making semiconductor chips for their own devices. These same companies may also act as foundries, manufacturing semiconductor chips for other electronic manufacturers or chip design companies. Some customers only function as foundries. A few companies design and manufacture branded chips that are sold to device manufacturers. In addition, some customers have partnerships or joint ventures with two or more semiconductor chip manufacturers to share the technology development and capital investment. The timing of purchases by foundry customers will depend on their success in securing manufacturing contracts. Also, foundry customers will look for equipment that can deliver the broadest capabilities in order to be prepared to manufacture all chip types, while integrated electronics manufacturers may invest in processing equipment dedicated to a specific application they require for their products.

The semiconductor capital equipment industry has historically been cyclical as global chip production capacities successively exceed, then lag behind, global chip demand. When chip demand is high, and inventories are low, chip manufacturers add capacity through capital equipment purchases. Given the difficulties of forecasting and calibrating chip demand and production capacity, the industry periodically experiences excess chip inventories and softening chip prices. Device manufacturers react with muted capital spending, lowering the demand for capital equipment. Changes in consumer and business demand for products in which chips are used also affect the industry. A successful semiconductor capital equipment manufacturer must not only provide some of the most technically complex products manufactured in the world but also must manage its business to thrive during low points in the cycle.

Axcelis' Strategy

Axcelis' 2023 strategic goals are to:

- Exceed our \$1.0 billion revenue model in 2023, positioning us to achieve our \$1.3 billion revenue ion implant only model in future years by insuring high levels of customer satisfaction and quality
 - Grow the Purion footprint with our existing customer base as well as at new accounts in targeted market segments and geographies
 - Capitalize on strong spending in the mature process technology segment, especially by power device customers
 - Capture additional high value memory business
 - Continue to penetrate leading edge logic and foundry customers
 - Drive Customer Solutions & Innovation (“CS&I”) revenues by delivering excellent customer satisfaction via innovative, high value products and services
 - Continue to drive gross margin improvements through supply chain optimization, value engineering, lean manufacturing, quality improvements, product and service innovation and sales excellence
- Deliver attractive earnings per share and cash as defined in targeted business models
 - Manage revenues and expenses in line with growth initiatives and industry trends
 - Execute a capital strategy that allows for appropriate business investments while returning value to shareholders
- Expand beyond ion implant by launching identified corporate development growth initiatives

We continue to invest in research and development to ensure our products meet the needs of our customers. We take pride in our scientists and engineers who are adding to our portfolio of patents and unpatented proprietary technology to ensure that our investment in technology leadership translates into unique product advantages. We strive for operational excellence by focusing on ways to lower our product, manufacturing and design costs and to improve our delivery times to our customers. Global customer teams and a focused account management structure maintain and strengthen our customer relationships and increase customer satisfaction. Finally, we endeavor to maintain a strong cash balance to ensure sufficient capital to fund business growth.

Ion Implantation Systems

Ion implantation is a principal step in the transistor formation cycle of the semiconductor chip manufacturing process. Ion implantation is also used to change the material characteristics of the silicon for reasons other than electrical doping, a process known as “material modification.” An ion implanter is a large, technically advanced system that injects dopants such as arsenic, boron or phosphorus into a wafer. These dopants are ionized and therefore have an electrical charge state. This electric charge state allows the dopants to be accelerated, focused and filtered with electric and magnetic fields. Ion implanters use these fields to create a beam of ions with a precisely defined energy level (ranging between several hundred and eight million electron-volts) and with a precisely defined beam current level (ranging from microamps to milliamps). Certain areas of the silicon wafer are blocked off by a polymer material known as photoresist, which acts as a “stencil” to pattern devices so that the dopants will only enter the wafer where needed. Typical process flows require twenty implant steps, with the most advanced processes requiring substantially more steps. Each implant step is characterized by four key parameters: dopant type, dose (amount of dopant), energy (depth into the silicon) and tilt/twist (angle of wafer relative to the ion beam).

In order to efficiently cover the wide range of implant steps, three different broad categories of implanters have been developed, each targeted at a specific range of applications, primarily defined by dose and energy. The three traditional implanter categories are referred to as high current, high energy and medium current:

- High current implanters were the second type of implanter to emerge, having low energy capability and high dose range.
- High energy implanters emerged to address the need for deeper implants with a high energy range and low dose.
- Medium current implanters are the original model of ion implanter, with mid to low-range energy and dose capability.

The Purion Platform and Family of Ion Implanters

Axcelis offers a complete line of high energy, high current and medium current implanters for all application requirements. Our Purion flagship systems are all based on a common platform which enables a unique combination of implant purity, precision and productivity. Combining a state-of-the-art single wafer end station, with advanced spot beam architectures (that ensures all points across the wafer see the same beam condition at the same beam angle), Purion products enable exceptional process control to optimize device performance and yield, at high productivity.

- **High Current Implant.** Our Purion H, Purion Dragon and Purion H200 spot beam, high current systems cover all traditional high current requirements as well as those associated with emerging and future devices. Our Purion high current capabilities extend beyond traditional high current energy and dose ranges, in order to cover new device fabrication requirements as well as to maximize capital utilization and flexibility. In addition, Axcelis' Purion systems provide advantages for material modification applications, including those requiring hot and cold implant capabilities.
- **High Energy Implant.** Our Purion XE and other Purion high energy systems combine Axcelis' production-proven RF Linac high energy, spot beam technology with the Purion platform wafer handling system. Axcelis has been a market leader in high energy ion implanters for many years and continues to offer legacy high energy systems, as well as a range of new Purion systems which have differentiated capabilities for specialty applications.
- **Medium Current Implant.** Our Purion M Si and SiC medium current system offers higher productivity and lower electrical energy consumption compared to competitive offerings, in addition to other advantages. Our Purion M systems also offer differentiated capabilities for specialty applications.

In addition to the above categories, ion implanters may also be categorized by the types of applications for which they are designed. For example, the Axcelis Purion Power Series, which provides full recipe coverage for power device applications critical to mobile devices and electric vehicles, is comprised of a group of high current, medium current and high energy implanters that have been developed to optimize semiconductor devices created on Silicon Carbide wafers, which are advantageous for certain power devices.

We believe our ion implant products will continue to meet customer demand for advantages in productivity, process performance and technical extendibility.

Aftermarket Support and Services

Through our CS&I business, we offer our customers extensive aftermarket service and support throughout the lifecycle of the equipment we manufacture. We believe that approximately 3,100 of our products are in use in 28 countries worldwide. The service and support that we provide includes used tools, spare parts, equipment upgrades, and maintenance services. We offer varying levels of sales, service and application support out of our field offices. Revenue generated

through our CS&I business of \$227.9 million, \$207.8 million and \$180.9 million represents 24.8%, 31.4% and 38.1% of total revenue in 2022, 2021 and 2020, respectively.

To support our aftermarket business, we have sales and marketing personnel, field service engineers, and spare parts and applications engineers, as well as employees located at our manufacturing facilities who work with our customers to provide customer training and documentation, and product, process and applications support.

Most of our customers maintain spare parts inventories for our machines. In addition to our web-based spare parts management and replenishment tracking program, we offer a number of Business-to-Business options to support our customers' parts management requirements. Our Axcelis Managed Inventory service offering provides the customer with full spare parts support through a parts consignment arrangement in which Axcelis retains responsibility for the complete supply chain. These services provide ease of use alternatives that reduce order fulfillment costs and improve cycle time, resulting in an expanded customer base for this service offering.

Sales and Marketing

We primarily sell our equipment and services through our direct sales force. We conduct sales and marketing activities from our sales offices located in the United States, Taiwan, South Korea, China, Singapore, Japan, Germany and Italy.

International revenue, including export sales from our U.S. manufacturing facilities to foreign customers and sales by foreign subsidiaries and branches, accounted for 84.4%, 92.6% and 89.3% of total revenue in 2022, 2021 and 2020, respectively. In 2022, approximately 90.9% of our sales were denominated in U.S. dollars. See Note 17 to our Consolidated Financial Statements contained in Item 15 of this Form 10-K for a breakdown of our revenue and long-lived assets in the United States, Europe and Asia. See also Item 1A, "Risk Factors," for information about risks attendant to our foreign operations.

Customers

In 2022, according to Gartner Inc., the top 20 semiconductor chip manufacturers accounted for approximately 89.0% of total semiconductor capital equipment spending, which decreased from 92.0% in 2021. These manufacturers are from the largest semiconductor chip manufacturing regions in the world: the United States, Asia Pacific (Taiwan, South Korea, Singapore, Japan and China) and Europe.

Information on net sales to unaffiliated customers is included in Note 2 of Notes to Consolidated Financial Statements. For the year ended December 31, 2022, revenues from Samsung Electronics Co, Ltd. and Semiconductor Manufacturing International Corporation ("SMIC") represented 10% or more of our consolidated revenues. The loss of either of these customers would have a material adverse effect on our business.

U.S. export controls impact our ability to sell to certain customers in China, a country that has represented a significant portion of our sales in recent years. Since the placement of SMIC on the U.S. Entity List in 2020, we are required to obtain export control licenses to ship to mature process SMIC fabs, which to date, we have been able to obtain. Another chipmaker, Yangtze Memory Technologies Co., Ltd. ("YMTC"), was placed on the Entity List in 2022, without a similar policy allowing licensed shipments. A new export controls regulatory framework was issued by the U.S. in October 2022 that limits all semiconductor equipment shipments to Chinese customers who are producing or developing logic, DRAM and NAND chips that meet specific advanced parameters. While these regulations have further excluded exports to certain Chinese customers, we currently are able to continue to ship to the majority of our Chinese customers. In general, however, sales to Chinese customers represent a higher risk than sales to customers in other international locations because of trade tensions between the U.S. government and the Chinese government, and other challenges reflecting China's stage of development, including public health concerns and rapid growth.

Research and Development

Our industry continues to experience rapid technological change, requiring us to frequently introduce new products and enhancements. Our Beverly, Massachusetts Advanced Technology Center houses a process development

laboratory with a 13,500 square feet class 10/100/1000 clean room for product demonstrations and process development and a 17,500 square feet customer training center. The Advanced Technology Center provides infrastructure and process capabilities that allow customers to test their unique process steps on our systems under conditions that substantially replicate the customers' production environments. This facility also provides significant capability for our research and development efforts.

We devote a significant portion of our personnel and financial resources to research and development programs and seek to maintain close relationships with our customers to remain responsive to their product needs. We have also sought to reduce the development cycle for new products through a collaborative process whereby our engineering, manufacturing and marketing personnel work closely together with one another and with our customers at an earlier stage in the process. We use 3D, computer-aided design, finite element analysis and other computer-based modeling methods to test new designs.

Our expenses for research and development were \$78.4 million, \$65.4 million and \$61.8 million in 2022, 2021 and 2020, respectively, or 8.5%, 9.9% and 13.0% of revenue, respectively.

Manufacturing

We manufacture products at our 417,000 square feet ISO 9001:2015 and ISO 14001:2015 certified plant in Beverly, Massachusetts as well as our 38,000 square feet Axcelis Asia Operations Center in South Korea. Our facilities employ best in class manufacturing techniques, including lean manufacturing, six sigma controls and advanced inventory management, purchasing and quality systems. In 2022, we signed an additional lease of property in Beverly, Massachusetts, on which a state-of-the-art logistics and flex manufacturing center with 98,000 square feet is being built to our specifications, referred to as the Axcelis Logistics Center.

Our clean manufacturing process uses class 1,000/10,000 space to facilitate most of our manufacturing requirements.

Our core competency in manufacturing and supply chain management is built around system assembly and testing, which remains an in-house capability due to the high degree of expertise and intellectual property associated with the process and design. Non-core work is sourced to global partners and includes items such as vacuum systems, wafer handling and commodity-level components. We continuously pursue outsourcing opportunities where the economics are justified, with a goal of enabling quality and margin improvement. Our supply chain team is globally focused and is located in Beverly, Korea and Singapore. Customized and commercially available software solutions drive our planning, purchasing and inventory tracking process.

The companies supplying Axcelis play a critical part in our success. We want to ensure these companies share our values and have adopted a Supplier Code of Conduct, which contains our expectation that our suppliers will comply with our Environmental Policy, our Corporate Social Responsibility Policy, and other industry standards and policies. Our Supplier Code of Conduct provides that if a supplier fails to comply with these policies, our business relationship with that company will be permanently ended, although a compliance remediation period of up to 90 days may be allowed. In 2022, Axcelis audited 54 suppliers for compliance with our Supplier Code of Conduct and other quality standards. The outcome of these and prior audits included (i) the issuance of a total of over 190 corrective actions to suppliers, (ii) requiring more than 30 of our suppliers to participate in quarterly reviews focused on improvement projects, and (iii) subjecting two suppliers to more comprehensive audits and action plans.

Our products are designed to be assembled and tested in a modular fashion, which facilitates our industry-recognized "ship-from-cell" process. Specially developed test stands, software and tooling provide the framework for this accelerated delivery process. Customers that choose the "ship-from-cell" process substantially improve their delivery times while receiving the same high level of quality provided by more traditional, longer cycle integration techniques. Product margins and inventory turns also improve as a result of shorter factory cycle times and increased labor productivity.

Installation of our equipment is provided by factory and field teams. The process includes assembling the equipment at our installation site, and after it has been connected, recalibrating it to factory specifications.

Competition

The semiconductor equipment industry is highly competitive and is characterized by a small number of participants ranging in size. Significant competitive factors in the semiconductor capital equipment market include price, cost of ownership, equipment performance, customer support, capabilities and breadth of product line.

In the area ion implantation, we mainly compete against Applied Materials, Inc. Axcelis and Applied Materials are the only ion implant manufacturers with a full range of implant products, as well as service and support infrastructures able to service our customers globally. Other non-U.S. players we compete with include Sumitomo Heavy Industries Ion Technology Co. Ltd. and Nissin Ion Equipment Co., Ltd in Japan, Advanced Ion Beam Technology, Inc. in Taiwan, as well as CETC Electronics Equipment Group Co., Ltd. in the People's Republic of China. Non-U.S. suppliers may have an advantage over U.S. suppliers under recently established U.S. export controls regulation for shipments to China.

Intellectual Property

We rely on patent, copyright, trademark and trade secret protection in the United States and in other countries, as well as contractual restrictions, to protect our proprietary rights in our products and our business. As of December 31, 2022, we had 209 active patents issued in the United States and 467 active patents granted in other countries, as well as 213 patent applications (29 in the United States and 184 in other countries) on file with various patent agencies worldwide. Patents are generally in effect for up to 20 years from the filing of the application.

We intend to file additional patent applications and grow our intellectual property portfolio as appropriate. Although patents are important to our business, we do not believe that we are substantially dependent on any single patent or any group of patents.

We have trademarks, both registered and unregistered, that are maintained to provide customer recognition for our products in the marketplace. Trademark registrations generally remain in effect as long as the trademarks are in use. From time to time, we enter into license agreements with third parties under which we obtain or grant rights to patented or proprietary technology. We do not believe that any of our licenses are currently material to us.

Backlog

Systems backlog, including deferred systems revenue, was \$1,124.2 million and \$460.6 million as of December 31, 2022 and 2021, respectively. We believe it is meaningful to investors to include deferred systems revenue as part of our backlog. Deferred systems revenue represents revenue that will be recognized in future periods based on prior shipments or customer prepayments. Our policy is to include in backlog only those system orders for which we have accepted purchase orders. All orders are subject to cancellations or rescheduling by customers with limited or no penalties.

Backlog does not include orders received and fulfilled within a quarter. Our backlog at the beginning of a quarter typically does not include all orders required to achieve our sales objectives for that quarter. Backlog is not necessarily an indicator of future business trends because orders for services or parts received during the quarter are generally performed or shipped within the same quarter.

Bookings in the quarter ended December 31, 2022 were \$211.5 million compared to \$194.0 million in the quarter ended December 31, 2021.

Human Capital

As of December 31, 2022, we had 1,388 employees and 97 agency temporary staff worldwide. During 2022, our total employee and temporary staff headcount increased by approximately 24% to support our increased business during the year. While the majority of our headcount is based in the U.S. at our main manufacturing facility in Beverly, MA, our business requires our presence where our customers are located around the world, resulting in Axcelis employees working in 28 different countries. Of our total year end 2022 employees, 966 work in North America, 349 in Asia and 73 in Europe.

Our future success largely depends upon our continued ability to attract and retain highly skilled employees. We provide competitive compensation and benefits programs. In addition to salaries, all Axcelis employees are eligible for cash incentive programs with annual payouts tied to annual financial metrics, as described in our proxy statements, with two exceptions: (i) certain sales staff receive commission and other sales compensation, and (ii) in order to provide greater certainty of compensation to lower level U.S. employees, we pay quarterly bonuses to those employees in amounts communicated at the start of the year. Beyond these basic forms of cash compensation, we offer recognition bonuses, equity awards, an Employee Stock Purchase Plan, a 401(k) plan with a competitive employer match, healthcare and insurance benefits, health savings and flexible spending accounts, paid time off, family leave, family care resources, flexible work schedules, employee assistance programs, and tuition assistance. These programs all contribute to both attracting and retaining a highly skilled employee base, including those with critical leadership and industry skills and experience.

During 2022, our voluntary turnover rate for employees was 13.1%, or 11.4% without retirements, well below the worldwide technology industry (all reported) voluntary turnover average of 18.4% reported in the Aon 2022 Salary Increase and Turnover Study -- December 2022.

We also recognize that training is an important aspect of both employee retention and talent development. Axcelis conducts an annual talent review process and establishes individualized development programs agreed upon by employees and their managers. Human Resources provides training on personal development planning and leadership skills. All Axcelis employees have access to LinkedIn Learning to pursue independent training on business subjects. Our manufacturing staff each receives 35 hours of training upon commencement of employment, and our field service and other technical employees receive training on various ion implanter systems to develop product support, applications and service skills on all of our products. Finally, all staff are required to complete monthly, annual or biennial training on cybersecurity, various health and safety topics, and legal matters, such as the Foreign Corrupt Practices Act, export controls compliance, ethical business practices, and confidentiality. At a minimum, all Axcelis employees are required to complete at least 15 hours of training per year, and they can access additional voluntary training at the Company's expense.

The success of our business is fundamentally connected to the well-being of our people. Accordingly, we are committed to the health, safety and wellness of our employees. We provide our employees and their families with access to health and wellness insurance and programs that offer choice where possible so they can customize their benefits to meet their needs and the needs of their families. During the COVID-19 pandemic, we implemented significant changes that we determined were in the best interest of our employees, as well as the communities in which we operate, and which comply with government regulations. This included having those employees that could productively work from home continue to do so, while implementing additional safety measures for employees continuing critical on-site work. While all employees may now return to work in the Beverly facility, we are maintaining certain restrictions related to the manufacturing areas of the building to ensure that those members of our workforce are not unnecessarily exposed to other workers.

Axcelis is dedicated to building a diverse workforce, fostering a culture built on the principle of inclusion, and maintaining a workplace free from discrimination. We strongly believe that a diversity of experience, perspectives and backgrounds will lead to a better environment for our employees and better products for our customers. Axcelis' commitment to diversity extends to our Board of Directors, our leadership team and all teams and functions across our global locations.

We encourage you to review the "Focus on Diversity" report (located in the "Investors" and "About Us" sections of our Axcelis.com website) for more detailed information regarding diversity and inclusion at Axcelis. Nothing on our website, including our Focus on Diversity Report or sections thereof, shall be deemed incorporated by reference into this Annual Report.

Environmental

We are subject to environmental laws and regulations in the countries in which we operate that regulate, among other things: air emissions; water discharges; and the generation, use, storage, transportation, handling and disposal of solid and hazardous wastes produced by our manufacturing, research and development and sales activities. As with other companies engaged in like businesses, the nature of our operations exposes us to the risk of environmental liabilities, claims, penalties and orders.

We are proud of our commitment to improving our environment. We believe that our operations are in compliance with applicable environmental laws and regulations and that there are no pending environmental matters that would have a material impact on our business. We are ISO 9001:2015 and ISO 14001:2015 certified at our Beverly, MA facility.

We are also proud that our Power Series ion implantation systems have become enabling technology for the production of power management devices, which are critical to the electrification of vehicles, an important component of our society's actions to address climate change.

In 2022, Axcelis became a founding member of the Semiconductor Climate Consortium ("SCC") of Semiconductor Equipment and Materials International ("SEMI"), our industry organization serving the manufacturing supply chain for the micro- and nano-electronics industries. In doing so, we expect to bolster our own sustainability work with the power of the semiconductor ecosystem. By collaborating with SCC member companies' joint knowledge and innovative technologies, Axcelis hopes to promote progressive action towards climate change.

Information about our Executive Officers

Mary G. Puma, 65, has been our President and Chief Executive Officer since January 2002, having served as Chairman from 2005 to 2015. From May 2000 until January 2002, Ms. Puma was our President and Chief Operating Officer. In 1998, she became General Manager and Vice President of the Implant Systems Division of Eaton Corporation, a global diversified industrial manufacturer. In May 1996, she joined Eaton as General Manager of the Commercial Controls Division. Prior to joining Eaton, Ms. Puma spent 15 years in various marketing and general management positions for General Electric Company. Ms. Puma is also a director of Nordson Corporation, a manufacturer of precision dispensing equipment for industrial liquid and powder coatings, adhesives, and sealants, and serves as a director and, since early 2023, as Chairperson of the Board of Semiconductor Equipment and Materials International.

Kevin J. Brewer, 64, became our Executive Vice President and Chief Financial Officer in September 2013, having served as interim Chief Financial Officer beginning in June 2013. Mr. Brewer also manages our Global Operations. Mr. Brewer had previously been our Executive Vice President, Global Operations since 2008 and our Senior Vice President, Manufacturing Operations since May 2005, prior to which he had been Vice President of Manufacturing Operations since October 2002 and Director of Operations from 1999 to 2002. Prior to joining Axcelis in 1999, Mr. Brewer was Director of Operations, Business Jets at Raytheon Aircraft Company, a leading manufacturer of business and special mission aircraft owned by Raytheon Company, a manufacturer of defense, government and commercial electronics, as well as aircraft. Prior to that, Mr. Brewer held various management positions in operations and strategic planning in Raytheon Company's Electronic Systems and Missile Systems groups.

Russell J. Low, Ph.D., 52, is our Executive Vice President, Global Customer and Engineering Operations, a position he assumed in January 2021, having served as Executive Vice President, Engineering since joining Axcelis in October 2016. Dr. Low joined Axcelis in October 2016 as Executive Vice President, Engineering. Prior to joining the Company, Dr. Low held the position of Vice President of Engineering, MOCVD Business Unit at Veeco Instruments since 2013, prior to which he was Veeco's Senior Director of Engineering, Molecular Beam Epitaxy Business Unit beginning in 2012. From 2003 to 2012, Dr. Low held a number of positions at Varian Semiconductor Equipment Associates, most recently as Director of Technology. Prior to that, Dr. Low held engineering positions in the thermal processing and ion implant divisions of Applied Materials, Inc. from 1997 to 2003.

Greg Redinbo, Ph.D., 58, is our Executive Vice President, Marketing and Applications, a position he assumed in September 2022. Dr. Redinbo joined Axcelis in 2021 as Senior Vice President of Strategic Marketing and Business Development. Dr. Redinbo has over 25 years of experience in the semiconductor capital equipment industry. Prior to joining Axcelis, Dr. Redinbo held the position of Vice President, Global Strategic Accounts at ASML. Dr. Redinbo's past positions also include Global Vice President of Sales, Service and Applications at FEI, Director of Sales, U.S. and Europe, and Director of Product Marketing, High Current Products at Varian Semiconductor and Product Management in the Thermal Processing Division at Applied Materials.

Lynnette C. Fallon, 63, is our Executive Vice President, Human Resources/Legal and General Counsel, a position she has held since May 2005. Prior to that, Ms. Fallon was Senior Vice President HR/Legal and General Counsel since 2002, and Senior Vice President and General Counsel since 2001. Ms. Fallon has also been our corporate Secretary since 2001. Before joining Axcelis in 2001, Ms. Fallon had been a partner in the Boston law firm of Palmer & Dodge LLP since 1992, where she was head of the Business Law Department from 1997 to 2001. Ms. Fallon is also a member of the Board

of Directors of ClearPoint Neuro, Inc., a global therapy-enabling platform company providing stereotactic navigation and delivery to the brain.

Douglas A. Lawson, 62, has been our Executive Vice President, Corporate Marketing and Strategy since November 2013, having joined Axcelis as Vice President Business Development in 2010, and holding the position of Senior Vice President of Strategic Initiatives beginning in 2011. Mr. Lawson also manages our Information Technology function. Prior to joining the Company in 2010, he held the position of General Manager of Luminus Devices from 2009 to 2010. He has over 30 years of experience in the technology industry and has held numerous executive and technical positions at BTU International, PRI Automation, Digital Equipment and Intel.

Item 1A. Risk Factors.

Risks Related to Our Business and Industry

Set forth below and elsewhere in this Form 10-K and in other documents we file with the SEC are risks and uncertainties that could cause actual results to differ materially from the results contemplated by the forward-looking statements contained in this Form 10-K. It is not possible to predict or identify all such risk factors. Consequently, the following is not a complete discussion of all potential risks or uncertainties.

If semiconductor chip manufacturers do not make sufficient capital expenditures, our sales and profitability will be harmed.

New systems orders and used tool sales depend upon demand from semiconductor chip manufacturers who build or expand fabrication facilities. When the rate of construction or expansion of fabrication facilities declines, demand for our systems will decline, reducing our revenue. In addition, all or a portion of the demand for increased capacity may be satisfied by a semiconductor chip manufacturer's ability to reconfigure and re-use equipment they already own. Revenue decline also hurts our profitability because our established cost structure and our continued investments in engineering, research and development, and marketing necessary to develop new products and to maintain extensive customer service and support capabilities, limit our ability to reduce expenses in proportion to declining sales.

If we fail to develop and introduce reliable new or enhanced products and services that meet the needs of semiconductor chip manufacturers, our results will suffer.

Rapid technological changes in semiconductor chip manufacturing processes require us to respond quickly to changing customer requirements. Our future success will depend in part upon our ability to develop, manufacture and successfully introduce new systems and product lines with improved capabilities. This will depend upon a variety of factors, including new product selection, timely and efficient completion of product design and development as well as manufacturing and assembly processes, product performance in the field and effective sales and marketing. In particular:

- We must continue to develop competitive technical specifications for new systems, or enhancements to our existing systems, and manufacture and ship these systems or enhancements in volume in a timely manner.
- We will need to accurately predict the schedule on which our customers will be ready to transition to new products, in order to accurately forecast demand for new products while managing the transition from older products.
- We will need to effectively manage product reliability or quality problems that often exist with new systems, in order to avoid higher manufacturing costs, delays in acceptance and payment and additional service and warranty expenses, and ultimately, a lack of repeat orders.
- Our new products must be accepted in the marketplace.

Our failure to meet any of these requirements will have a material adverse effect on our operating results and profitability.

Axcelis is subject to the risks of operating internationally: we derive a substantial portion of our revenue from outside the United States, especially from Asia.

We are substantially dependent on sales of our products and services to customers outside the United States. International sales, including export sales from our U.S. manufacturing facilities to non-U.S. customers and sales by our non-U.S. subsidiaries, accounted for 84.4% of total revenue in 2022. Customers based in Asia dominate our international sales. Ion implanter system shipments to customers in Asia represented 76.0% of total system revenue in 2022. We anticipate that international sales will continue to account for a significant portion of our revenue. In particular, we expect

that sales to Chinese customers (both global and domestic Chinese chip manufacturers) will continue to represent a significant portion of our total sales, creating both risk and opportunity.

U.S. export controls on shipments to Chinese customers have been notably increasing since 2020. Since the placement of SMIC on the U.S. Entity List in 2020, we are required to obtain export control licenses to ship to mature process SMIC fabs, which to date, we have been able to obtain. Another chipmaker, YMTC, was placed on the Entity List in 2022, without a similar policy allowing licensed shipments. A new export controls regulatory framework was issued by the U.S. in October 2022 that limits all semiconductor equipment shipments to Chinese customers who are producing or developing logic, DRAM and NAND chips meeting specific advanced parameters. While these regulations have further excluded exports to certain Chinese customers, we currently are able to continue to ship to the majority of our Chinese customers. In general, however, continuing revenue from Chinese customers is at higher risk than continuing revenue from customers in some other international locations because of trade tensions between the United States government and the Chinese government, and other challenges reflecting China's stage of development, including public health concerns and rapid growth.

Increased U.S. export controls and other political and trade tensions exacerbate the risk that Chinese customers will change suppliers to non-U.S. vendors, such as Advanced Ion Beam Technology, Inc., Nissin Ion Equipment Co., Ltd. and Sumitomo Heavy Industries Ion Technology Co., Ltd. In addition, a Chinese entity, known as CETC Electronics Equipment Group Co., Ltd., is developing ion implanters for the Chinese domestic market. The loss of a significant customer or any reduction or delays in our ability to ship to any significant customer will adversely affect us.

We source a substantial portion of our materials from outside of the United States. Because of our dependence upon international sales and our global supply chain, our results and prospects may be adversely affected by a number of factors, including:

- changes in laws or regulations resulting in more burdensome governmental controls, tariffs, restrictions, embargoes or export license requirements;
- volatility in currency exchange rates;
- political and economic instability;
- global health emergencies, such as the COVID-19 pandemic, which have the potential to disrupt our manufacturing operations and those of our supply chain, as well as cause our customers to delay or cancel shipments;
- difficulties in accounts receivable collections;
- extended payment terms beyond those customarily offered in the United States;
- difficulties in managing suppliers, service providers or representatives outside of the United States;
- difficulties in staffing and managing foreign subsidiary operations; and
- potential adverse tax consequences.

Our dependence upon suppliers for many components and sub-assemblies could result in increased costs or delays in the manufacture and sale of our products.

We rely to a substantial extent on outside vendors to manufacture many of the components and sub-assemblies of our products. We obtain many of these components and sub-assemblies from a limited group of suppliers. Accordingly, based on situations outside of our control, we may be unable to obtain an adequate supply of required components on a timely basis, on price and other terms acceptable to us, or at all. In addition, we often quote prices to our customers and accept customer orders for our products before purchasing components and sub-assemblies from our suppliers. If our suppliers increase the cost of components or sub-assemblies, we may not have alternative sources of supply and may not be able to raise the price of our products to cover all or part of the increased cost of components, negatively impacting our gross margin.

The manufacture of some of these components and sub-assemblies is an extremely complex process and requires long lead times. As a result, we could experience delays or shortages. If we are unable to obtain adequate and timely deliveries of our required components or sub-assemblies, we may have to seek alternative sources of supply or manufacture

these components internally. This could delay our ability to manufacture or to ship our systems on a timely basis, causing us to lose sales, incur additional costs, delay new product introductions and suffer harm to our reputation.

Moreover, if actual demand for Axcelis' products is different than expected, Axcelis may purchase more or fewer parts than necessary or incur costs for canceling, postponing or expediting delivery of parts. If Axcelis purchases inventory in anticipation of customer demand that does not materialize, or if customers reduce or delay orders, Axcelis may incur excess inventory charges.

A significant portion of our revenue depends on customers electing to buy aftermarket products and services from Axcelis.

Historically, a significant portion of our product revenue and all of our service revenue relates to our sale of "aftermarket" products and services, which include parts, consumables, upgrades, service contracts, and time and materials billings. Some of our customers purchase fewer aftermarket products and services, often training their own staff to maintain and service semiconductor capital equipment rather than relying on the equipment manufacturer for these services. In addition, we compete against third-party parts suppliers for the sale of parts and consumables that are not protected by patents or otherwise proprietary. To the extent our customers purchase parts and services from other vendors or provide their own system maintenance labor, our revenue and profitability will be reduced.

If we fail to compete successfully in the highly competitive semiconductor capital equipment industry, our sales and profitability will decline.

The ion implant segment is highly competitive and includes one company with substantially greater financial, engineering, manufacturing, marketing and customer service and support resources that may better position it to compete successfully than we can, as well as several smaller companies that could provide innovative systems with technology that may have performance advantages. We expect our competitors to continue to improve the design and performance of their existing products and processes and to introduce new products and processes with improved price and performance characteristics. If we are unable to improve or introduce competing products when demanded by the markets, our business will be harmed. Finally, if we must lower prices to remain competitive without commensurate cost of goods savings, our gross margin and profitability will be adversely affected.

We are dependent on sales to a limited number of large customers; the loss of a significant customer or any reduction in orders from them could materially affect our sales.

Historically, we have sold a significant portion of our products and services to a limited number of semiconductor chip manufacturers. In 2022, our top ten customers accounted for 59.4% of our net sales, in comparison to 69.5% and 74.0% in 2021 and 2020, respectively. None of our customers have entered into a long-term agreement requiring it to purchase our products. One of our largest customers, SMIC, is based in China, which is subject to U.S. export controls risks, discussed above. Although the composition of the group comprising our largest customers has varied from year to year, the loss of a significant customer or any reduction or delays in orders from any significant customer will adversely affect us. Consolidation of semiconductor chip manufacturers may result in the loss of a customer.

Our international operations involve currency risk.

Substantially all of our system sales are billed in U.S. dollars. We also pay almost all non-U.S. vendors providing materials, components and subassemblies to our U.S. factory in U.S. dollars. However, the aftermarket revenues of our non-U.S. subsidiaries, and most of the operating expenses of these non-U.S. subsidiaries, are received and incurred in local currencies. The establishment of the Axcelis Asia Operations Center in South Korea has increased the volume of our transactions in non-U.S. dollar currencies and increased the impact of foreign exchange gain / loss on the Company's financial results. The Company experiences translation adjustments when local currency accounts payable on non-U.S. subsidiary books are re-measured for consolidated financial reporting. Similarly, the translation of long-term asset and liability values to U.S. dollars are recorded in stockholders' equity as an element of accumulated other comprehensive income (loss). The value of the asset or liability in U.S. dollars will increase or decrease relative to the local currency based on changes in the exchange rate between the two currencies over the period. As a result, any unplanned non-cash gains or losses are recorded in the Company's consolidated financial statements. Accordingly, fluctuations in exchange rates can

impact reported revenues, expense, and profitability and asset values in our Consolidated Financial Statements. During the year ended December 31, 2022, approximately 9.1% of our revenue was derived in local currencies from foreign operations with this inherent risk. In addition, at December 31, 2022, our operations outside of the United States accounted for approximately 10.2% of our total assets, the majority of which was denominated in currencies other than the U.S. dollar.

We may not be able to maintain and expand our business if we are not able to hire, retain and integrate qualified personnel.

Our business depends on our ability to attract and retain qualified, experienced employees. There is substantial competition for experienced engineering, technical, financial, sales and marketing personnel in our industry. In particular, we must attract and retain highly skilled design and process engineers. Competition for such personnel is intense, both in the Boston metropolitan area and in other locations around the world. If we are unable to retain our existing key personnel, or attract and retain additional qualified personnel, we may from time to time experience insufficient levels of staffing to fully develop, manufacture and market our products and perform services for our customers. As a result, our growth could be limited or we could fail to meet our delivery commitments or experience deterioration in service levels or decreased customer satisfaction, all of which could adversely affect our financial results.

Our financial results may fluctuate significantly.

We derive our new systems revenue from the sale of a small number of expensive products to a relatively small number of customers. The selling prices on our ion implant systems range from approximately \$2.4 million to \$10.0 million. We also sell used equipment in our aftermarket business. Each sale, or failure to make a sale, may have a significant effect on us in a particular quarter. In a given quarter, a number of factors can adversely affect our revenue and results, including changes in our product mix, increased fixed expenses per unit due to reductions in the number of products manufactured, and higher fixed costs due to increased levels of research and development and expansion of our worldwide sales and marketing organization. Our financial results also fluctuate based on gross profit realized on sales. A variety of factors may cause gross profit as a percentage of revenue to vary, including the mix and average selling prices of products sold, costs to manufacture and customize systems, warranty costs and the impact of changes to inventory reserves. New product introductions may also affect our gross margin. Fluctuations in our financial results may have an adverse effect on the price of our common stock.

Our financial results may fall short of anticipated levels because forecasting revenue and profitability is complex and may be inaccurate.

Management may from time to time provide financial forecasts to investors. These forecasts are based on assumptions, which are believed to be reasonable when made, of the timing of system orders, system shipments, system acceptance and aftermarket revenue. Any of these assumptions can prove erroneous and the level of revenue recognizable in a particular quarter may vary from the forecast. Our lengthy sales cycle, coupled with customers' competing capital budget considerations, make revenue difficult to predict. In addition, our backlog at the beginning of a quarter typically does not include all orders required to achieve our sales objectives for that quarter and is not a reliable indicator of our future sales. As a result, our revenue and operating results for a quarter depend on our shipping systems on previous orders as scheduled during that quarter, receiving customer acceptance of previously shipped products, and obtaining new orders for products and services to be provided within that same quarter. Any delay in, or cancellation of, scheduled shipments and customer acceptances or in revenue from new orders, including aftermarket revenue, could materially affect our financial results.

Accounting rules addressing revenue recognition add more complexity in forecasting quarterly revenue and profitability. Orders for our products usually contain multiple performance obligations that result in revenue deferral under generally accepted accounting principles. Due to the foregoing factors, investors should understand that our actual financial results for a quarter may vary significantly from our forecasts of financial performance for that quarter. Failure to meet forecasted financial performance may have an adverse effect on the price of our common stock.

The semiconductor equipment industry is cyclical and we expect that demand for our products will increase and decrease, making it difficult to manage the business and potentially causing harm to our sales and profitability.

The semiconductor industry is cyclical, experiencing upturns when the demand for our products is high and downturns when our customers are not investing in new or expanded fabrication facilities. From time to time, inventory buildups in the semiconductor device industry produce an oversupply of semiconductors. This can cause a reduced demand for capital equipment such as our products, negatively impacting our sales and level of profitability. Our revenue can vary significantly from one point in the cycle to another, making it difficult to manage the business, both when revenue is increasing and when it is decreasing. In addition, a substantial portion of our operating expenses do not fluctuate with changes in volume. Significant decreases in revenue can therefore have a disproportionate effect on profitability. In addition, reduced demand for our products and services may require Axcelis to implement cost reduction efforts, including restructuring activities, which may adversely affect Axcelis' ability to capitalize on opportunities that arise in the future.

Axcelis is exposed to risks related to cybersecurity threats and incidents.

In the conduct of our business, Axcelis collects, uses, transmits and stores data on information technology systems. This data includes confidential information belonging to Axcelis, our employees or our customers or other business partners, some of which is personally-identifiable information of individuals. As reported in the 2022 Verizon Data Breach Investigation Report, cyber-attacks in the manufacturing industries are largely financially motivated, although business espionage is the objective in a strong majority of the incidents. Axcelis has been and expects to continue to be subject to cybersecurity threats and incidents, including through employee error or misuse; individual attempts to gain unauthorized access to information systems; and sophisticated and targeted measures known as advanced persistent threats, none of which have had a material impact on the Company to date.

Axcelis implements a "Layered Security Strategy" that aligns with National Institute of Standards and Technology Cybersecurity Framework. To do so, we devote significant resources to network security, data encryption, employee training and other measures to protect our systems and data from unauthorized access or misuse. This includes continuously monitoring and reacting to the cybersecurity environment, by implementing best-in-class solutions from a number of vendors. On an on-going basis, we engage a cybersecurity consultant to validate and advise on the Company's cyber landscape and to drive employee vigilance through employee cyber training and messaging. We continually replace less secure legacy systems to improve internal and external cyber defenses and maintain a cyber incident response plan including reporting and recovery processes. As discussed in our proxy statement, the full Board of Directors receive quarterly reports on cybersecurity risks and annual reports on management initiatives to promote cybersecurity.

However, depending on their nature and scope, cybersecurity incidents could result in business disruption; the misappropriation, corruption or loss of confidential information and critical data (Axcelis' and that of third parties); reputational damage; unnecessary expense; litigation with third parties; diminution in the value of Axcelis' investment in research, development and engineering; data privacy issues; and increased cybersecurity protection and remediation costs. These adverse outcomes could negatively impact our revenues, expenses, profitability and asset values.

Axcelis is subject to risks associated with compliance with environmental, health and safety regulations.

Axcelis is subject to environmental, health and safety regulations in connection with its global business operations, including but not limited to: regulations related to the development, manufacture, shipping and use of its products; handling, discharge, recycling and disposal of hazardous materials used in its products or in producing its products; the operation of its facilities; and the use of its real property. The failure or inability to comply with existing or future environmental and safety regulations could result in: significant remediation or other legal liabilities; the imposition of penalties and fines; restrictions on the development, manufacture, sale, shipment or use of certain of its products; limitations on the operation of its facilities or ability to use its real property; and a decrease in the value of its real property. Axcelis could be required to alter its manufacturing and operations and incur substantial expense in order to comply with environmental, health and safety regulations. Any failure to comply with these regulations could subject Axcelis to significant costs and liabilities that could adversely affect Axcelis' business, financial condition and results of operations.

Our financial condition and results of operations could be adversely affected by global pandemics.

Global pandemics, such as COVID-19, cause disruptions and restrictions on our operations and ability to travel, and similar disruptions and restrictions impacting our suppliers or customers could adversely affect our sales and operating results. Axcelis' products rely on an extensive global supply chain, and shortages of certain parts could impact our ability to meet customers' shipment expectations, negatively affecting our revenues. Such pandemics may drive changes in the demand for certain of our customers' products, resulting in their delay or cancellation of purchases from us. The extent to which pandemics may impact our results will depend on future developments, which are highly uncertain and cannot be predicted.

Our proprietary technology may be vulnerable to efforts by competitors to challenge or design around, potentially reducing our market share.

We rely on a combination of patents, copyrights, trademark and trade secret laws, non-disclosure agreements and other intellectual property protection methods to protect our proprietary technology. Despite our efforts to protect our intellectual property, our competitors may be able to challenge, design around or legitimately use the proprietary technology embedded in our systems or other technology or information used in our business. If this occurs, the value of our proprietary technology will be diminished. Our means of protecting our proprietary rights may not be adequate and our patents may not be sufficient to prevent others from using technology that is similar to or the same as our technology. Patents issued to us may be challenged and might be invalidated or circumvented and any rights granted under our patents may not provide adequate protection to us. Our competitors may independently develop similar technology, duplicate features of our products or design around patents that may be issued to us. As a result of these threats to our proprietary technology, we may have to resort to costly litigation to enforce or defend our intellectual property rights. Finally, all patents expire after a period of time (in the U.S., patents expire 20 years from the date of filing of the patent application). Our market share could be negatively impacted by the invalidation or expiration of a patent which had created a barrier for our competitors.

Axcelis also has agreements with third parties for licensing of patented or proprietary technology with Axcelis as the licensor or the licensee. Termination of license agreements or claims of infringement with respect to such technology could have an adverse impact on our financial performance or ability to ship products with existing configurations.

We (or customers that we indemnify) might face intellectual property infringement claims or patent disputes that may be costly to resolve and, if resolved against us, could be very costly to us and prevent us from making and selling our systems.

From time to time, claims and proceedings may be asserted against us relative to patent validity or infringement matters. We typically agree to indemnify our customers from liability to third parties for intellectual property infringement arising from the use of our products in their intended manner. Therefore, we may receive notification from customers who believe that we owe them indemnification or other obligations related to infringement claims made against the customers by third parties. Our involvement in any patent dispute or other intellectual property dispute or action to protect trade secrets, even if the claims are without merit, could be very expensive and could divert the attention of our management. Adverse determinations in any litigation could subject us to significant liabilities to third parties, require us to remove certain features from our products or seek costly licenses from third parties or prevent us from manufacturing and selling our systems. In addition, infringement indemnification clauses in system sale agreements may require us to take other actions or require us to provide certain remedies to customers who are exposed to indemnified liabilities. Any of these situations could have a material adverse effect on our business results.

If operations were to be disrupted at Axcelis' manufacturing facilities, it would have a negative impact on our business.

Our primary manufacturing facility is located in Massachusetts, with a smaller facility located in South Korea. Our operations could be subject to disruption for a variety of reasons, including, but not limited to severe weather events, other effects of climate change, natural disasters, work stoppages, operational facility constraints and terrorism. Such disruption could cause delays in shipments of products to our customers and could result in cancellation of orders or loss of customers, which could seriously harm our business.

If we do not have access to capital on favorable terms, on the timeline we anticipate, or at all, our financial condition and results of operations could be materially adversely affected.

We require a substantial amount of capital to meet our operating requirements and remain competitive. We routinely incur significant costs to purchase inventory to meet expected system sales, to develop and introduce new products, and to place evaluation systems at new customer sites. There can be no assurance that we will realize a return on the capital expended. Although our current cash levels and borrowing capacity are expected to be adequate for our foreseeable cash requirements, if our operating results falter, or our cash flow or capital resources prove inadequate, we may incur debt to fund these requirements. Significant volatility or disruption in the global financial markets may result in us not being able to obtain additional financing on favorable terms, on the timeline we anticipate, or at all, and we may not be able to refinance, if necessary, any outstanding debt when due, all of which could have a material adverse effect on our financial condition. Any inability to obtain financing on favorable terms, on the timeline we anticipate, or at all, may cause us to curtail our operations significantly, reduce planned capital expenditures and research and development, or obtain funds through arrangements that management does not currently anticipate, including disposing of our assets and relinquishing rights to certain technologies, the occurrence of any of which may significantly impair our ability to remain competitive, and materially and adversely affect our results of operations and financial condition.

The market price of our common stock may be volatile, which could result in substantial losses for investors.

The stock markets in general, and the markets for semiconductor equipment stocks in particular, have experienced extreme volatility that has often been unrelated to the operating performance of particular companies. These broad market fluctuations may adversely affect the trading price of our common stock. The market price of the common stock may also fluctuate significantly in response to the following factors, among others, some of which are beyond our control:

- variations in our quarterly results;
- the issuance or repurchase of shares of our common stock;
- changes in securities analysts' estimates of our financial performance;
- changes in market valuations of similar companies;
- announcements by us or our competitors of significant contracts, acquisitions, strategic partnerships, joint ventures, capital commitments, new products or product enhancements;
- loss of a major customer or failure to complete significant transactions;
- additions or departures of key personnel; and
- new positions adopted by investor stewardship groups and proxy advisory firms regarding desired environmental, social and governance disclosures, policies, ranking systems and other initiatives.

The trading price of our common stock in the past has been significantly volatile, and we cannot accurately predict every potential risk that may materially and adversely affect our stock price.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

We lease our principal facility in Beverly, Massachusetts, which comprises 417,000 square feet. The facility is principally used for manufacturing, research and development, sales/marketing, customer support, advanced process development, product demonstration, customer-training center and corporate headquarters. We also lease our Axcelis Asia Operations Center in South Korea, which comprises 38,000 square feet and is principally used for manufacturing. In 2022, we signed an additional lease of property in Beverly, Massachusetts, on which a state-of-the-art logistics and flex manufacturing center with 98,000 square feet is being built to our specifications, referred to as the Axcelis Logistics Center.

We believe that our manufacturing facilities and equipment generally are well maintained, in good operating condition, suitable for our purposes, and adequate for our present operations.

We own 23 acres of undeveloped property in Beverly, Massachusetts, adjacent to our headquarters.

As of December 31, 2022, we also leased 38 other properties, of which 10 are located in the United States and the remainder are located in Asia and Europe, including offices in Taiwan, Singapore, South Korea, China, Japan, Italy and Germany. These properties are used for sales and service offices and warehousing.

Our Beverly, Massachusetts facility is ISO 9001:2015 and ISO 14001:2015 certified and our European office is ISO 9001:2015 certified.

Item 3. Legal Proceedings.

We are not presently a party to any litigation that we believe might have a material adverse effect on our business operations. We are, from time to time, a party to litigation that arises in the normal course of our business operations.

Item 4. Mine Safety Disclosures.

Not applicable.

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

Our common stock trades on the Nasdaq Global Select Market under the symbol ACLS. As of February 21, 2023, we had approximately 763 stockholders of record.

The following table summarizes the stock repurchase activity for the 12 months ended December 31, 2022 pursuant to our stock repurchase program:

	Total Number of Shares Purchased	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Program	Approximate Dollar Value of Shares that May Yet Be Purchased Under the Program
January 1 through January 31	—	N/A	—	\$ 100,000
February 1 through February 28	—	N/A	—	100,000
March 1 through March 31	284	\$70.41	284	80,000
April 1 through April 30	45	\$60.36	45	77,284
May 1 through May 31	60	\$56.44	60	73,885
June 1 through June 30	110	\$58.30	110	67,502
July 1 through July 31	90	\$56.47	90	62,419
August 1 through August 31	79	\$72.38	79	56,701
September 1 through September 30	26	\$64.39	26	55,005
October 1 through October 31	95	\$57.88	95	49,506
November 1 through November 30	99	\$70.56	99	42,505
December 1 through December 31	—	N/A	—	\$ 42,505
Total	888		888	

We currently maintain one equity compensation plan, the 2012 Equity Incentive Plan (the “2012 Equity Plan”). The number of shares issuable upon exercise of outstanding options and unvested restricted stock units granted to employees and non-employee directors, as well as the number of shares remaining available for future issuance, under our equity compensation plans as of December 31, 2022 are summarized in the following table:

Plan category	(A) Number of shares to be issued upon exercise of outstanding options, warrants and rights (1)	(B) Weighted-average exercise price of outstanding options, warrants and rights (2)	(C) Number of shares remaining available for future issuance under equity compensation plans (excluding shares reflected in column (A)) (3)
Equity compensation plans approved by stockholders	1,091,710	\$ 0.19	1,995,688
Equity compensation plans not approved by stockholders	—	NA	NA
Total	1,091,710		1,995,688
Weighted average exercise price of outstanding options at December 31, 2022	\$43.33		
Weighted average remaining term of outstanding options at December 31, 2022	3.9 years		

(1) Represents, as of December 31, 2022: (A) 4,874 shares issuable on exercise of outstanding options under the 2012 Equity Plan, plus (B) 725,012 shares issuable on vesting of outstanding RSUs under the 2012 Equity Plan (some of which will be withheld in respect of tax withholding obligations).

(2) For the purposes of this table, the weighted-average exercise price of outstanding options, warrants and rights includes RSUs as if they had a \$0.00 exercise price. The weighted-average exercise price of outstanding options at December 31, 2022 was \$43.33.

(3) Represents the total shares available for issuance under our 2012 Equity Plan and our Employee Stock Purchase Plan, as of December 31, 2022, as follows:

1,068,101 shares were available for future issuance under the 2012 Equity Plan. Such amount represents the total number of shares reserved for issuance under the 2012 Equity Plan ((7,762,500 shares approved by the shareholders, plus 1,777,029 shares added in accordance with the terms of the 2012 Equity Plan as a result of the expiration or forfeiture of awards granted under our prior equity grant plan that were outstanding at the time of the adoption of the 2012 Equity Plan), less the shares issuable on options and restricted stock units (counted at 1.5 shares each) outstanding under the 2012 Equity Plan included in column (A)) and the shares issued prior to such date on exercise of options and vesting of restricted stock units granted under the 2012 Equity Plan. This plan is generally used for grants to employees and directors and was approved by our stockholders at our 2012 annual meeting.

(A) 925,087 shares were available under our 2022 Employee Stock Purchase Plan, which represents the total number of shares reserved for issuance under the plan (1,000,000) less the shares purchased through December 31, 2022.

Item 6. [RESERVED]

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

Certain statements in "Management's Discussion and Analysis of Financial Condition and Results of Operations" are forward-looking statements that involve risks and uncertainties. Words such as may, will, should, would, anticipates, expects, intends, plans, believes, seeks, estimates and similar expressions identify such forward-looking statements. The forward-looking statements contained herein are based on current expectations and entail various risks and uncertainties that could cause actual results to differ materially from those expressed in such forward-looking statements. Factors that might cause such a difference include, among other things, those set forth under "Liquidity and Capital Resources" and "Risk Factors" and others discussed elsewhere in this Form 10-K. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect management's analysis only as of the date hereof. We assume no obligation to update these forward-looking statements to reflect actual results or changes in factors or assumptions affecting forward-looking statements, except as may be required by law.

Overview

The semiconductor capital equipment industry is subject to cyclical swings in capital spending by semiconductor chip manufacturers. Capital spending is influenced by demand for semiconductors and the products using them, the utilization rate and capacity of existing semiconductor chip manufacturing facilities and changes in semiconductor technology, all of which are outside of our control. As a result, our revenue may fluctuate from year to year and period to period. Our established cost structure does not vary significantly with changes in volume. We may also experience fluctuations in operating results and cash flows depending on our revenue level.

2022 was an exceptional year for Axcelis despite logistical challenges brought on by the geo-political environment and the COVID-19 pandemic. As a result of the strength of the overall electronics market and the continued growth of the Purion product family in 2022, we delivered record full year revenue, operating profit and gross margin since our first full year as a public company in 2001. Revenue for 2022 was \$920.0 million, an increase of 38.9% from 2021 revenue of \$662.4 million. Systems revenue for 2022 was \$692.1 million, compared to \$454.6 million in 2021. Operating profit was \$401.8 million in 2022, compared to \$127.3 million in 2021. Gross margin for the year was 43.7% compared to 43.2% in 2021. Net income for the year was \$183.1 million, an increase of 85.6% following a 97.4% increase in revenue from the prior year.

The Company is in a strong competitive position as we participated in a period of extended industry growth in 2021 and 2022. A focused strategy on ion implant, combined with the hard work and dedication of our employees and the encouragement and support of our customers and suppliers, enabled us to achieve numerous critical milestones in our drive to market leadership. Axcelis had a number of important accomplishments in 2022:

- Axcelis' revenue grew 39% year over year;
- Our full year revenue, gross margins and operating profit were all at record levels since our first full year as a public company in 2001;
- The market for mature semiconductor devices grew rapidly, producing greater than 80% of our systems shipments, and within that total, the electrification of the automotive market drove the power device market to contribute approximately 39% of our systems shipments;
- Our global footprint in growing markets continued to expand, including through multiple evaluations at key customers in memory, mature process technologies and advanced logic, sales of our Purion product extensions into the Silicon Carbide market, follow-on orders for our Purion products in Japan, and device qualification for leading edge CMOS Image Sensor processes; and
- Rapid growth of our manufacturing capabilities through solid execution, strong supply chain partnerships and bringing online new capacity at both our Beverly, Massachusetts facility and Axcelis Asia Operations Center in South Korea.

We continue to work diligently to ensure that manufacturing and operating expense levels remain well aligned to business conditions.

The market for our systems and aftermarket products and services is represented by a relatively small number of companies. In 2022, the top 20 semiconductor chip manufacturers accounted for approximately 89.0% of total semiconductor capital equipment spending, down from 92.0% in 2021. Our net revenue from our ten largest customers accounted for 59.4% of total revenue for the year ended December 31, 2022 compared to 69.5% and 74.0% of revenue for the years ended December 31, 2021 and 2020, respectively. For the year ended December 31, 2022, we had two customers representing 13.1% and 11.5% of total revenue, respectively.

Critical Accounting Estimates

Management's discussion and analysis of our financial condition and results of operations are based upon Axcelis' consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires management to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue and expenses, and related disclosure of contingent assets and liabilities. On an on-going basis, we evaluate our estimates and assumptions. Management's estimates are based on historical experience and on various other assumptions that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

We believe the following accounting policies are critical in the portrayal of our financial condition and results of operations and require management's most significant judgments and estimates in the preparation of our consolidated financial statements. For additional accounting policies, see Note 2 to the consolidated financial statements for the year ended December 31, 2022 included in this Annual Report on Form 10-K.

Revenue Recognition

Our accounting policies relating to the recognition of revenue require management to make estimates, determinations and judgments based on historical experience and on various other assumptions, which include (i) the existence of a contract with the customer, (ii) the identification of the performance obligations in the contract, (iii) the value of any variable consideration in the contract, (iv) the standalone selling price of multiple obligations in the contract, for the purpose of allocating the consideration in the contract, and (v) determining when a performance obligation has been met. Our revenue recognition policies are set forth in section (i) of Note 2, Summary of Significant Accounting Policies, to the consolidated financial statements for the year ended December 31, 2022 included in this Annual Report on Form 10-K. Recognition of revenue based on incorrect judgments, including an erroneous allocation of the estimated sales price between the units of accounting, could result in inappropriate recognition of revenue, or incorrect timing of revenue recognition, which could have a material effect on our financial condition and results of operations.

Inventory—Provision for Excess and Obsolescence and Lower of Cost or Net Realizable Value

We record a provision for estimated excess and obsolete inventory and lower of cost or net realizable value. The provision is determined using management's assumptions of materials usage, based on estimates of forecasted and historical demand and market conditions. Specifically, our assumptions of forecasted system sales and the size and utilization of the installed base of systems may have a significant effect on estimated materials usage. If actual market conditions become less favorable than those projected by management, additional inventory write-downs may be required.

Although we make every effort to ensure the accuracy of our forecasts or product demand and pricing assumptions, any significant unanticipated changes in demand, pricing, or technical developments would significantly impact the value of our inventory and our reported operating results. In the future, if we determine that inventory needs to be written down, we will recognize such costs in our cost of revenue at the time of such determination. If we subsequently sell product that has previously been written down, our gross margin in that period will be favorably impacted.

Product Warranty

We generally offer a one-year warranty for all of our systems, the terms and conditions of which vary depending upon the product sold. For all systems sold, we accrue a liability for the estimated cost of standard warranty at the time of system shipment and defer the portion of systems revenue attributable to the relative fair value of non-standard warranty.

Costs for non-standard warranty are expensed as incurred. Factors that affect our warranty liability include the number of installed units, historical and anticipated product failure rates, material usage and service labor costs. We periodically assess the adequacy of our recorded liability and adjust the amount as necessary.

Income Taxes

We record income taxes using the asset and liability method. Deferred income tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective income tax basis, and net operating loss and tax credit carryforwards.

Our consolidated financial statements contain certain deferred tax assets which have arisen primarily as a result of operating losses, as well as other temporary differences between financial and income tax accounting.

We establish a valuation allowance when it is more likely than not that some portion or all of the deferred tax assets will not be realized. Significant management judgment is required in determining our provision for income taxes, the deferred tax assets and liabilities and any valuation allowance recorded against those net deferred tax assets.

We evaluate the weight of all available evidence such as historical losses, the expected timing of the reversals of existing temporary differences and projected future taxable income to determine whether it is more likely than not that some portion or all of the net deferred income tax assets will not be realized.

Our income tax expense includes the largest amount of tax benefit for an uncertain tax position that is more likely than not to be sustained upon audit based on the technical merits of the tax position. Settlements with tax authorities, the expiration of statutes of limitations for particular tax positions, or obtaining new information on particular tax positions may cause a change to the effective tax rate. We recognize accrued interest related to unrecognized tax benefits as interest expense and penalties as operating expense.

Results of Operations

The following year-to-year comparative statements include the 2022 and 2021 year periods. For comparative statements for 2021 and 2020 periods, please refer to our 2021 Annual Report on Form 10-K, filed with the Securities and Exchange Commission on February 25, 2022.

The following table sets forth our results of operations as a percentage of total revenue:

	Year ended December 31,	
	2022	2021
Revenue:		
Product	96.8 %	95.8 %
Services	3.2	4.2
Total revenue	100.0	100.0
Cost of revenue:		
Product	53.5	52.8
Services	2.8	4.0
Total cost of revenue	56.3	56.8
Gross profit	43.7	43.2
Operating expenses:		
Research and development	8.5	9.9
Sales and marketing	5.8	7.1
General and administrative	6.2	7.0
Total operating expenses	20.5	24.0
Income from operations	23.2	19.2
Other (expense) income:		
Interest income	0.5	—
Interest expense	(0.6)	(0.7)
Other, net	(0.7)	(0.3)
Total other expense	(0.8)	(1.0)
Income before income taxes	22.4	18.2
Income tax provision	2.4	3.3
Net income	20.0 %	14.9 %

Revenue

The following table sets forth our revenue:

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
Revenue:				
Product	\$ 890,582	\$ 634,445	\$ 256,137	40.4 %
<i>Percentage of revenue</i>	96.8 %	95.8 %		
Services	29,416	27,983	1,433	5.1 %
<i>Percentage of revenue</i>	3.2 %	4.2 %		
Total revenue	\$ 919,998	\$ 662,428	\$ 257,570	38.9 %

Product

Product revenue, which includes new system sales, sales of spare parts, product upgrades and used system sales was \$890.6 million or 96.8% of revenue in 2022, compared with \$634.4 million or 95.8% of revenue in 2021. The increase in product revenue in 2022 was primarily driven by an increase in the number of Purion systems sold.

A portion of our revenue from system sales is deferred until installation and other services related to future deliverables are performed. The total amount of deferred revenue at December 31, 2022 and 2021 was \$154.8 million and \$68.4 million, respectively. The increase was primarily due to increases in system prepayments and the volume of systems sold.

Services

Services revenue, which includes the labor component of maintenance and service contracts and fees for service hours provided by on-site service personnel, was \$29.4 million, or 3.2% of revenue for 2022, compared with \$28.0 million, or 4.2% of revenue for 2021. Although services revenue should increase with the expansion of the installed base of systems, it can fluctuate from period to period based on capacity utilization at customers' manufacturing facilities, which affects the need for equipment service.

Revenue Categories used by Management

In addition to the line item revenue categories discussed above, management also uses revenue categorizations which break down revenue into other groupings. Management regularly disaggregates revenue in the following categories, which it finds relevant and useful:

- Systems and Customer Solutions and Innovation (also known as "aftermarket") revenue, in which "CS&I" or "Aftermarket" revenue is
 - A. The portion of Product revenue relating to spare parts, product upgrades and used systems combined with;
 - B. Service revenue, which is the labor component of aftermarket revenues

Aftermarket revenue reflects current fab utilization as opposed to System revenue, which reflects capital investment decisions by our customers, which have differing economic drivers;

- Revenue by geographic regions, since economic factors impacting customer purchasing decisions may vary by geographic region; and
- Revenue by our customers' end markets, since they tend to be subject to different economic environments at different periods of time, impacting a customer's likelihood of purchasing capital equipment during any particular period; currently, management uses three end market categories: Memory, mature process technology and leading edge foundry and logic.

The CS&I/aftermarket revenue categories for the twelve month periods ended December 31, 2022 and 2021 are discussed below.

CS&I/Aftermarket

Revenue from our aftermarket business was \$227.9 million in 2022, compared to \$207.8 million for 2021. Aftermarket revenue generally increases with the expansion of the installed base of systems but can fluctuate from period to period based on capacity utilization at customers' manufacturing facilities which affects the sale of spare parts and demand for equipment service.

Gross Profit / Gross Margin

The following table sets forth our gross profit (dollars in thousands):

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
Gross Profit:				
Product	\$ 398,478	\$ 284,887	\$ 113,591	39.9 %
<i>Product gross margin</i>	<i>44.7 %</i>	<i>44.9 %</i>		
Services	3,312	1,558	1,754	112.6 %
<i>Services gross margin</i>	<i>11.3 %</i>	<i>5.6 %</i>		
Total gross profit	<u>\$ 401,790</u>	<u>\$ 286,445</u>	<u>\$ 115,345</u>	<u>40.3 %</u>
Gross margin	<i>43.7 %</i>	<i>43.2 %</i>		

Product

Gross margin from product revenue was 44.7% for the twelve months ended December 31, 2022, compared to 44.9% for the twelve months ended December 31, 2021. The slight decrease in gross margin is primarily attributable to changes in the mix of products.

Services

Gross margin from services revenue was 11.3% for the twelve months ended December 31, 2022, compared to 5.6% for the twelve months ended December 31, 2021. The increase in gross margin is attributable to changes in the mix of service contracts.

Operating Expenses

The following table sets forth our operating expenses:

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
Research and development	\$ 78,356	\$ 65,431	\$ 12,925	19.8 %
<i>Percentage of revenue</i>	<i>8.5 %</i>	<i>9.9 %</i>		
Sales and marketing	53,599	47,548	6,051	12.7 %
<i>Percentage of revenue</i>	<i>5.8 %</i>	<i>7.1 %</i>		
General and administrative	57,474	46,141	11,333	24.6 %
<i>Percentage of revenue</i>	<i>6.2 %</i>	<i>7.0 %</i>		
Total operating expenses	<u>\$ 189,429</u>	<u>\$ 159,120</u>	<u>\$ 30,309</u>	<u>19.0 %</u>
<i>Percentage of revenue</i>	<i>20.5 %</i>	<i>24.0 %</i>		

Our operating expenses consist primarily of personnel costs, including salaries, commissions, bonuses, stock-based compensation and related benefits and taxes; project material costs related to the design and development of new products and enhancement of existing products; and professional fees, facilities and amortization and depreciation expenses. Personnel costs are our largest expense, representing \$114.8 million, or 60.6% of our total operating expenses, for the year ended December 31, 2022; and \$100.3 million, or 63.1% of our total operating expenses for the year ended December 31, 2021.

Research and Development

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
Research and development	\$ 78,356	\$ 65,431	\$ 12,925	19.8 %
<i>Percentage of revenue</i>	8.5 %	9.9 %		

Our ability to remain competitive depends largely on continuously developing innovative technology, with new and enhanced features and systems and introducing them at competitive prices on a timely basis. Accordingly, based on our strategic plan, we establish annual research and development budgets to fund programs that we expect will drive competitive advantages.

Research and development (“R&D”) expense was \$78.4 million in 2022, an increase of \$12.9 million, or 19.8%, compared with \$65.4 million in 2021. The increase was primarily due to higher payroll related costs due to increased headcount and incentive based pay as well as increased material and supplies expense to support ongoing R&D projects.

Sales and Marketing

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
Sales and marketing	\$ 53,599	\$ 47,548	\$ 6,051	12.7 %
<i>Percentage of revenue</i>	5.8 %	7.1 %		

Our sales and marketing expenses result primarily from the sale of our equipment and services through our direct sales force.

Sales and marketing expense was \$53.6 million in 2022, an increase of \$6.1 million, or 12.7%, compared with \$47.5 million in 2021. The increase was primarily due to higher payroll related costs due to increased headcount and incentive based pay as well as increased freight and travel expense.

General and Administrative

	Year ended December 31,		Period-to-Period Change	
	2022	2021	\$	%
General and administrative	\$ 57,474	\$ 46,141	\$ 11,333	24.6 %
<i>Percentage of revenue</i>	6.2 %	7.0 %		

Our general and administrative expenses result primarily from the costs associated with our executive, finance, information technology, legal and human resource functions.

General and administrative expense was \$57.5 million in 2022, an increase of \$11.3 million, or 24.6% compared with \$46.1 million in 2021. The increase was primarily due to higher payroll related costs due to increased headcount and incentive based pay as well as increases in various other expenses to support growth.

Other (Expense) Income

Other (expense) income consists of interest expense relating to the lease obligation we incurred in connection with the 2015 sale of our headquarters facility (“sale leaseback”) and other financing obligations, foreign exchange gains and losses attributable to fluctuations of the U.S. dollar against the local currencies of certain of the countries in which we operate, as well as interest earned on our invested cash balances.

	Year ended December 31,		Period-to-period change	
	2022	2021	\$	%
Other expense	\$ (7,476)	\$ (6,897)	\$ 579	(8.4)%
<i>Percentage of revenue</i>	<i>(0.8)%</i>	<i>(1.0)%</i>		

Other expense for the year ended December 31, 2022 was \$7.5 million, which includes \$5.0 million of interest expense related to our sale leaseback obligation and \$6.4 million of foreign currency translation losses, partially offset by interest income \$4.6 million. Other expense for the year ended December 31, 2021 was \$6.9 million, which includes \$5.1 million of interest expense related to our sale leaseback obligation and \$2.5 million of foreign currency translation loss, slightly offset by other miscellaneous income of \$0.3 million, a reversal of interest expense of \$0.2 million relating to a tax position for which the statute of limitations expired and interest income of \$0.2 million.

Income Taxes

	Year ended December 31,		Period-to-period change	
	2022	2021	\$	%
Income tax provision	\$ 21,806	\$ 21,778	\$ 28	0.1 %
<i>Percentage of revenue</i>	<i>2.4 %</i>	<i>3.3 %</i>		

Income tax expense was \$21.8 million for the years ended December 31, 2022 and 2021. The effective tax rate for the year ended December 31, 2022 was 10.6% compared to 18.1% for year ended December 31, 2021. The decrease in the effective tax rate in 2022 is due to Foreign-derived intangible income (“FDII”), which is taxed at a lower tax rate than the U.S. statutory rate, resulting in a tax benefit of \$20.5 million in the current year. The full utilization of the U.S. federal net operating losses allowed us to make use of the FDII in the current year.

At December 31, 2022, we had \$31.7 million of net deferred tax assets worldwide relating to capitalized research and development costs and other temporary differences, which are available to reduce income taxes in future years. We have recorded a \$8.4 million valuation allowance against certain tax credits and state net operating losses due to the uncertainty of their realization. Realization of our net deferred tax assets is dependent on future taxable income. We believe it is more likely than not that such assets will be realized; however, ultimate realization could be impacted by market conditions and other variables not known or anticipated at this time.

Liquidity and Capital Resources

Our liquidity is affected by many factors. Some of these relate specifically to the operations of our business. For example, our sales and other factors are influenced by the uncertainties of global economies, including the availability of credit and the condition of the overall semiconductor capital equipment industry. Our industry requires ongoing investments in operations and research and development that are not easily adjusted to reflect changes in revenue. As a result, profitability and cash flows can fluctuate more widely than revenue.

In 2022, \$215.6 million of cash was provided by operating activities. This compares to \$150.2 million of cash provided by operations in 2021. Cash and cash equivalents at December 31, 2022 was \$185.6 million, compared to \$294.9 million at December 31, 2021. Approximately \$47.7 million of cash was located in foreign jurisdictions as of December 31, 2022. In addition to the cash and cash equivalent balance at December 31, 2022, we had \$0.8 million in restricted cash which relates to a \$0.7 million letter of credit relating to workers’ compensation insurance and a \$0.1 million deposit relating to customs activity. Working capital at December 31, 2022 was \$629.5 million. At December 31, 2022, we had no bank debt.

In 2022, \$257.3 million of cash was used in investing activities. Capital expenditures were \$10.7 million for the year ended December 31, 2022. We held \$246.6 million of short-term investments at December 31, 2022. These short-term investments consist of U.S. Government securities and agency investments. In 2021, \$8.7 million was used in investing activities for capital expenditures. Total capital expenditures for 2023 are projected to be approximately \$19.1 million.

Future capital expenditures beyond 2023 will depend on a number of factors, including the timing and rate of expansion of our business and our ability to generate cash to fund them.

Cash used in financing activities for the year ended December 31, 2022 was \$65.5 million, which consisted of \$57.5 million related to our stock repurchase program, \$9.9 million related to net settlement of restricted stock issuances and \$1.0 million related to principal reduction on our financing lease. These amounts were partially offset by \$1.2 million in proceeds of stock option exercises and \$1.7 million in proceeds from our employee stock purchase plan. Cash used in financing activities was \$52.4 million for the year ended December 31, 2021, which consisted of \$50.0 million related to our stock repurchase program, \$6.6 million related to net settlement of restricted stock issuances, and \$0.8 million of principal reduction on our finance lease. These uses of cash were partially offset by \$3.7 million in proceeds of stock option exercises and \$1.2 million in proceeds from our employee stock purchase plan.

We have outstanding letters of credit, surety bonds and deposits in the amount of \$14.7 million to cover the security deposit under the lease of our headquarters, our workers' compensation insurance program, customs and bank deposits and certain value added tax claims in Europe.

The following represents our commercial commitments as of December 31, 2022 (in thousands):

Other Commercial Commitments	Total	Amount of Commitment Expiration by Period		
		2023	2024	2025
Surety bonds	\$ 8,095	\$ 4,178	\$ 539	\$ 3,378
Standby letters of credit and deposits	6,640	6,575	—	65
Total	\$ 14,735	\$ 10,753	\$ 539	\$ 3,443

The following represents our contractual obligations as of December 31, 2022 (in thousands):

Contractual Obligations	Total	Payments Due by Period			
		2023	2024-2025	2026-2027	2028 - Beyond
Sale leaseback obligation	\$ 92,018	\$ 6,114	\$ 12,182	\$ 12,136	\$ 61,586
Purchase order commitments	412,347	403,892	6,817	1,638	—
Operating leases	46,943	7,426	8,901	6,012	24,604
Total	\$ 551,308	\$ 417,432	\$ 27,900	\$ 19,786	\$ 86,190

The table above includes lease agreements signed but not yet commenced as of December 31, 2022 and is based on the expected contractual commencement dates. We have no off-balance sheet arrangements as of December 31, 2022, other than leases signed but not commenced. See Note 18 – Income Taxes in the Notes to the Consolidated Financial Statements for information related to our unrecognized tax benefits.

We consider the undistributed earnings of our foreign subsidiaries as of December 31, 2022, to be indefinitely reinvested and, accordingly, no U.S. income taxes have been provided thereon. As of December 31, 2022, the amount of cash associated with indefinitely reinvested foreign earnings was approximately \$15.3 million. We have not, nor do we anticipate the need to, repatriate funds to the United States to satisfy domestic liquidity needs arising in the ordinary course of business, including liquidity needs associated with any domestic debt service requirements. Upon repatriation of those earnings, in the form of dividends or otherwise, we could be subject to withholding taxes payable to the various foreign tax jurisdictions.

Under the rules of the U.S. Securities and Exchange Commission (the "SEC"), we qualify as a "well-known seasoned issuer," which allows us to file shelf registration statements to register an unspecified amount of securities that are effective upon filing. On May 29, 2020, we filed such a shelf registration statement with the SEC for the issuance of an unspecified amount of common stock, preferred stock, various series of debt securities and/or warrants to purchase any of such securities, either individually or in units, from time to time at prices and on terms to be determined at the time of any such offering. This registration statement was effective upon filing and will expire in May 2023. We may file another shelf registration statement to maintain the availability of this financing option.

On July 31, 2020, we entered into a Senior Secured Credit Facilities Credit Agreement (the “Credit Agreement”) with Silicon Valley Bank. The Credit Agreement provides for a revolving credit facility in an aggregate principal amount not to exceed \$40.0 million. Our obligations under the Credit Agreement are secured by a security interest, senior to any current and future debts and to any security interest, in all of our rights, title, and interest in, to and under substantially all of our assets, subject to limited exceptions, including permitted liens. The revolving credit facility terminates on July 31, 2023. As of December 31, 2022, we were in compliance with all covenant requirements of the Credit Agreement. As of such date, no borrowings had been made under the Credit Agreement, although a letter of credit for \$5.9 million reduces the funds available for borrowing under the credit line. We have no immediate plans to borrow under the Credit Agreement, but we will use the facility for letters of credit, for ongoing working capital needs and to fund general corporate purposes, as desired. We entered into a First Amendment to the Credit Agreement with Silicon Valley Bank in March 2021 to (i) align the covenants with our 2021 stock repurchase program, and (ii) establish terms to transition from a Eurodollar based interest rate option to an interest rate benchmark using a secured overnight financing rate (known as “SOFR”) published by the Federal Reserve Bank of New York.

We believe that based on our current market, revenue, expense and cash flow forecasts, our existing cash, cash equivalents, short-term investments and borrowing capacity will be sufficient to satisfy our anticipated cash requirements for the short and long-term.

Related-Party Transactions

There are no significant related-party transactions that require disclosure in the consolidated financial statements for the year ended December 31, 2022, or in this Annual Report on Form 10-K.

Recent Accounting Pronouncements

A discussion of recent accounting pronouncements, the impact of some of which may be material, is included in Note 2 to the consolidated financial statements for the year ended December 31, 2022 included in this Annual Report on Form 10-K.

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

Interest Rate Sensitivity

Our exposure to market risk for changes in interest rates relates primarily to our investment portfolio, which consists of cash equivalents and short-term investments at December 31, 2022. The primary objective of our investment activities is to preserve principal. This is accomplished by investing in marketable investment grade securities. We do not use derivative financial instruments in managing our investment portfolio. Due to the nature of our investments, we do not expect our operating results or cash flows to be affected to any significant degree by any change in market interest rates.

Foreign Currency Exchange Risk

Substantially all of our sales are billed in U.S. dollars, thereby reducing the impact of fluctuations in foreign exchange rates on our results. Operating margins of certain foreign operations can fluctuate with changes in foreign exchange rates to the extent revenue is billed in U.S. dollars and operating expenses are incurred in the local currency. During the years ended December 31, 2022 and 2021, approximately 9.1% and 21.6% of our revenue, respectively, were derived in local currencies from foreign operations with this inherent risk. In addition, at both December 31, 2022 and 2021, our operations outside of the United States accounted for approximately 10.2% and 12.6% of our total assets, respectively, the majority of which was denominated in currencies other than the U.S. dollar. We currently do not use derivative financial instruments in managing our foreign currency exchange risk.

Item 8. Financial Statements and Supplementary Data.

Response to this Item is submitted as a separate section of this report immediately following Item 15.

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 principal executive officer and principal financial officer, has evaluated the effectiveness of our disclosure controls and procedures (as defined in Rule 13a-15(e) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”)) as of the end of the period covered by this annual report (the “Evaluation Date”). Based on this evaluation, our principal executive officer and principal financial officer concluded that, as of the Evaluation Date, these disclosure controls and procedures are effective.

Internal Control over Financial Reporting

Management’s Annual Report on Internal Control over Financial Reporting

Management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Rule 13a-15(f) under the Exchange Act. Because of its inherent limitations, internal control over financial reporting may not prevent or detect all misstatements. A control system, no matter how well designed and operated, can provide only reasonable assurance with respect to financial statement preparation and presentation. 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.

Management assessed the effectiveness of our internal control over financial reporting as of December 31, 2022. In making this assessment, management used the criteria set forth in the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”) Internal Control—2013 Integrated Framework.

Based on this assessment, management has concluded that, as of December 31, 2022, our internal control over financial reporting is effective based on those criteria.

The independent registered public accounting firm of Ernst & Young LLP, as auditors of our consolidated financial statements, has issued an attestation report on its assessment of our internal control over financial reporting.

To the Stockholders and the Board of Directors of Axcelis Technologies, Inc.

Opinion on Internal Control Over Financial Reporting

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

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the 2022 consolidated financial statements of the Company and our report dated February 24, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

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

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

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

Definition and Limitations of Internal Control Over Financial Reporting

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

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

/s/ Ernst & Young LLP

Boston, Massachusetts
February 24, 2023

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting (as defined in Rule 13a-15(f) under the Exchange Act) identified in connection with the evaluation of our internal control that occurred during our fourth quarter that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

Item 9C. Disclosure regarding Foreign Jurisdictions that Prevent Inspections.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

A portion of the information required by Item 10 of Form 10-K is incorporated by reference from the information responsive thereto contained in the sections in Axcelis Proxy Statement for the Annual Meeting of Stockholders to be held May 10, 2023 (the “Proxy Statement”) captioned:

- “Proposal 1: Election of Directors,”
- “Board of Directors,”
- “Board Committees,” and
- “Corporate Governance.”

The remainder of such information is set forth under the heading “Information about Our Executive Officers” at the end of Item 1 in Part I of this report and is incorporated herein by reference.

Item 11. Executive Compensation.

The information required by Item 11 of Form 10-K is incorporated by reference from the information responsive thereto contained in the sections in the Proxy Statement captioned:

- “Executive Compensation,” and
- “Board Committees—Compensation Committee Interlocks and Insider Participation.”

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

The information required by Item 12 of Form 10-K is incorporated by reference from the information responsive thereto contained in the sections in the Proxy Statement captioned:

- “Share Ownership of 5% Stockholders,” and
- “Share Ownership of Directors and Executive Officers.”

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

The information required by Item 13 of Form 10-K is incorporated by reference from the information responsive thereto contained in the sections in the Proxy Statement captioned:

- “Executive Compensation,”
- “Board of Directors,” and
- “Corporate Governance—Certain Relationships and Related Transactions.”

Item 14. Principal Accountant Fees and Services

The information required by Item 14 of Form 10-K is incorporated by reference from the information responsive thereto contained in the section captioned “Proposal 2: Ratification of the Appointment of our Independent Registered Public Accounting Firm” in the Proxy Statement.

PART IV

Item 15. Exhibits and Financial Statement Schedules.

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

1) Financial Statements:

<u>Report of Independent Registered Public Accounting Firm</u> (PCAOB ID: 42)	37
<u>Consolidated Statements of Operations — For the years ended December 31, 2022, 2021 and 2020</u>	39
<u>Consolidated Statements of Comprehensive Income — For the years ended December 31, 2022, 2021 and 2020</u>	40
<u>Consolidated Balance Sheets — December 31, 2022 and 2021</u>	41
<u>Consolidated Statements of Stockholders' Equity — For the years ended December 31, 2022, 2021 and 2020</u>	42
<u>Consolidated Statements of Cash Flows — For the years ended December 31, 2022, 2021 and 2020</u>	43
<u>Notes to Consolidated Financial Statements</u>	44

2) Financial Statement Schedules:

Schedule II—Valuation and Qualifying Accounts for the years ended December 31, 2022, 2021 and 2020.

3) Exhibits

The exhibits filed as part of this Form 10-K are listed on the Exhibit Index immediately preceding the signature page, which Exhibit Index is incorporated herein by reference.

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

Item 16. Form 10-K Summary.

Not applicable.

To the Stockholders and the Board of Directors of Axcelis Technologies, Inc.

Opinion on the Financial Statements

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

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework), and our report dated February 24, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

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

Systems Revenue recognition

Description of the Matter

As discussed in Note 2 and Note 3 to the consolidated financial statements, the Company generates revenue from the sale of ion implantation and other processing equipment used in the manufacture of semiconductor chips ("systems revenue"). The Company's revenue contracts for systems have multiple performance obligations, including the systems themselves and obligations that are not delivered simultaneously with the systems. Systems revenue accounted for \$692.1 million of the Company's total revenue of \$920.0 million in 2022.

Auditing the Company's determination of the distinct performance obligations related to its systems revenue contracts involved extensive audit effort to identify all of the promised products and services in an arrangement and assess distinct performance obligations. These determinations have a significant

effect on the pattern of revenue recognition.

*How We
Addressed the
Matter in Our
Audit*

We obtained an understanding, evaluated the design and tested the operating effectiveness of controls over the Company's systems revenue recognition process. For example, we tested management's controls over the identification of distinct performance obligations in systems revenue contracts.

To test systems revenue recognition, our procedures included, among others, independently identifying promises and determining the interdependence of the performance obligations. For example, we selected and read a sample of arrangements to evaluate the completeness of the promised products and services. We also confirmed directly with certain of the Company's customers the terms of the selected system revenue arrangement.

Estimate of Excess Inventory

*Description of the
Matter*

The Company's inventories totaled \$242.4 million, net, as of December 31, 2022. As described in Note 2 and Note 6 to the consolidated financial statements, the Company records a provision for estimated excess inventory. Management determines the provision using its assumptions of future materials usage, based on estimates of demand and market conditions.

Auditing the Company's provision for excess inventory is complex due to the highly judgmental nature of the factors used to estimate demand and market conditions. Specifically, the Company's estimated materials usage may be significantly affected by management's assumptions of forecasted system sales and the size and utilization of the installed base of systems. Management's identification and measurement of these factors are forward looking and could be affected by future economic and market conditions that could have a significant effect on the excess inventory reserve.

*How We
Addressed the
Matter in Our
Audit*

We obtained an understanding, evaluated the design, and tested the operating effectiveness of internal controls, including management review controls, over the Company's excess inventory reserve estimation process. This included management's assessment of the assumptions and data underlying the excess inventory provision. For example, we tested controls over management's review of its systems sales forecasts, as well as management's review of the assumptions relating to the market size and utilization of installed systems. We also tested management's controls over the completeness and accuracy of the data used in the estimation model.

Our substantive audit procedures included evaluating the significant assumptions stated above and testing the accuracy and completeness of the underlying data used by management to compute the value of excess inventory. For example, we compared the quantities of on-hand inventories to historical and forecasted materials usage and evaluated adjustments to forecasts for specific product considerations, such as technological changes or alternative uses. We also assessed the historical accuracy of management's estimates and performed sensitivity analyses over the significant assumptions to evaluate the changes in the excess inventory estimates that would result from changes in the underlying assumptions.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 1999.

Boston, Massachusetts
February 24, 2023

Axcelis Technologies, Inc.
Consolidated Statements of Operations
(In thousands, except per share amounts)

	Twelve months ended December 31,		
	2022	2021	2020
Revenue:			
Product	\$ 890,582	\$ 634,445	\$ 449,903
Services	29,416	27,983	24,657
Total revenue	<u>919,998</u>	<u>662,428</u>	<u>474,560</u>
Cost of revenue:			
Product	492,104	349,558	252,390
Services	26,104	26,425	23,586
Total cost of revenue	<u>518,208</u>	<u>375,983</u>	<u>275,976</u>
Gross profit	401,790	286,445	198,584
Operating expenses:			
Research and development	78,356	65,431	61,833
Sales and marketing	53,599	47,548	38,746
General and administrative	57,474	46,141	39,964
Total operating expenses	<u>189,429</u>	<u>159,120</u>	<u>140,543</u>
Income from operations	212,361	127,325	58,041
Other (expense) income:			
Interest income	4,551	209	738
Interest expense	(5,576)	(4,835)	(5,211)
Other, net	(6,451)	(2,271)	2,318
Total other expense	<u>(7,476)</u>	<u>(6,897)</u>	<u>(2,155)</u>
Income before income taxes	204,885	120,428	55,886
Income tax provision	21,806	21,778	5,904
Net income	<u>\$ 183,079</u>	<u>\$ 98,650</u>	<u>\$ 49,982</u>
Net income per share:			
Basic	<u>\$ 5.54</u>	<u>\$ 2.94</u>	<u>\$ 1.50</u>
Diluted	<u>\$ 5.46</u>	<u>\$ 2.88</u>	<u>\$ 1.46</u>
Shares used in computing net income per share:			
Basic weighted average common shares	<u>33,043</u>	<u>33,555</u>	<u>33,257</u>
Diluted weighted average common shares	<u>33,542</u>	<u>34,268</u>	<u>34,128</u>

See accompanying Notes to these Consolidated Financial Statements

Axcelis Technologies, Inc.
Consolidated Statements of Comprehensive Income
(In thousands)

	Twelve months ended		
	December 31,		
	2022	2021	2020
Net income	\$ 183,079	\$ 98,650	\$ 49,982
Other comprehensive (loss) income:			
Foreign currency translation adjustments	(4,058)	(1,881)	3,427
Amortization of actuarial net gain and other adjustments from pension plan, net of tax	325	211	266
Total other comprehensive (loss) income	(3,733)	(1,670)	3,693
Comprehensive income	<u>\$ 179,346</u>	<u>\$ 96,980</u>	<u>\$ 53,675</u>

See accompanying Notes to these Consolidated Financial Statements

Axcelis Technologies, Inc.
Consolidated Balance Sheets
(In thousands, except per share amounts)

	December 31, 2022	December 31, 2021
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 185,595	\$ 294,923
Short-term investments	246,571	—
Accounts receivable, net	169,773	104,410
Inventories, net	242,406	194,984
Prepaid expenses and other current assets	33,300	24,929
Total current assets	877,645	619,246
Property, plant and equipment, net	39,664	34,972
Operating lease assets	12,146	9,242
Finance lease assets, net	17,942	19,238
Long-term restricted cash	752	757
Deferred income taxes	31,701	35,454
Other assets	33,791	34,331
Total assets	<u>\$ 1,013,641</u>	<u>\$ 753,240</u>
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	\$ 62,346	\$ 38,025
Accrued compensation	35,540	30,732
Warranty	8,299	6,424
Income taxes	4,304	887
Deferred revenue	123,471	60,454
Current portion of finance lease obligation	1,229	979
Other current liabilities	12,943	12,639
Total current liabilities	248,132	150,140
Long-term finance lease obligation	45,185	46,415
Long-term deferred revenue	31,306	7,982
Other long-term liabilities	21,762	9,744
Total liabilities	346,385	214,281
Commitments and contingencies (Note 16)		
Stockholders' equity:		
Common stock, \$0.001 par value, 75,000 shares authorized; 32,775 shares issued and outstanding at December 31, 2022; 33,240 shares issued and outstanding at December 31, 2021	33	33
Additional paid-in capital	550,299	559,883
Retained earnings (accumulated deficit)	118,892	(22,722)
Accumulated other comprehensive (loss) income	(1,968)	1,765
Total stockholders' equity	667,256	538,959
Total liabilities and stockholders' equity	<u>\$ 1,013,641</u>	<u>\$ 753,240</u>

See accompanying Notes to these Consolidated Financial Statements

Axcelis Technologies, Inc.
Consolidated Statements of Stockholders' Equity
(In thousands)

	Common Stock		Additional Paid-in Capital	Accumulated Deficit / Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2019	32,585	\$ 33	\$ 559,878	\$ (140,226)	\$ (258)	\$ 419,427
Net income	—	—	—	49,982	—	49,982
Foreign currency translation adjustments	—	—	—	—	3,427	3,427
Change in pension obligation, net of tax	—	—	—	—	266	266
Exercise of stock options	1,001	1	8,418	—	—	8,419
Issuance of shares under Employee Stock Purchase Plan	41	—	1,011	—	—	1,011
Issuance of restricted common shares	364	—	(3,915)	—	—	(3,915)
Stock-based compensation expense	—	—	10,485	—	—	10,485
Repurchase of common stock	(358)	—	(5,775)	(1,725.0)	—	(7,500)
Balance at December 31, 2020	33,633	34	570,102	(91,969)	3,435	481,602
Net income	—	—	—	98,650	—	98,650
Foreign currency translation adjustments	—	—	—	—	(1,881)	(1,881)
Change in pension obligation, net of tax	—	—	—	—	211	211
Exercise of stock options	396	—	3,687	—	—	3,687
Issuance of shares under Employee Stock Purchase Plan	26	—	1,179	—	—	1,179
Issuance of restricted common shares	326	—	(6,564)	—	—	(6,564)
Stock-based compensation expense	—	—	12,067	—	—	12,067
Repurchase of common stock	(1,141)	(1)	(20,588)	(29,403)	—	(49,992)
Balance at December 31, 2021	33,240	33	559,883	(22,722)	1,765	538,959
Net income	—	—	—	183,079	—	183,079
Foreign currency translation adjustments	—	—	—	—	(4,058)	(4,058)
Change in pension obligation, net of tax	—	—	—	—	325	325
Exercise of stock options	103	—	1,247	—	—	1,247
Issuance of shares under Employee Stock Purchase Plan	29	—	1,662	—	—	1,662
Issuance of restricted common shares	291	—	(9,907)	—	—	(9,907)
Stock-based compensation expense	—	—	13,444	—	—	13,444
Repurchase of common stock	(888)	—	(16,030)	(41,465)	—	(57,495)
Balance at December 31, 2022	32,775	\$ 33	\$ 550,299	\$ 118,892	\$ (1,968)	\$ 667,256

See accompanying Notes to these Consolidated Financial Statements

Axcelis Technologies, Inc.
Consolidated Statements of Cash Flows
(In thousands)

	Twelve months ended December 31,		
	2022	2021	2020
Cash flows from operating activities			
Net income	\$ 183,079	\$ 98,650	\$ 49,982
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	11,607	10,818	9,939
Gain on sale of equipment	—	—	(168)
Deferred income taxes	8,536	20,257	4,685
Stock-based compensation expense	13,444	12,067	10,485
Provision for excess and obsolete inventory	4,565	3,755	3,696
Currency loss on foreign denominated transactions	5,986	—	—
Changes in operating assets and liabilities:			
Accounts receivable	(67,270)	(18,146)	(1,393)
Inventories	(58,433)	(39,023)	(17,652)
Prepaid expenses and other current assets	(6,533)	(3,955)	(7,322)
Accounts payable and other current liabilities	31,392	22,046	18,062
Deferred revenue	86,366	45,385	(6,215)
Income taxes	3,493	253	332
Other assets and liabilities	(625)	(1,917)	5,272
Net cash provided by operating activities	<u>215,607</u>	<u>150,190</u>	<u>69,703</u>
Cash flows from investing activities			
Proceeds from sale of equipment	—	—	168
Expenditures for property, plant and equipment and capitalized software	(10,683)	(8,718)	(7,434)
Purchase of short-term investments	(246,571)	—	—
Net cash used in investing activities	<u>(257,254)</u>	<u>(8,718)</u>	<u>(7,266)</u>
Cash flows from financing activities			
Net settlement on restricted stock grants	(9,907)	(6,564)	(3,915)
Repurchase of common stock	(57,495)	(49,992)	(7,501)
Proceeds from Employee Stock Purchase Plan purchases	1,662	1,179	1,009
Principal payments on finance lease obligation	(987)	(763)	(399)
Proceeds from exercise of stock options	1,247	3,687	8,419
Net cash used in financing activities	<u>(65,480)</u>	<u>(52,453)</u>	<u>(2,387)</u>
Effect of exchange rate changes on cash and cash equivalents	(2,206)	2,429	(2,352)
Net increase in cash, cash equivalents and restricted cash	<u>(109,333)</u>	<u>91,448</u>	<u>57,698</u>
Cash, cash equivalents and restricted cash at beginning of period	295,680	204,232	146,534
Cash, cash equivalents and restricted cash at end of period	<u>\$ 186,347</u>	<u>\$ 295,680</u>	<u>\$ 204,232</u>
Supplemental disclosure of cash flow information			
Cash paid for:			
Income taxes	\$ 10,763	\$ 1,500	\$ 876
Interest	\$ 4,992	\$ 5,086	\$ 5,156

See accompanying Notes to these Consolidated Financial Statements

Note 1. Nature of Business

Axcelis Technologies, Inc. (“Axcelis” or the “Company”) was incorporated in Delaware in 1995, and is a worldwide producer of ion implantation and other processing equipment used in the fabrication of semiconductor chips in the United States, Europe and Asia. In addition to equipment, we provide extensive aftermarket lifecycle products and services, including spare parts, equipment upgrades, maintenance services and customer training.

Note 2. Summary of Significant Accounting Policies

The accompanying consolidated financial statements reflect the application of certain significant accounting policies as described in this note and elsewhere in the footnotes.

(a) Basis of Presentation

The accompanying consolidated financial statements include the consolidated accounts of the Company and its wholly-owned, controlled subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Events occurring subsequent to December 31, 2022 have been evaluated for potential recognition or disclosure in the consolidated financial statements.

(b) Use of Estimates

The preparation of these consolidated financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the dates of the financial statements and the reported amounts of revenue and expenses during the reporting periods. On an ongoing basis, we evaluate our estimates and judgments, including those related to revenue recognition, the realizable value of accounts receivable and inventories, valuing stock-based compensation instruments and reserves relating to tax assets and liabilities. Actual amounts could differ from these estimates. Changes in estimates are recorded in the period in which they become known.

(c) Foreign Currency

The functional currency for substantially all operations outside the United States is the local currency. Financial statements for these operations are translated into United States dollars at year-end rates as to assets and liabilities and average exchange rates during the year as to revenue and expenses. The resulting translation adjustments are recorded in stockholders' equity as an element of accumulated other comprehensive income (loss). Foreign currency transaction gains and losses are included in other income (expense) in the Consolidated Statements of Operations.

For the years ended December 31, 2022 and 2021, we had foreign exchange losses of \$6.6 million and \$2.5 million, respectively. For the year ended December 31, 2020 we had \$1.4 million in foreign exchange gain.

(d) Cash, Cash Equivalents and Short-term Investments

Cash and cash equivalents consist of cash on hand and highly liquid investments with original maturities of ninety days or less. Cash equivalents consist primarily of money market funds, U.S. Government and Agency Securities and deposit accounts. Cash equivalents are carried on the balance sheet at fair market value. Short-term investments are highly liquid investments with original maturities of greater than 90 days but less than one year from date of purchase and are carried on the balance sheet at fair market value. Our short-term investments consist primarily of U.S. Government and Agency securities and are classified as held-to-maturity based on our positive intent and ability to hold the securities to maturity. Income related to these securities is recorded in interest income in the Consolidated Statements of Operations.

(e) Inventories

Inventories are carried at the lower of cost or net realizable value, determined using the first-in, first-out (“FIFO”) method. We periodically review our inventories and make provisions as necessary for estimated obsolescence or damaged goods to ensure values approximate lower of cost or net realizable value. The amount of such markdowns is equal to the difference between cost of inventory and the estimated market value based upon assumptions about future demands, selling prices, and market conditions.

We record a provision for estimated excess inventory. The provision is determined using management’s assumptions of materials usage, based on estimates of demand, market conditions, and the size and utilization of our installed base. If actual market conditions become less favorable than those projected by management, additional inventory write-downs may be required.

(f) Property, Plant and Equipment and Leased Assets

Property, plant and equipment are stated at cost, less accumulated depreciation and amortization.

On January 30, 2015, we sold our corporate headquarters facility. As part of this sale, we also entered into a 22-year lease agreement. We accounted for the sale leaseback transaction as a financing arrangement for financial reporting purposes. We retained the historical costs of the property and the related accumulated depreciation on our financial books within property, plant and equipment and will continue to depreciate the property for financial reporting purposes over the lesser of its remaining useful life or its initial lease term of 22 years.

Depreciation and amortization are recorded using the straight-line method over the estimated useful lives of the related assets as follows:

<u>Asset Classification</u>	<u>Estimated Useful Life</u>
Land, buildings and equipment (under lease)	Lesser of the lease term or estimated useful life of the asset
Machinery and equipment	3 to 10 years

Repairs and maintenance costs are expensed as incurred. Expenditures greater than \$2.5 thousand for renewals and betterments are capitalized and depreciated over their useful lives.

(g) Impairment of Long-Lived Assets

We record impairment losses on long-lived assets when events and circumstances indicate that these assets might not be recoverable. Recoverability is assessed by a comparison of the assets’ carrying amount to their expected future undiscounted net cash flows. If such assets are considered to be impaired, the impairment is measured based on the amount by which the carrying value exceeds its fair value.

We did not have any indicators of impairment during the period ending December 31, 2022. We did not record an impairment charge in the years ended December 31, 2022, 2021, or 2020.

Actual performance could be materially different from our current forecasts, which could impact estimates of undiscounted cash flows and may result in the impairment of the carrying amount of the long-lived assets in the future. This could be caused by strategic decisions made in response to economic and competitive conditions, the impact of the economic environment on our customer base, or a material adverse change in our relationships with significant customers.

(h) Concentration of Risk and Off-Balance Sheet Risk

Financial instruments that potentially subject us to concentrations of credit risk are principally cash equivalents, short-term investments and accounts receivable. Our cash equivalents and short-term investments are principally maintained in investment grade money-market funds, U.S. Government and Agency Securities and deposit accounts.

We have no significant off-balance-sheet risk such as currency exchange contracts, option contracts or other hedging arrangements.

Our exposure to market risk for changes in interest rates relates primarily to cash equivalents and short-term investments. The primary objective of our investment activities is to preserve principal without significantly increasing risk. This is accomplished by investing in marketable investment grade securities. We do not use derivative financial instruments to manage our investment portfolio and do not expect operating results or cash flows to be affected to any significant degree by any change in market interest rates.

We perform ongoing credit evaluations of our customers' financial condition and generally require no collateral to secure accounts receivable. For selected overseas sales, we require customers to obtain letters of credit before product is shipped. We maintain an allowance for doubtful accounts based on our assessment of the collectability of accounts receivable. We review the allowance for doubtful accounts quarterly. We do not have any off-balance sheet credit exposure related to our customers.

Our customers consist of semiconductor chip manufacturers located throughout the world and net sales to our ten largest customers accounted for 59.4%, 69.5% and 74.0% of revenue in 2022, 2021 and 2020, respectively.

For the year ended December 31, 2022 we had two customers representing 13.1% and 11.5% of total revenue, respectively. For the year ended December 31, 2021, we had two customers representing 17.8% and 15.4% of total revenue, respectively. For the year ended December 31, 2020, we had two customers representing 17.9% and 16.4% of total revenue, respectively.

As of December 31, 2022, we had two customers account for 19.4% and 11.5% of consolidated accounts receivable, respectively. As of December 31, 2021, we had two customers account for 29.1% and 13.6% of consolidated accounts receivable, respectively.

Some of the components and sub-assemblies included in our products are obtained either from a sole source or a limited group of suppliers. Disruption to our supply source, resulting either from economic conditions or other factors, could affect our ability to deliver products to our customers.

(i) Revenue Recognition

We recognize revenue in accordance with Accounting Standards Codification ("ASC") Topic 606, *Revenue from Contracts with Customers* or ("ASC 606"). Under ASC 606, revenue is recognized when a customer obtains control of promised goods or services in an amount that reflects the consideration we expect to receive in exchange for those goods or services. We measure revenue based on the consideration specified in the customer arrangement, and revenue is recognized when the performance obligations in the customer arrangement are satisfied. A performance obligation is a promise in a contract to transfer a distinct product or service to the customer. The transaction price of a contract is allocated to each distinct performance obligation based upon the relative standalone selling price for each performance obligation and recognized as revenue when, or as, the customer receives the benefit of the performance obligation. To account for and measure revenue, we apply the following five steps:

1) Identify the contract with the customer

A contract with a customer exists when (i) we enter into an enforceable contract with a customer that defines each party's rights regarding the goods or services to be transferred and identifies the related payment terms, (ii) the contract has commercial substance, and (iii) we determine that collection of substantially all consideration for goods and services that are transferred is probable based on the customer's intent and ability to pay the promised consideration.

2) Identify the performance obligations in the contract

Performance obligations promised in a contract are identified based on the goods and services that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the good or service either on its own or together with other available resources, and are distinct in the context of the contract, whereby

the transfer of the good or service is separately identifiable from other promises in the contract. To the extent a contract includes multiple promised goods and services, we must apply judgment to determine whether promised goods and services are capable of being distinct and distinct in the context of the contract. If these criteria are not met, the promised goods and services are accounted for as a combined performance obligation.

Systems sales consist of multiple performance obligations, including the system itself and obligations that are not delivered simultaneously with the system. These undelivered obligations might include a combination of installation services, extended warranty and support and spare parts, all of which are generally covered by a single sales price.

The Aftermarket business includes both products and services type arrangements. Performance obligations in these contracts consist of used tools, spare parts, equipment upgrades, maintenance services and customer training.

Customers who purchase new systems are provided an assurance-type warranty for one year after acceptance of the tool. For aftermarket transactions, we provide customers an assurance-type warranty for 90 days. Customers can choose to purchase extended warranty terms with enhanced support similar to a service-type warranty ranging from one to three years. In accordance with ASC 606, assurance-type warranties are not considered a performance obligation, whereas service-type warranties are.

3) Determine the transaction price

The transaction price is determined based on the consideration to which we will be entitled in exchange for transferring goods and services to the customer. To the extent the transaction price includes variable consideration, we estimate the amount of variable consideration that should be included in the transaction price utilizing either the expected value method or the most likely amount method depending on the nature of the variable consideration. Variable consideration is included in the transaction price if, in our judgment, it is probable that a significant future reversal of cumulative revenue under the contract will not occur. Any estimates, including the effect of the constraint on variable consideration, are evaluated at each reporting period for any changes. In applying this guidance, Companies must also consider whether any significant financing components exist.

The transaction price for all transactions is based on the price reflected in the individual customer's purchase order. Variable consideration has not been identified as a significant component of the transaction price for any of our transactions.

For those transactions where all performance obligations will be satisfied within one year or less, we apply the practical expedient outlined in ASC 606-10-32-18. This practical expedient allows us not to adjust promised consideration for the effects of a significant financing component if we expect at contract inception that the period between when we transfer the promised good or service to a customer and when the customer pays for that good or service will be one year or less. For those transactions that are expected to be completed after one year, we have assessed that there are no significant financing components because any difference between the promised consideration and the cash selling price of the good or service is for reasons other than the provision of financing.

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

If the contract contains a single performance obligation, the entire transaction price is allocated to the single performance obligation. Contracts that contain multiple performance obligations require an allocation of the transaction price to each performance obligation on a relative standalone selling price basis unless the transaction price is variable and meets the criteria to be allocated entirely to a performance obligation or to a distinct service that forms part of a single performance obligation.

Where required, we determine standalone selling price ("SSP") for each obligation based on consideration of both market and Company specific factors, including the selling price and profit margin for similar products, the cost to produce, and the anticipated margin.

For those contracts that contain multiple performance obligations (primarily systems sales, as well as some aftermarket contracts requiring both time and material inputs), we must determine the SSP. We use a cost plus margin

approach in determining the SSP for any materials related performance obligations (such as upgrades, spare parts, systems). To determine the SSP for labor related performance obligations (such as the labor component of installation), we use directly observable inputs based on the standalone sale prices for these services.

5) *Recognize revenue when or as we have satisfied a performance obligation*

We satisfy performance obligations either over time or at a point in time. Revenue is recognized over time if either 1) the customer simultaneously receives and consumes the benefits provided by the entity's performance, 2) the entity's performance creates or enhances an asset that the customer controls as the asset is created or enhanced, or 3) the entity's performance does not create an asset with an alternative use to the entity and the entity has an enforceable right to payment for performance completed to date. If the entity does not satisfy a performance obligation over time, the related performance obligation is satisfied at a point in time by transferring the control of a promised good or service to a customer. Examples of control are using the asset to produce goods or services, enhance the value of other assets or settle liabilities, and holding or selling the asset. For over time recognition, ASC 606 requires us to select a single revenue recognition method for the performance obligation that faithfully depicts our performance in transferring control of the goods and services. The guidance allows entities to choose between two methods to measure progress toward complete satisfaction of a performance obligation:

Output methods - recognize revenue on the basis of direct measurements of the value to the customer of the goods or services transferred to date relative to the remaining goods or services promised under the contract (e.g., surveys of performance completed to date, appraisals of results achieved, milestones reached, time elapsed, and units produced or units delivered); and

Input methods - recognize revenue on the basis of the entity's efforts or inputs to the satisfaction of a performance obligation (e.g., resources consumed, labor hours expended, costs incurred, or time elapsed) relative to the total expected inputs to the satisfaction of that performance obligation.

We have the right to consideration from a customer in an amount that corresponds directly with the value to the customer of the entity's performance completed to date (i.e., certain aftermarket contracts), as such we have elected a practical expedient to recognize revenue in the amount to which the entity has a right to invoice for such services.

Product related revenues (whether for systems or aftermarket business) are recognized at a point in time, when they are shipped or delivered, depending on shipping terms.

For installation services, revenue is recognized at a point in time, once the installation of the tool is complete. The nature of the installation services is such that the customer does not simultaneously receive and consume the benefits provided by the entity's performance, nor does performance of installation services create or enhance an asset that the customer controls. Installation services do not create an asset with an alternative use to the entity, and the entity does not have an enforceable right to payment for performance completed to date.

Contract liabilities are reflected as deferred revenue on the consolidated balance sheet. Contract liabilities relate to payments invoiced or received in advance of completion of performance obligations under a contract. Contract liabilities are recognized as revenue upon the fulfillment of performance obligations.

Service-type warranties for any product are recognized over time, as these represent a stand ready obligation to service the product during the warranty period. Progress in the satisfaction of these performance obligations is measured using an input method of time elapsed.

Maintenance and service contracts are recognized over time. Progress in the satisfaction of these performance obligations is measured using an input method of either time elapsed in the case of fixed period contracts, or labor hours expended, in the case of project-based contracts.

(j) Recognizing Assets related to Recoverable Customer Contract Costs

We recognize an asset related to incremental costs incurred by us to obtain a contract with a customer if we expect to recover those costs. We will recognize an asset from costs incurred to fulfill a contract only if such costs relate directly to a contract with an entity that we can specifically identify, the costs incurred will generate or enhance resources that will be used in satisfying performance obligations in the future, and the costs are expected to be recovered. Any assets recognized related to costs to obtain or fulfill a contract are amortized on a systematic basis that is consistent with the transfer to the customer of the goods or services to which the asset relates.

In substantially all of our business transactions, we incur incremental costs to obtain contracts with customers, in the form of sales commissions. We maintain a commission program which awards our employees for System sales, aftermarket activity and other individual goals. Under ASC 606, an asset is amortized on a systematic basis that is consistent with the transfer to the customer of the goods or services to which the asset relates. However, ASC 606 provides a practical expedient to allow for the recognition of commission expense when incurred if the amortization period of the asset that the entity otherwise would have recognized is one year or less. Based on the nature of our commission agreements, all commissions are expensed as incurred based upon the expectation that the amortization period would be one year or less.

(k) Shipping and Handling Costs

Shipping and handling costs are included in cost of revenue.

(l) Stock-Based Compensation

We generally recognize compensation expense for all stock-based payments to employees and directors, including grants of stock options and restricted stock units, based on the grant-date fair value of those stock-based payments. For stock option awards, we use the Black-Scholes option pricing model, adjusted for expected forfeitures. Other valuation models may be utilized in the limited circumstances where awards with market-based vesting considerations, such as the price of our common stock, or performance-based awards, are granted. Stock-based compensation expense is recognized ratably over the requisite service period. For each stock option or restricted stock unit grant with vesting based on a combination of time, market or performance conditions, where vesting will occur if either condition is met, the related compensation costs are recognized over the shorter of the explicit service period or the derived service period.

See Note 13 for additional information relating to stock-based compensation.

(m) Income Taxes

We record income taxes using the asset and liability method. Deferred income tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective income tax basis, and operating loss and tax credit carryforwards.

Our consolidated financial statements contain certain deferred tax assets which have arisen primarily as a result of operating losses, as well as other temporary differences between financial and tax basis accounting. We establish a valuation allowance if the likelihood of realization of the deferred tax assets is reduced based on an evaluation of objective verifiable evidence. Significant management judgment is required in determining our provision for income taxes, our deferred tax assets and liabilities and any valuation allowance recorded against those net deferred tax assets. We evaluate the weight of all available evidence to determine whether it is more likely than not that some portion or all of the net deferred income tax assets will not be realized.

Income taxes include the largest amount of tax benefit for an uncertain tax position that is more likely than not to be sustained upon audit based on the technical merits of the tax position. Settlements with tax authorities, the expiration of statutes of limitations for particular tax positions, or obtaining new information on particular tax positions may cause a

change to the effective tax rate. We recognize accrued interest related to unrecognized tax benefits as interest expense and penalties within operating expense in the consolidated statements of operations.

See Note 18 for additional information relating to income taxes.

(n) Computation of Net Income per Share

Basic earnings per share is computed by dividing income available to common stockholders (the numerator) by the weighted-average number of common shares outstanding (the denominator) for the period. The computation of diluted earnings per share is similar to basic earnings per share, except that the denominator is increased to include the number of additional common shares that would have been outstanding if the potentially dilutive common shares had been issued, calculated using the treasury stock method.

The components of net income per share are as follows:

	Year ended December 31,		
	2022	2021	2020
	(in thousands, except per share data)		
Net income available to common stockholders	<u>\$ 183,079</u>	<u>\$ 98,650</u>	<u>\$ 49,982</u>
Weighted average common shares outstanding used in computing basic income per share	33,043	33,555	33,257
Incremental options and RSUs	499	713	871
Weighted average common shares used in computing diluted net income per share	<u>33,542</u>	<u>34,268</u>	<u>34,128</u>
Net income per share			
Basic	\$ 5.54	\$ 2.94	\$ 1.50
Diluted	<u>\$ 5.46</u>	<u>\$ 2.88</u>	<u>\$ 1.46</u>

Diluted weighted average common shares outstanding does not include restricted stock units outstanding to purchase 4,929, 2,554 and 1,951 common equivalent shares for the periods ended December 31, 2022, 2021 and 2020, respectively, as their effect would have been anti-dilutive.

(o) Accumulated Other Comprehensive Income (Loss)

The following table presents the changes in accumulated other comprehensive loss, net of tax, by component, for the year ended December 31, 2022:

	Foreign currency	Defined benefit pension plan	Total
	(in thousands)		
Balance at December 31, 2021	\$ 2,064	\$ (299)	\$ 1,765
Other comprehensive loss and pension reclassification	(4,058)	325	(3,733)
Balance at December 31, 2022	<u>\$ (1,994)</u>	<u>\$ 26</u>	<u>\$ (1,968)</u>

(p) Recent Accounting Guidance

None.

Note 3. Revenue

We design, manufacture and service ion implantation and other processing equipment used in the fabrication of semiconductor chips and sell our products to leading semiconductor chip manufacturers worldwide. We offer a complete line of high energy, high current and medium current implanters for all application requirements. In addition, we provide extensive aftermarket lifecycle products and services, including used tools, spare parts, equipment upgrades, maintenance service and customer training. Our revenue recognition policies are set forth in Section (i) of Note 2, Summary of

(a) Alternative Operational Revenue Categories used by Management

To reflect the organization of our business operations, management reviews revenue in two categories: revenue from sales of new systems and revenue arising from the sale of used systems, parts and labor to customers who own systems, which we refer to as “CS&I” or “aftermarket.”

Below are the revenues by categories used by management for the periods covered in this report:

	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
Systems	\$ 692,061	\$ 454,598	\$ 293,624
Aftermarket	227,937	207,830	180,936
Total Revenue	<u>\$ 919,998</u>	<u>\$ 662,428</u>	<u>\$ 474,560</u>

(b) Economic Factors Affecting our Revenue: Geographic Breakdown of Revenue

Global economic conditions have a direct impact on our revenue. We are substantially dependent on sales of our products and services to customers outside of the United States. Adverse economic conditions, political instability, potential adverse tax consequences, regulatory changes and volatility in exchange rates pose a risk that our clients may reduce, postpone or cancel spending for our products and services, which would impact our revenue.

Revenue by geographic markets is determined based upon the location to which our products are shipped and where our services are performed. Revenue in our principal geographic markets is as follows:

	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
North America	\$ 143,701	\$ 48,715	\$ 50,786
Asia Pacific	673,752	516,105	385,233
Europe	102,545	97,608	38,541
Total Revenue	<u>\$ 919,998</u>	<u>\$ 662,428</u>	<u>\$ 474,560</u>

(c) Recognition of Deferred Revenue from Contract Liabilities

Contract liabilities are as follows:

	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
Balance, beginning of the period	\$ 68,436	\$ 23,058	\$ 29,251
Deferral of revenue	146,674	66,349	17,862
Recognition of deferred revenue	(60,333)	(20,971)	(24,055)
Balance, end of the period	<u>\$ 154,777</u>	<u>\$ 68,436</u>	<u>\$ 23,058</u>

Contract liabilities are reflected as deferred revenue on the consolidated balance sheet. Contract liabilities relate to payments received or amounts invoiced in advance of completion of performance obligations under a contract. Contract liabilities are recognized as revenue upon the fulfillment of performance obligations.

As of December 31, 2022, we had deferred revenue of \$154.8 million. This represents the portion of the transaction price for contracts with customers allocated to the performance obligations that remain unsatisfied or partially unsatisfied. Short-term deferred revenue of \$123.5 million as of December 31, 2022 represents performance obligations that are expected to be satisfied within the next 12 months. This amount relates primarily to prepayments made prior to system delivery as well as to installation and non-standard warranty performance obligations for system sales. Long-term deferred revenue of \$31.3 million as of December 31, 2022 relates to prepayments made prior to system delivery as well as to extended warranty performance obligations that we expect to be completed in excess of the next 12 months but within the next 24 months.

The majority of our system transactions have payment terms that are 90% due upon shipment of the tool and 10% due upon installation. Aftermarket transaction payment terms are such that payment is due either within 30 or 60 days of service provided or delivery of parts.

Note 4. Cash, cash equivalents and restricted cash

	December 31, 2022	December 31, 2021
	(in thousands)	
Cash and cash equivalents	\$ 185,595	\$ 294,923
Long-term restricted cash	752	757
Total cash, cash equivalents and restricted cash	\$ 186,347	\$ 295,680

As of December 31, 2022, we had \$0.8 million in restricted cash which relates to a \$0.7 million letter of credit relating to workers' compensation insurance and a \$0.1 million deposit relating to customs activity.

Note 5. Accounts Receivable and Allowance for Credit Losses

All trade receivables are reported on the Consolidated Balance Sheets at their amortized cost adjusted for any write-offs and net of allowances for credit losses.

Axcelis maintains an allowance for credit losses, which represents an estimate of expected losses over the remaining contractual life of its receivables considering current market conditions and estimates for supportable forecasts when appropriate. The estimate is a result of the Company's ongoing assessments and evaluations of collectability, historical loss experience, and future expectations in estimating credit losses in its receivable portfolio. Axcelis uses historical loss experience rates and applies them to a related aging analysis while also considering customer and/or economic risk where appropriate. Determination of the proper amount of allowances requires management to exercise judgment about the timing, frequency and severity of credit losses that could materially affect the provision for credit losses and, as a result, net earnings. The allowance takes into consideration numerous quantitative and qualitative factors that include receivable type, historical loss experience, delinquency trends, collection experience, current economic conditions, estimates for supportable forecasts, when appropriate, and credit risk characteristics.

Axcelis evaluates the credit risk of the customer when extending credit based on a combination of various financial and qualitative factors that may affect its customers' ability to pay. These factors may include the customer's financial condition, past payment experience, and credit ratings from credit bureaus, as well as the value of the underlying collateral.

Management performs detailed reviews of its receivables on a quarterly basis to assess the adequacy of the allowances and to determine if any impairment has occurred. Amounts determined to be uncollectable are charged directly against the allowance, while amounts recovered on previously written-off accounts increase the allowance. Changes to the allowance for credit losses are maintained through adjustments to the provision for credit losses, which are charged to current period earnings.

The following table shows changes of the allowances for credit losses related to trade receivables for the twelve months ended December 31, 2022 and 2021, respectively:

	Year ended	
	December 31,	
	2022	2021
	(in thousands)	
Balance, beginning of period	\$ —	\$ —
Provision for credit losses	—	—
Charge-offs	—	—
Recoveries	—	—
Balance, end of period	<u>\$ —</u>	<u>\$ —</u>

The components of accounts receivable are as follows:

	December 31,	
	2022	2021
	(in thousands)	
Trade receivables	\$ 169,773	\$ 104,410
Allowance for doubtful accounts	—	—
Trade receivables, net	<u>\$ 169,773</u>	<u>\$ 104,410</u>

Note 6. Inventories, net

The components of inventories are as follows:

	December 31,	December 31,
	2022	2021
	(in thousands)	
Raw materials	\$ 187,313	\$ 133,784
Work in process	35,069	43,164
Finished goods (completed systems)	20,024	18,036
Inventories, net	<u>\$ 242,406</u>	<u>\$ 194,984</u>

When recorded, inventory reserves are intended to reduce the carrying value of inventories to their net realizable value. We establish inventory reserves when conditions exist that indicate inventory may be in excess of anticipated demand or is obsolete based upon assumptions about future demand for our products or market conditions. We regularly evaluate our ability to realize the value of inventories based on a combination of factors including the following: forecasted sales and the size and utilization of our installed base, estimated product end of life dates, estimated current and future market value and new product introductions. Purchasing and usage alternatives are also explored to mitigate inventory exposure. In 2022, we recorded an increase of \$0.2 million in inventory reserves. At December 31, 2022 and 2021, inventories are stated net of inventory reserves of \$6.7 million and \$6.5 million, respectively.

During the years ended December 31, 2022, 2021 and 2020, we recorded charges to cost of sales of \$4.6 million, \$3.8 million and \$3.7 million, respectively, to adjust inventories to their lower of cost or net realizable value.

We have inventory on consignment at customer locations at December 31, 2022 and 2021, of \$6.4 million and \$5.5 million, respectively.

Note 7. Property, Plant and Equipment, net

The components of property, plant and equipment are as follows:

	<u>December 31,</u>	
	<u>2022</u>	<u>2021</u>
	(in thousands)	
Land and buildings	\$ 18,001	\$ 15,881
Machinery and equipment	34,728	34,312
Construction in process	10,189	6,852
Total cost	62,918	57,045
Accumulated depreciation	(23,254)	(22,073)
Property, plant and equipment, net	<u>\$ 39,664</u>	<u>\$ 34,972</u>

Depreciation expense was \$5.1 million, \$4.2 million and \$3.4 million for the years ended December 31, 2022, 2021 and 2020, respectively.

Note 8. Assets Manufactured for Internal Use, net

Assets manufactured for internal use, included in other assets, are depreciated using the straight-line method over their 10 year estimated useful life. Their components are as follows:

	<u>December 31,</u>	
	<u>2022</u>	<u>2021</u>
	(in thousands)	
Internal use assets	\$ 61,603	\$ 60,596
Construction in process	2,629	172
Total cost	64,232	60,768
Accumulated depreciation	(33,992)	(28,764)
Assets manufactured for internal use, net	<u>\$ 30,240</u>	<u>\$ 32,004</u>

These products are used for research and development, training, and customer demonstration purposes.

Depreciation expense was \$5.2 million, \$5.3 million and \$5.2 million for the years ended December 31, 2022, 2021 and 2020, respectively.

Note 9. Leases

We have operating leases for manufacturing, office space, warehouse space, computer and office equipment and vehicles used in our business operations. We have a finance lease in relation to the 2015 sale-leaseback of our corporate headquarters in Beverly, Massachusetts. We review all agreements to determine if the agreement contains a lease component. An agreement contains a lease component if it provides the use of a specific physical space or a specific physical item.

We recognize operating lease obligations under Accounting Standards Codification Leases (Topic 842). The guidance in Topic 842 requires recognition of lease assets and related liabilities on a discounted basis using the explicit or implicit discount rate stated within the agreement. We recognize a corresponding right-of-use asset, which is initially determined based upon the net present value of the associated liability and is adjusted for deferred costs and possible impairment, if any. For those lease agreements that do not indicate the applicable discount rate, we use our incremental borrowing rate. The value of the right-of-use asset is initially determined based on the net present value of the associated liability, and is adjusted for deferred costs and possible impairments, if any. We have made the following policy elections: (i) operating leases with an initial term of 12 months or less are not recorded on the consolidated balance sheet; (ii) we recognize lease expense for operating leases on a straight-line basis over the lease term; and (iii) we account for lease

components and non-lease components that are fixed payments as one component. Some of our operating leases include one or more options to renew, with renewal terms that can extend the respective lease term 1 to 3 years. The exercise of lease renewal options is at our sole discretion. For lease extensions that are reasonably certain to occur, we have included the renewal periods in our calculation of the net present value of the lease obligation and related right-of-use asset. Certain leases also include options to purchase the leased property. The depreciable life of certain assets and leasehold improvements are limited by the expected lease term, unless there is a transfer of title or purchase option reasonably certain of exercise. Our lease agreements do not contain any material residual value guarantees or material restrictive covenants. The amounts of operating and finance lease right-of-use assets and related lease obligations recorded within our consolidated balance sheets are as follows:

Leases	Classification	December 31,	December 31,
		2022	2021
Assets		(in thousands)	
Operating leases	Operating lease assets	\$ 12,146	\$ 9,242
Finance lease	Finance lease assets *	17,942	19,238
Total leased assets		<u>\$ 30,088</u>	<u>\$ 28,480</u>
Liabilities			
Current			
Operating	Other current liabilities	\$ 5,367	\$ 4,716
Finance	Current portion of finance lease obligation	1,229	979
Noncurrent			
Operating	Other long-term liabilities	6,931	4,357
Finance	Finance lease obligation	45,185	46,415
Total lease liabilities		<u>\$ 58,712</u>	<u>\$ 56,467</u>

*Finance lease assets are recorded net of accumulated depreciation of \$45.9 million and includes \$0.6 million of prepaid financing costs as of December 31, 2022. Finance lease assets are recorded net of accumulated depreciation of \$48.6 million and includes \$0.7 million of prepaid financing costs as of December 31, 2021.

All of our office locations support selling and servicing functions. We also have a manufacturing facility in South Korea. Lease expense, depreciation expense relating to finance leased assets and interest expense relating to our finance lease obligation recognized within our consolidated statement of operations for the twelve-month periods ended December

31, 2022, 2021 and 2020 are as follows:

Lease cost	Classification	Year ended		
		December 31,		
		2022	2021	2020
Operating lease cost		(in thousands)		
Product / Services*	Cost of revenue	\$ 5,427	\$ 2,978	\$ 2,402
Research and development	Operating expenses	322	430	491
Sales and marketing*	Operating expenses	1,526	1,605	1,389
General and administrative*	Operating expenses	1,065	996	877
Total operating lease cost		<u>\$ 8,340</u>	<u>\$ 6,009</u>	<u>\$ 5,159</u>
Finance lease cost				
Depreciation of leased assets	Cost of revenue, R&D, Sales and marketing and G&A	\$ 1,296	\$ 1,306	\$ 1,336
Interest on lease liabilities	Interest expense	4,992	5,086	5,211
Total finance lease cost		<u>\$ 6,288</u>	<u>\$ 6,392</u>	<u>\$ 6,547</u>
Total lease cost		<u>\$ 14,628</u>	<u>\$ 12,401</u>	<u>\$ 11,706</u>

* Product / services, sales and marketing and general and administrative expense also includes short-term lease and variable lease costs of approximately \$1.8 million, \$1.9 million and \$1.2 million for the twelve months ended December 31, 2022, 2021 and 2020, respectively.

Our corporate headquarters, shown below under finance leases, has an original lease term of 22 years. All other locations are treated as operating leases, with lease terms ranging from 1 to 10 years. The tables below reflect the minimum cash outflow regarding our current lease obligations as well as the weighted-average remaining lease term and weighted-average discount rates used in our calculation of our lease obligations and right-of-use assets:

Maturity of Lease Liabilities	Finance Leases	Operating Leases (in thousands)	Total Leases
2023	\$ 6,114	\$ 6,588	\$ 12,702
2024	6,252	3,292	9,544
2025	5,930	2,172	8,102
2026	6,008	1,602	7,610
2027	6,128	799	6,927
Thereafter	61,586	13	61,599
Total lease payments	<u>\$ 92,018</u>	<u>\$ 14,466</u>	<u>\$ 106,484</u>
Less interest portion*	(45,604)	(2,168)	(47,772)
Finance lease and operating lease obligations	<u>\$ 46,414</u>	<u>\$ 12,298</u>	<u>\$ 58,712</u>

* Finance lease interest calculated using the implied interest rate; operating lease interest calculated using estimated corporate borrowing rate.

The table above does not include options to renew lease terms that are not reasonably certain of being exercised, nor leases signed but not yet commenced as of December 31, 2022. As of December 31, 2022, total estimated future minimum lease payments for leases signed but not yet commenced, which consists only of the lease of property in Beverly, Massachusetts, on which a state-of-the-art logistics and flex manufacturing center with 98,000 square feet is being built to our specifications and has an expected commencement date in 2023, is estimated to be \$32.5 million.

Lease term and discount rate	December 31,
	2022
Weighted-average remaining lease term (years):	
Operating leases	3.1
Finance leases	14.1
Weighted-average discount rate:	
Operating leases	4.5%
Finance leases	10.5%

Our cash outflows from our operating leases include rent expense and other charges associated with these leases. These cash flows are included within the operating section of our statement of cash flows. Our cash flows from our finance lease include an interest and payment of principal component. The table below shows our cash outflows, by lease type and related section of our statement of cash flows, as well as the non-cash amount capitalized on our balance sheet in relation to our operating lease right-of-use assets:

Cash paid for amounts included in the measurement of lease liabilities	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
Operating cash outflows from operating leases	\$ 8,340	\$ 6,009	\$ 5,159
Operating cash outflows from finance leases	4,992	5,086	5,321
Financing cash outflows from finance leases	987	763	399
Operating lease assets obtained in exchange for operating lease liabilities	6,173	8,670	2,369
Finance lease assets obtained in exchange for new finance lease liabilities	—	—	—

Note 10. Product Warranty

We generally offer a one-year warranty for all of our systems, the terms and conditions of which vary depending upon the product sold. For all systems sold, we accrue a liability for the estimated cost of standard warranty at the time of system shipment and defer the portion of systems revenue attributable to the fair value of non-standard warranty. Costs for non-standard warranty are expensed as incurred. Factors that affect our warranty liability include the number of installed units, historical and anticipated product failure rates, material usage and service labor costs. We periodically assess the adequacy of our recorded liability and adjust the amount as necessary.

The changes in our product warranty liability are as follows:

	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
Balance at January 1 (beginning of year)	\$ 6,924	\$ 4,612	\$ 3,244
Warranties issued during the period	10,597	7,808	5,005
Settlements made during the period	(6,798)	(4,282)	(4,270)
Changes in estimate of liability for pre-existing warranties during the period	(236)	(1,214)	633
Balance at December 31 (end of period)	<u>\$ 10,487</u>	<u>\$ 6,924</u>	<u>\$ 4,612</u>
Amount classified as current	\$ 8,299	\$ 6,424	\$ 4,280
Amount classified as long-term	2,188	500	332
Total warranty liability	<u>\$ 10,487</u>	<u>\$ 6,924</u>	<u>\$ 4,612</u>

Note 11. Financing Arrangements

On January 30, 2015, we sold our corporate headquarters facility for the sale price of \$48.9 million. As part of the sale, we also entered into a 22-year lease agreement with the buyer. The sale leaseback is accounted for as a financing arrangement for financial reporting purposes and, as such, we recorded a financing obligation of \$46.4 million as of December 31, 2022, \$1.2 million of which is classified within current liabilities. The associated lease payments include both an interest component and payment of principal, with the underlying liability being extinguished at the end of the original lease term. We posted a collateralized security deposit of \$5.9 million in the form of an irrevocable letter of credit at the time of the closing. This letter of credit is currently issued under the credit facility described in the next paragraph.

On July 31, 2020, we entered into a Senior Secured Credit Facilities Credit Agreement (the "Credit Agreement") with Silicon Valley Bank, in its capacity as administrative agent and collateral agent for itself and as a lender, and such other banks and financial institutions or entities that from time to time join as lenders under the Credit Agreement. The Credit Agreement provides for a revolving credit facility in an aggregate principal amount not to exceed \$40.0 million. Our obligations under the Credit Agreement are secured by a security interest, senior to any current and future debts and to any security interest, in all of our rights, title, and interest in, to and under substantially all of our assets, subject to limited exceptions, including permitted liens. The revolving credit facility terminates on July 31, 2023. As of December 31, 2022, we were in compliance with all covenant requirements of the Credit Agreement. As of such date, no borrowings had been made under the Credit Agreement, although a letter of credit for \$5.9 million reduces the funds available for borrowing under the credit line. We entered into a First Amendment to the Credit Agreement with Silicon Valley Bank in March 2021 to (i) align the covenants with our 2021 stock repurchase program, and (ii) establish terms to transition from a Eurodollar based interest rate option to an interest rate benchmark using a secured overnight financing rate (known as "SOFR") published by the Federal Reserve Bank of New York.

Note 12. Employee Benefit Plans

(a) Defined Contribution Plan

We maintain the Axcelis Long-Term Investment Plan, a defined contribution plan. Eligible employees may contribute up to 35% of their compensation on a before-tax basis subject to Internal Revenue Service ("IRS") limitations. Highly compensated employees may contribute up to 16% of their compensation on a before-tax basis subject to IRS limitations. In 2022, 2021 and 2020 we provided an employer match of 50% of employees' pre-tax contributions on the first 6% of eligible compensation. Total related matching contribution expense was \$2.7 million, \$2.2 million and \$2.0 million, for 2022, 2021 and 2020, respectively.

(b) Other Compensation Plans

We operate in foreign jurisdictions that require lump sum benefits, payable based on statutory regulations, for voluntary or involuntary termination. Where required, an annual actuarial valuation of the benefit plans is obtained.

We have recorded an unfunded liability of \$3.5 million and \$4.7 million at December 31, 2022 and 2021, respectively, for costs associated with these compensation plans in foreign jurisdictions. The following table presents the classification of these liabilities in the Consolidated Balance Sheets:

	Year ended December 31,	
	2022	2021
	(in thousands)	
Long-term:		
Other long-term liabilities	3,516	4,681
Total liabilities	<u>\$ 3,516</u>	<u>\$ 4,681</u>

The expense recorded in connection with these plans was \$1.5 million, \$1.5 million and \$1.2 million during the years ended December 31, 2022, 2021 and 2020, respectively.

Note 13. Stock Award Plans and Stock Based Compensation

(a) Equity Incentive Plans

We maintain the Axcelis Technologies, Inc. 2012 Equity Incentive Plan (the “2012 Equity Plan” or the “Plan”), which became effective on May 2, 2012.

The 2012 Equity Plan, as amended, reserves 9.5 million shares of common stock, \$0.001 par value, for grant and permits the issuance of options, stock appreciation rights, restricted stock, restricted stock units, stock equivalents and awards of shares of common stock that are not subject to restrictions or forfeiture to selected employees, directors and consultants of the Company. The total number of shares reserved for issuance under the Plan is the sum of 7.76 million shares approved by the shareholders, and 1.78 million shares added in accordance with the terms of the Plan as a result of the expiration or forfeiture of awards granted under our prior equity plan. Shares that are not issued under an award (because such award expires, is terminated unexercised or is forfeited) revert back to the Plan.

The term of stock options granted under the Plan is specified in the award agreements. Unless a lesser term is otherwise specified by the Compensation Committee of the Company’s Board of Directors, awards under the 2012 Equity Plan will expire seven years from the date of grant. Under the terms of the Plan, the exercise price of a stock option may not be less than the fair market value of a share of the Company’s common stock on the date of grant. Under the 2012 Equity Plan, fair market value is defined as the last reported sale price of a share of the Company’s common stock on a national securities exchange as of any applicable date, as long as the Company’s shares are traded on such exchange.

Stock options granted to employees generally vest over a period of four years, while stock options granted to non-employee members of the Company’s Board of Directors generally vest over a period of six months and, once vested, are not affected by the director’s termination of service to the Company. In limited circumstances, the Company may grant stock option awards with market-based vesting conditions, such as the Company’s common stock price, or other performance conditions. Termination of service by an employee will cause options to cease vesting as of the date of termination, and in most cases, employees will have 90 days after termination to exercise options that were vested as of the termination of employment. In general, retiring employees will have one year after termination of employment to exercise vested options. The Company settles stock option exercises with newly issued common shares.

Restricted stock units granted to employees during 2022 had both service-based vesting provisions and performance-based vesting provisions. Restricted stock units granted to employees generally vest over a service period of four years, while restricted stock units granted to non-employee members of the Company’s Board of Directors in 2022 vest over a service period of one year. We have granted restricted stock units to executive officers and other senior employees with performance vesting conditions, which may be subject to further service-based vesting terms. Unvested restricted stock unit awards expire upon termination of service to the Company. We settle restricted stock units upon vesting with newly issued common shares. No restricted stock was granted during the three year period ended December 31, 2022.

As of December 31, 2022, there were 1.1 million shares available for grant under the 2012 Equity Plan.

As of December 31, 2022, there were five thousand options outstanding and 0.7 million unvested restricted stock units outstanding under the 2012 Stock Plan.

(b) Employee Stock Purchase Plan

The 2020 Employee Stock Purchase Plan (the “2020 ESPP”) provides effectively all of our employees the opportunity to purchase common stock of the Company at less than market prices. Purchases are made through payroll deductions of up to 10% of the employee’s salary as elected by the participant, subject to certain caps set forth in the 2020 ESPP. Employees may purchase the Company’s common stock at 85% of its market price on the day the stock is purchased.

The 2020 ESPP is considered compensatory and as such, compensation expense has been recognized based on the benefit of the discounted stock price, amortized to compensation expense over each offering period of six months.

Compensation expense relating to the 2020 ESPP was approximately \$0.3 million and \$0.2 million for the years ended December 31, 2022 and 2021, respectively. Compensation expense under the 2020 ESPP and our prior employee stock purchase plan (the “2000 ESPP”) was approximately \$0.2 million for the year ended December 31, 2020.

As of December 31, 2022, there were approximately 1.0 million shares reserved for issuance and available for purchase under the 2020 ESPP, with 14,061 shares purchased on that date to be issued pending settlement. Less than 0.1 million shares were purchased under the 2020 ESPP for each of the years ended December 31, 2022 and 2021. The 2000 ESPP expired in June 2020. Less than 0.1 million shares were purchased under the 2020 ESPP and 2000 ESPP for the year ended December 31, 2020.

(c) Valuation of Stock Options and Restricted Stock Units

For the purpose of valuing stock options with service conditions, we use the Black-Scholes option pricing model to calculate the grant-date fair value of an award.

	2021
Weighted-average expected volatility	53.07%
Weighted-average expected term	4.71 years
Risk-free interest rate	1.22%
Expected dividend yield	0.00%

There were no stock option awards granted in 2022 and 2020.

The fair value of the Company’s restricted stock units is calculated based upon the fair market value of the Company’s stock at the date of grant.

(d) Summary of Stock-based Compensation Expense

We use the straight-line attribution method to recognize expense for stock-based awards such that the expense associated with awards is evenly recognized throughout the period.

The amount of stock-based compensation recognized is based on the value of the portion of the awards that are ultimately expected to vest. We estimate forfeitures at the time of grant and revise them, if necessary, in subsequent periods, if actual forfeitures differ from those estimates. The term “forfeitures” is distinct from “cancellations” or “expirations” and represents only the unvested portion of the surrendered stock-based award. Based on a historical analysis, a forfeiture rate of 5% per year was applied to stock-based awards, including executive officer awards, for the years ended December 31, 2022, 2021 and 2020.

For the years ended December 31, 2022, 2021 and 2020, we recognized stock-based compensation expense of \$13.4 million, \$12.1 million and \$10.5 million, respectively. We present the expenses related to stock-based compensation in the same expense line items as cash compensation paid to our employees. For the years ended December 31, 2022, 2021 and 2020, we used restricted stock units in our annual equity compensation program.

The benefit of tax deductions in excess of recognized compensation cost is reported in the consolidated statements of cash flows as part of cash flows from operating activities. Axcelis had tax deductions in excess of recognized compensation cost of \$5.3 million for the year ended December 31, 2022 which resulted in a tax benefit of \$1.1 million.

(e) **Stock Option Awards**

The following table summarizes the stock option activity for the year ended December 31, 2022:

	<u>Options</u> <u>(in thousands)</u>	<u>Weighted</u> <u>Average</u> <u>Exercise</u> <u>Price</u>	<u>Weighted</u> <u>Average</u> <u>Remaining</u> <u>Contractual</u> <u>Term</u> <u>(years)</u>	<u>Aggregate</u> <u>Intrinsic</u> <u>Value</u> <u>(in thousands)</u>
Outstanding at December 31, 2021	111	\$ 13.51		
Granted	—	—		
Exercised	(103)	12.15		
Canceled	—	—		
Expired	(4)	12.04		
Outstanding at December 31, 2022	<u>4</u>	<u>\$ 43.33</u>	<u>3.9</u>	<u>\$ 176</u>
Exercisable at December 31, 2022	<u>3</u>	<u>\$ 27.48</u>	<u>2.2</u>	<u>\$ 136</u>
Options Vested at December 31, 2022	<u>4</u>	<u>\$ 42.03</u>	<u>3.8</u>	<u>\$ 170</u>

The total intrinsic value, which is defined as the difference between the market price at exercise and the price paid by the employee to exercise the options, for options exercised during the years ended December 31, 2022, 2021 and 2020 was \$5.4 million, \$12.8 million and \$18.4 million, respectively.

No stock options vested during the year ended December 31, 2022. The total fair value of stock options vested during the years ended December 31, 2021 and 2020 was \$0 million and \$0.1 million respectively. As of December 31, 2022, there was less than \$0.1 million of unrecognized compensation cost related to non-vested stock options granted under the 2012 Equity Incentive Plan.

(f) **Restricted Stock Units and Restricted Stock**

Restricted stock units represent the Company's unfunded and unsecured promise to issue shares of the common stock at a future date, subject to the terms of the Award Agreement issued under the 2012 Equity Incentive Plan. Restricted stock unit awards granted in 2022 included time vested share awards and awards with performance vesting conditions. Restricted stock awards are issued shares of common stock that are subject to forfeiture on terms described in the Award Agreement, and may be granted under the 2012 Equity Incentive Plan. No restricted stock awards were granted, or vested, during the years ended December 31, 2022, 2021 and 2020. The fair value of a restricted stock unit and restricted stock award is charged to expense ratably over the applicable service period. The purpose of these awards is to assist in attracting and retaining highly competent employees and directors and to act as an incentive in motivating selected employees and directors to achieve long-term corporate objectives.

Changes in the Company's non-vested restricted stock units for the year ended December 31, 2022 is as follows:

	<u>Shares/units</u> <u>(in thousands)</u>	<u>Weighted-Average</u> <u>Grant Date Fair</u> <u>Value per Share</u>
Outstanding at December 31, 2021	899	\$ 26.74
Granted	300	55.47
Vested	(449)	25.69
Forfeited	(25)	27.6
Outstanding at December 31, 2022	<u>725</u>	<u>\$ 39.23</u>

The weighted average grant-date fair value of restricted stock units granted for the years ended December 31, 2022, 2021 and 2020 was \$55.47, \$38.54 and \$23.60, respectively. Most restricted stock units provide for net share settlement to cover the employee's personal income tax withholding obligations on vesting of the employee's restricted stock units. Vesting activity above reflects shares vested before net share settlement. As of December 31, 2022, there was

\$21.0 million of total forfeiture-adjusted unrecognized compensation cost related to non-vested restricted stock units granted under the 2012 Equity Incentive Plan. That cost is expected to be recognized over a weighted-average period of 2.4 years.

Note 14. Stockholders' Equity

We may issue up to 75 million shares of common stock without additional shareholder approval. At December 31, 2022 and 2021, there were 32.8 million and 33.2 million outstanding shares of common stock, respectively.

Note 15. Fair Value Measurements

Fair value is defined as the exchange price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date.

(a) Fair Value Hierarchy

The accounting guidance for fair value measurement requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. The standard establishes a fair value hierarchy based on the level of independent, objective evidence surrounding the inputs used to measure fair value. A financial instrument's categorization within the fair value hierarchy is based upon the lowest level of input that is significant to the fair value measurement. The fair value hierarchy is as follows:

Level 1—applies to assets or liabilities for which there are quoted prices in active markets for identical assets or liabilities.

Level 2—applies to assets or liabilities for which there are inputs other than quoted prices that are observable for the asset or liability, such as quoted prices for similar assets or liabilities in active markets; quoted prices for identical assets or liabilities in markets with insufficient volume or infrequent transactions (less active markets); or model-derived valuations in which significant inputs are observable or can be derived principally from, or corroborated by, observable market data.

Level 3—applies to assets or liabilities for which there are unobservable inputs to the valuation methodology that are significant to the measurement of the fair value of the assets or liabilities.

(b) Assets and Liabilities Measured at Fair Value

Our money market funds and short-term investments with maturities of 90 days or less at time of purchase are included in cash and cash equivalents in the consolidated balance sheets. Short-term investments with maturities greater than 90 days but not greater than 365 days are included in short-term investments in the consolidated balance sheets.

The following table sets forth Company's assets which are measured at fair value by level within the fair value hierarchy.

	December 31, 2022			
	Fair Value Measurements			
	Level 1	Level 2	Level 3	Total
(in thousands)				
Assets				
Cash equivalents and other short-term investments:				
Cash equivalents (money market funds, U.S. Government Securities and Agency Investments)	\$ 111,771	\$ 25,000	\$ —	\$ 136,771
Short-term investments (U.S. Government Securities and Agency Investments)	245,247	—	—	245,247
Total	\$ 357,018	\$ 25,000	\$ —	\$ 382,018

	December 31, 2021			
	Fair Value Measurements			
	Level 1	Level 2	Level 3	Total
(in thousands)				
Assets				
Cash equivalents:				
Money market funds, U.S. Government Securities and Agency Investments	\$ 261,090	\$ —	\$ —	\$ 261,090

(c) Other Financial Instruments

The carrying amounts reflected in the consolidated balance sheets for accounts receivable, prepaid expenses and other current and non-current assets, restricted cash, accounts payable and accrued expenses approximate fair value due to their short-term maturities.

Note 16. Commitments and Contingencies

In addition to the finance and operating leases discussed in Note 9, we have purchase commitments and other contingency considerations.

(a) Purchase Commitments

We have contracts and purchase orders for inventory and other expenditures of \$412.3 million at December 31, 2022, approximately \$403.9 million are expected to occur in 2023.

(b) Litigation

We are not presently a party to any litigation that we believe might have a material adverse effect on our business operations. We are, from time to time, a party to litigation that arises in the normal course of our business operations.

(c) Indemnifications

Our system sales agreements typically include provisions under which we agree to take certain actions, provide certain remedies and defend our customers against third-party claims of intellectual property infringement under specified conditions and to indemnify customers against any damage and costs awarded in connection with such claims. We have not incurred any material costs as a result of such indemnifications and have not accrued any liabilities related to such obligations in the accompanying consolidated financial statements.

Note 17. Business Segment and Geographic Region Information

We operate in one business segment, which is the manufacture of capital equipment for the semiconductor chip manufacturing industry. The principal market for semiconductor capital equipment is semiconductor chip manufacturers. Substantially all sales are made directly by us to our customers located in the United States, Europe and Asia Pacific.

Our ion implantation systems product line includes high current, medium current and high energy implanters. Other legacy processing products include curing and thermal processing systems. In addition to new equipment, we provide post-sales equipment service and support, including spare parts, equipment upgrades, used equipment, maintenance services and customer training.

Revenue by product lines is as follows:

	Year ended December 31,		
	2022	2021 (in thousands)	2020
Ion implantation systems and services	\$ 898,132	\$ 645,504	\$ 456,788
Other systems and services	21,866	16,924	17,772
Total revenue	\$ 919,998	\$ 662,428	\$ 474,560

Revenue and long-lived assets by geographic region, based on the physical location of the operation recording the sale or the asset, are as follows:

	Revenue	Long-Lived Assets
	(in thousands)	
2022		
United States	\$ 634,081	\$ 66,227
Europe	38,963	212
Asia Pacific	246,954	3,464
	<u>\$ 919,998</u>	<u>\$ 69,903</u>
2021		
United States	\$ 519,408	\$ 63,590
Europe	36,622	191
Asia Pacific	106,398	3,194
	<u>\$ 662,428</u>	<u>\$ 66,975</u>
2020		
United States	\$ 351,069	\$ 67,521
Europe	28,977	235
Asia Pacific	94,514	547
	<u>\$ 474,560</u>	<u>\$ 68,303</u>

Long-lived assets consist of property, plant and equipment, net, and assets manufactured for internal use, net. Operations in Asia Pacific consist of manufacturing, sales and service organizations. Operations in Europe consist of sales and service organizations.

International revenue, which includes export sales from U.S. manufacturing facilities to foreign customers and sales by foreign subsidiaries and branches, was \$776.3 million (84.4% of total revenue), \$613.5 million (92.6% of total revenue) and \$423.7 million (89.3% of total revenue) in 2022, 2021 and 2020, respectively.

Note 18. Income Taxes

Income before income taxes is as follows:

	Year ended December 31,		
	2022	2021 (in thousands)	2020
United States	\$ 198,028	\$ 116,380	\$ 51,934
Foreign	6,857	4,048	3,952
Income before income taxes	<u>\$ 204,885</u>	<u>\$ 120,428</u>	<u>\$ 55,886</u>

Provision for income taxes is as follows:

	Year ended December 31,		
	2022	2021 (in thousands)	2020
Current:			
United States			
Federal	\$ 8,430	\$ —	\$ —
State	1,716	82	157
Foreign	3,124	1,439	1,062
Total current	<u>13,270</u>	<u>1,521</u>	<u>1,219</u>
Deferred:			
Federal	9,097	20,521	4,594
State	(102)	406	295
Foreign	(459)	(670)	(204)
Total deferred	<u>8,536</u>	<u>20,257</u>	<u>4,685</u>
Income tax provision	<u>\$ 21,806</u>	<u>\$ 21,778</u>	<u>\$ 5,904</u>

Reconciliation of income taxes at the United States Federal statutory rate to the effective income tax rate of 10.6% is as follows:

	Year ended December 31,		
	2022	2021 (in thousands)	2020
Income taxes at the United States statutory rate	\$ 43,026	\$ 25,290	\$ 11,736
State income taxes	1,075	387	226
Effect of change in valuation allowance	680	(1,443)	806
Foreign income tax rate differentials	289	152	181
Stock based compensation	(3,818)	(3,658)	(2,803)
Internal revenue code section 162(m) limitation	2,692	1,481	409
Credit expirations	1,181	2,342	(14)
Rate change	94	159	151
Credit generation	(4,764)	(3,096)	(2,473)
Discrete items, net	206	72	(147)
Previously unrecognized tax benefit	—	—	(4,063)
GILTI inclusion	69	301	732
Foreign-derived intangible income	(20,526)	—	—
Other, net	1,602	(209)	1,163
Income tax provision	<u>\$ 21,806</u>	<u>\$ 21,778</u>	<u>\$ 5,904</u>

Significant components of long-term deferred income taxes are as follows:

	Year ended December 31,	
	2022	2021
	(in thousands)	
Deferred tax assets:		
Federal net operating loss carryforwards	\$ —	\$ 5,635
State net operating loss carryforwards	291	727
Foreign net operating loss carryforwards	276	371
Federal tax credit carryforwards	—	18,840
State tax credit carryforwards	8,683	8,138
Property, plant and equipment	8,755	8,967
Operating lease liability	1,564	792
Accrued compensation	276	280
Inventories	1,613	1,729
Stock compensation	1,620	1,401
Warranty	1,993	1,471
Deferred revenue	4,501	836
Capitalized research and development costs	18,067	—
Gross deferred tax assets	47,639	49,187
Valuation allowance	(8,370)	(7,689)
Net deferred tax assets	39,269	41,498
Deferred tax liabilities:		
Intangible assets	(176)	(72)
Right-of-use asset	(5,400)	(4,918)
Other	(1,992)	(1,054)
Gross deferred tax liabilities	(7,568)	(6,044)
Deferred taxes, net	\$ 31,701	\$ 35,454

Changes in tax rates and tax laws are accounted for in the period of enactment. Our deferred tax assets and liabilities are measured at the enacted tax rate expected to apply when these temporary differences are expected to be realized or settled.

At December 31, 2022, we had \$31.7 million of net deferred tax assets worldwide relating to capitalized R&D costs and other temporary differences, which are available to reduce income taxes in future years. The decrease in our deferred tax assets from the prior year was primarily due to the utilization of our net operating losses, resulting in a decrease in deferred tax assets of \$24.5 million, partially offset by a \$18.1 million increase relating to capitalized R&D costs. At December 31, 2022, we maintained a \$8.4 million valuation allowance in the U.S. against certain tax credits and state net operating losses due to the uncertainty of their realization based on long-term Company forecasts and the expiration dates on these attributes. This represents an increase of \$0.7 million from the prior year.

At December 31, 2022, we had state net operating loss carryforwards of \$0.3 million. State net operating losses will expire between 2023 and 2034. At December 31, 2022, we have foreign net operating loss carryforwards of \$1.1 million. The majority of our foreign net operating losses have an unlimited carryforward period.

At December 31, 2022, we had research and development and other tax credit carryforwards of \$12.4 million. These carry forwards are subject to an uncertain tax position reserve of \$2.9 million. These credits can be used to reduce future federal and state income tax liabilities and expire principally between 2023 and 2035.

A provision of the Tax Cuts and Jobs Act (“TCJA”) took effect in 2022, creating a significant change to our treatment of research and experimental expenditures. Historically, businesses had the option of deducting R&D expenses in the year incurred or capitalizing and amortizing the costs over five years. The new TCJA provision eliminates this option and requires R&D expenses associated with research conducted in the U.S. to be capitalized and amortized over a five-year period. For expenses associated with research outside of the United States, R&D expenses are capitalized and amortized over a 15-year period. The Company has included the tax impact of capitalizing and amortizing these costs over the required periods in their tax provision for the year ended December 31, 2022.

We consider the undistributed earnings of our foreign subsidiaries as of December 31, 2022 to be indefinitely reinvested and, accordingly, no U.S. income taxes have been provided thereon. As of December 31, 2022, the amount of cash associated with indefinitely reinvested foreign earnings was approximately \$15.3 million. We have not, nor do we anticipate the need to, repatriate funds to the United States to satisfy domestic liquidity needs arising in the ordinary course of business, including liquidity needs associated with our domestic debt service requirements.

We and our subsidiaries file income tax returns in the U.S. federal jurisdiction and various states and foreign jurisdictions. We and most foreign subsidiaries are subject to income tax examinations by tax authorities for all years dating back to 2009. Our policy is to recognize interest related to unrecognized tax benefits as interest expense and penalties as operating expenses. We believe that we have appropriate support for the income tax positions taken and to be taken on our tax returns and that our accruals for tax liabilities are adequate for all open years based on an assessment of many factors including past experience and interpretations of tax law applied to the facts of each matter.

At December 31, 2022, we had unrecognized tax benefits related to uncertain tax positions of \$10.4 million, \$7.2 million of which is recorded as a long-term liability, and the remainder of which reduced the Company's state deferred tax assets and the offsetting valuation allowance. We recognized \$1.8 million in interest and penalty expenses for the year ended December 31, 2022 relating to these uncertain tax positions. These unrecognized tax benefits, if recognized, would reduce the effective tax rate and also reverse associated accrued interest and penalty expenses.

A reconciliation of the beginning and ending balance of unrecognized tax benefits are as follows:

	Year ended December 31,		
	2022	2021	2020
	(in thousands)		
Balance at beginning of year	\$ 9,961	\$ 10,044	\$ 9,799
Decrease in unrecognized tax benefits as a result of tax positions taken during a prior period	(122)	(546)	(502)
Decreases in unrecognized tax benefits related to settlements with tax authorities	(708)	—	—
Reductions to unrecognized tax benefits as a result of a lapse of the applicable statute of limitation	—	(472)	—
Increases in unrecognized tax benefits as a result of tax positions taken during the current period	1,312	935	747
Balance at end of year	<u>\$ 10,443</u>	<u>\$ 9,961</u>	<u>\$ 10,044</u>
Recorded as other long-term liability	\$ 7,190	\$ —	\$ 472
Recorded as a decrease in deferred tax assets	3,253	9,961	9,572
Balance at end of year	<u>\$ 10,443</u>	<u>\$ 9,961</u>	<u>\$ 10,044</u>

Schedule II—Valuation and Qualifying Accounts
Axcelis Technologies, Inc.
(In thousands)

	<u>Balance at Beginning of Period</u>	<u>Charged to Costs and Expenses</u>	<u>Deductions</u>	<u>Balance at End of Period</u>
Year ended December 31, 2022				
Allowance for doubtful accounts and returns	\$ —	\$ —	\$ —	\$ —
Deferred tax valuation allowance	7,689	1,529	848	8,370
Year ended December 31, 2021				
Allowance for doubtful accounts and returns	\$ —	\$ —	\$ —	\$ —
Deferred tax valuation allowance	9,133	780	2,224	7,689
Year ended December 31, 2020				
Allowance for doubtful accounts and returns	\$ 818	\$ —	\$ 818	\$ —
Deferred tax valuation allowance	8,327	806	—	9,133

Exhibit Index

Exhibit No.	Description
3.1	Restated Certificate of Incorporation of the Company, filed November 2, 2017. Incorporated by reference to Exhibit 3.1 of the Company's Form 10-Q filed with the Commission on November 3, 2017.
3.2	Bylaws of the Company, as amended and restated as of May 11, 2022. Incorporated by reference to Exhibit 3.1 of the Company's Form 8-K filed with the Commission on May 11, 2022.
4.4	Description of Securities Registered under Section 12 of the Securities Exchange Act of 1934. Incorporated by reference to Exhibit 4.4 of the Company's Form 10-K for the year ended December 31, 2019 filed with the Commission on March 2, 2020.
10.1*	Axcelis Technologies, Inc. 2012 Equity Incentive Plan, as approved by stockholders on May 14, 2019 and as amended by the Board of Directors on August 11, 2022. Incorporated by reference to Exhibit 10.1 of the Company's Form 10-Q for the quarter ended September 30, 2022 filed with the Commission on November 3, 2022.
10.2*	Axcelis Management Incentive Plan, as amended and restated by the Compensation Committee of the Board of Directors on February 11, 2010. Incorporated by reference to Exhibit 10.2 of the Company's report on Form 10-K for the year ended December 31, 2009 filed with the Commission on March 15, 2010.
10.3*	Form of Indemnification Agreement approved by the Board of Directors of the Company on February 9, 2012 for use with each of its directors and officers. Incorporated by reference to Exhibit 10.4 of the Company's report on Form 10-K for the year ended December 31, 2011 filed with the Commission on February 29, 2012.
10.4*	Form of Change in Control Agreement, as amended, as approved by the Compensation Committee of the Board of Directors on November 11, 2016, between the Company and each of its executive officers. Incorporated by reference to Exhibit 10.6 of the Company's Form 10-K for the year ended December 31, 2016 filed with the Commission on March 14, 2017.
10.5*	Form of Employee Non-Qualified Stock Option Certificate under the 2012 Equity Incentive Plan, adopted June 18, 2012. Incorporated by reference to Exhibit 10.2 of the Company's report on Form 10-Q for the quarter ended June 30, 2012 filed with the Commission on August 7, 2012.
10.6*	Form of Non-Employee Director Non-Qualified Stock Option Certificate under the 2012 Equity Incentive Plan, adopted June 18, 2012. Incorporated by reference to Exhibit 10.3 of the Company's report on Form 10-Q for the quarter ended June 30, 2012 filed with the Commission on August 7, 2012.
10.7*	Form of Restricted Stock Unit Award Agreement under the 2012 Equity Incentive Plan, adopted June 18, 2012. Incorporated by reference to Exhibit 10.4 of the Company's report on Form 10-Q for the quarter ended June 30, 2012 filed with the Commission on August 7, 2012.
10.8*	Named Executive Officer Base Compensation at February 15, 2023. Filed herewith.
10.9*	Non-Employee Director Cash Compensation at February 15, 2023. Filed herewith.
10.10*	2022 Amended and Restated Employment Agreement between the Company and Mary G. Puma dated May 24, 2022. Incorporated by reference to Exhibit 10.1 of the Company's report on Form 10-Q for the quarter ended June 30, 2022 filed with the Commission on August 4, 2022.
10.11*	Form of Amended and Restated Executive Separation Pay Agreement between the Company and Kevin J. Brewer, Russell Low, Lynnette C. Fallon, Greg Redinbo and Douglas Lawson dated May 15, 2019. Incorporated by reference to Exhibit 10.2 of the Company's Form 10-Q for the quarter ended June 30, 2019 filed with the Commission on August 7, 2019.

Exhibit No.	Description
10.12	<u>Lease Agreement between the Company and Beverly Property Owner LLC, effective January 30, 2015. Incorporated by reference to Exhibit 10.24 of the Company's Form 10-K for the year ended December 31, 2014 filed with the Commission on March 11, 2015.</u>
10.13	<u>Senior Secured Credit Facilities Credit Agreement dated as of July 31, 2020, among the Company, as the Borrower, the several lenders from time to time party thereto, and Silicon Valley Bank, as Administrative Agent, Issuing Lender and Swingline Lender, and as Lead Arranger. Incorporated by reference to Exhibit 10.1 of the Company's Form 10-Q for the quarter ended September 30, 2020 filed with the Commission on November 6, 2020.</u>
10.14	<u>Guarantee and Collateral Agreement dated as of July 31, 2020 made by the Company and the other grantors referred to therein in favor of Silicon Valley Bank, as Administrative Agent. Incorporated by reference to Exhibit 10.2 of the Company's Form 10-Q for the quarter ended September 30, 2020 filed with the Commission on November 6, 2020.</u>
10.15*	<u>Executive Compensation Clawback Policy, as adopted by the Board of Directors on November 13, 2014. Filed herewith.</u>
14.1	<u>Ethical Business Conduct at Axcelis, revised through January 2003. Incorporated by reference to Exhibit 14.1 of the Company's report on Form 10-K filed with the Commission on March 28, 2003.</u>
21.1	<u>Subsidiaries of the Company. Filed herewith.</u>
23.1	<u>Consent of Ernst & Young LLP, Independent Registered Public Accounting Firm. Filed herewith.</u>
31.1	<u>Certification of the Principal Executive Officer under Exchange Act Rule 13a-14(a)/15d-14(a) (Section 302 of the Sarbanes-Oxley Act), dated February 24, 2023. Filed herewith.</u>
31.2	<u>Certification of the Principal Financial Officer under Exchange Act Rule 13a-14(a)/15d-14(a) (Section 302 of the Sarbanes-Oxley Act), dated February 24, 2023. Filed herewith.</u>
32.1	<u>Certification of the Principal Executive Officer pursuant to Section 1350 of Chapter 63 of title 18 of the United States Code (Section 906 of the Sarbanes-Oxley Act), dated February 24, 2023. Filed herewith.</u>
32.2	<u>Certification of the Principal Financial Officer pursuant to Section 1350 of Chapter 63 of title 18 of the United States Code (Section 906 of the Sarbanes-Oxley Act), dated February 24, 2023. Filed herewith.</u>
101	The following materials from the Company's Form 10-K for the year ended December 31, 2022, formatted in eXtensible Business Reporting Language (XBRL): (i) Consolidated Statements of Operations, (ii) Consolidated Statement of Comprehensive Income (iii) Consolidated Balance Sheets, (iv) Consolidated Statements of Equity, (v) Consolidated Statements of Cash Flows, and (vi) Notes to Consolidated Financial Statements.
104	Cover Page Interactive Data File (formatted as iXBRL and contained in Exhibit 101).

* Indicates a management contract or compensatory plan.

Signatures

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

AXCELIS TECHNOLOGIES, INC.

By: /s/ MARY G. PUMA

Mary G. Puma,

President and Chief Executive Officer

Dated: February 24, 2023

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the date indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ MARY G. PUMA</u> Mary G. Puma	Director and Principal Executive Officer	February 24, 2023
<u>/s/ KEVIN J. BREWER</u> Kevin J. Brewer	Principal Accounting and Financial Officer	February 24, 2023
<u>Tzu-Yin Chiu</u>	Director	February 24, 2023
<u>/s/ RICHARD J. FAUBERT</u> Richard J. Faubert	Director	February 24, 2023
<u>/s/ JOSEPH P. KEITHLEY</u> Joseph P. Keithley	Director	February 24, 2023
<u>/s/ JOHN T. KURTZWEIL</u> John T. Kurtzweil	Director	February 24, 2023
<u>/s/ JEANNE QUIRK</u> Jeanne Quirk	Director	February 24, 2023
<u>/s/ THOMAS ST. DENNIS</u> Thomas St. Dennis	Director	February 24, 2023
<u>/s/ JORGE TITINGER</u> Jorge Titinger	Director	February 24, 2023
<u>/s/ DIPTI VACHANI</u> Dipti Vachani	Director	February 24, 2023

Axcelis Technologies, Inc.
Named Executive Officer Base Compensation at February 15, 2023

This Exhibit discloses the current understandings with respect to base compensation between Axcelis Technologies, Inc. (the “Company”) and each of:

- the Company’s principal executive officer (Mary G. Puma),
- the Company’s principal financial officer (Kevin J. Brewer), and
- the three most highly compensated other executive officers serving as executive officers at December 31, 2022.

These executive officers are referred to herein as “named executive officers” or “NEOs.”

Mary G. Puma and the Company have entered into a written agreement addressing a minimum level of base salary due to the executive. The Company’s Amended and Restated Employment Agreement with Ms. Puma (“Puma Employment Agreement”) is listed as an Exhibit to this Form 10-K. Each of the other NEOs and the Company have entered into an Executive Separation Pay Agreement in which a termination without cause will entitle the executive to one year of separation pay. The form of Executive Separation Pay Agreement is listed as an Exhibit to this Form 10-K.

The Company maintains that all executive officers, other than Ms. Puma, are employees at will and that the Company has no obligation to continue their employment, other in cases where such obligation arises under either a Change of Control Agreement or an Executive Separation Pay Agreement as described in our Proxy Statement and as filed as Exhibits to this Form 10-K.

Rate of Base Pay

In the course of the employment relationship with each NEO, the Company communicates to the named executive officer the amount of base salary approved by the Compensation Committee of the Board of Directors, which compensation is subject to change in the discretion of the Compensation Committee of the Board of Directors (provided Ms. Puma’s employment agreement sets a minimum base pay amount). The following table sets forth the annual base salary as communicated to the named executive officers of the Company as in effect on February 15, 2023:

Named Executive Officer	Title	Rate of Annual Base Pay
Mary G. Puma	President and Chief Executive Officer	\$ 625,000
Kevin J. Brewer	Executive VP and Chief Financial Officer	\$ 415,000
Russell J. Low	Executive VP, Global Customer and Engineering Operations	\$ 375,000
Lynnette C. Fallon	Executive VP, HR/Legal and General Counsel	\$ 375,000
Douglas Lawson	Executive VP, Corporate Marketing and Strategy	\$ 335,000

Axcelis Technologies, Inc.
Non-Employee Director Cash Compensation at February 15, 2023

This Exhibit discloses the current understandings with respect to cash compensation between Axcelis Technologies, Inc. (the “Company”) and each of its non-employee directors. Axcelis provides cash retainers to its non-employee directors, as follows:

Annual Cash Retainers, paid quarterly in advance	
<i>Board Member Retainer</i>	\$60,000
<i>Independent Chairman Premium</i>	\$50,000
<i>Committee Chair Retainers</i>	
Audit Committee Chairman	\$25,000
Compensation Committee Chairman	\$15,000
Nominating and Governance Committee Chairman	\$10,000
Technology and Product Development Committee Chairman	\$10,000
<i>Committee Member (not Chairman) Retainers</i>	
Audit Committee Member	\$10,000
Compensation Committee Member	\$7,500
Nominating and Governance Committee Member	\$5,000
Technology and Product Development Committee Member	\$5,000

Non-employee directors also receive reimbursement of out-of-pocket expenses incurred in attending Board and committee meetings. Non-employee directors do not receive any Company-paid perquisites.

The Board of Directors may, from time to time, form committees in addition to the Audit, Compensation, Nominating and Governance and Technology and Product Development Committees and set compensation for service on such additional committees.

Axcelis Technologies Inc.**Executive Compensation Clawback Policy****As adopted by the Board of Directors on November 13, 2014****Definitions**

For the purposes of this policy, the following definitions apply:

- *“Board”* shall mean the Board of Directors of the Company, provided that any executive officer serving on the Board of Directors will not participate in any vote relating to a determination to make a clawback demand or actions related thereto.
- *“Company”* shall mean Axcelis Technologies, Inc. or any successor.
- *“Excess Compensation”* means the difference between the amount of Performance-based Compensation received by the executive officer and the amount of any such Performance-based Compensation that would have been received by the executive officer if such Performance-based Compensation had been calculated based on the corrected financial information included in a Triggering Restatement. In the case of equity awards, Excess Compensation shall exist only to the extent that the erroneous data causing the Triggering Restatement was a factor in the Company’s determination of the size, vesting or other terms of the equity grant.
- *“Executive officer”* has the meaning given to that term in the Securities Exchange Act of 1934, as designated by the Board at the time the Performance-based Compensation is paid or received by the individual.
- *“Performance-based Compensation”* means all cash incentive compensation received by an executive officer and equity awards granted by the Company as a portion of the executive officer’s compensation, other than equity awards in lieu of base pay.
- *“Triggering Restatement”* shall mean a restatement of the Company’s financial information required to be reported under the federal securities laws as a result of erroneous data which caused a material non-compliance by the Company with a financial reporting requirement under the federal securities laws.

Clawback Triggers and Amounts

1. Clawback of Excess Compensation upon a Triggering Restatement. In the event that the Board determines that the Company must file a Triggering Restatement with the Securities and Exchange Commission, then the Board shall determine whether a clawback is required under this Section. The Company shall demand reimbursement of any Excess Compensation received by an individual during the 3 year period prior to the Board’s determination that a Triggering Restatement is required, provided the individual was an executive officer of the Company at the time of receipt. The time of receipt shall be (A) the time of payment of the cash Performance-based Compensation and (B) the time of grant of any equity Performance-based Compensation,
-

giving rise to the Excess Compensation.

2. Clawback of Performance-based Compensation on Violations of Company Agreement or Policy. The Board shall demand reimbursement of the after-tax portion of all Performance-based Compensation received by an executive officer during a period beginning 12 months prior to the executive officer's material violation of any agreement between the Company and the executive officer or violation of any material policy of the Company applicable to the executive officer, including but not limited to (A) acts of fraud, other legal non-compliance or ethical violations prohibited by the Company's Ethical Business Conduct Policy or (B) violations of the Assignment of Inventions and Confidentiality Agreement between the executive officer and the Company. Equity awards granted during the period, as well as profits received on exercise or sale of equity awards during the period, will be deemed to be Performance-based Compensation received during the period.

3. Clawback of Performance-based Compensation on Voluntary Departure to Work for a Competitor. The Board shall require reimbursement of the after-tax portion of all Performance-based Compensation received by an executive officer during the 24 month period beginning 12 months prior to the executive officer's voluntary termination of employment of the Company if such former executive officer acts as employee, agent, officer, director or proprietor in competition with the Company within one year of such termination of employment as reasonably determined by the Board. Equity awards granted during the period, as well as profits received on exercise or sale of equity awards during the period, will be deemed to be Performance-based Compensation received during the period.

In determining the after-tax portion of the amount of compensation to be claimed for clawback, the Board shall take into account its good faith estimate of the value of any tax deduction available to the executive officer in respect of such repayment.

In addition to the foregoing, this policy shall be deemed to encompass any clawback policy or right required or permissible under (i) Section 304 of the Sarbanes-Oxley Act of 2002, (ii) Section 954 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, or any law of similar effect for recovery of incentive-based compensation previously paid, and (iii) any regulations promulgated pursuant to any such laws.

Clawback Process

Clawback Demand Notice. In the event that the Board determines that a clawback process should be triggered under this policy, the Company shall give prompt written notice to the affected individual, stating the basis for the clawback and the amount of funds claims (the "Clawback Demand Notice").

Hearing. The Clawback Demand Notice shall offer the executive officer the opportunity to be heard, at a meeting of the Board (which may be in-person or telephonic, as determined by the Board). Following such meeting (or if the executive officer does not accept the offer to be heard within 10 business days following the clawback demand notice), the Board will send a second notice to the executive officer confirming or modifying its clawback demand (the "Final Notice").

Payment . The Final Notice shall specify the method(s) of repayment to be used, including:

- A cash payment from the individual to the Company within ten (10) business days after the Final Notice from the Company;
- A set-off by the Company against any amounts due to the individual from the Company, including, but not limited to deductions against payroll, as permitted by law;
- Unilateral cancellation or forfeiture of any payments under an incentive compensation program communicated to the individual but not yet paid to the extent such payment would give rise to compensation subject to a clawback; and/or
- Unilateral cancellation or forfeiture of any unexercised stock options and/or unvested stock awards to the extent the exercise, sale or vesting of such stock option or stock award would give rise to compensation subject to a clawback.

If the Company is unable to achieve repayment as requested by the Final Notice, then, on Board authorization, the Company may seek a court order against the affected individual for such repayment.

Board's Right to Delay or Decline to Seek Recovery

The Board may delay seeking recovery or determine not to seek recovery if the Board reasonably determines that it would not be in the best interests of the stockholders of the Company to do so. In making such determination, the Board shall take into account such considerations as it deems appropriate, including, without limitation:

- the immateriality of the amount involved;
 - In the case of triggers 2 and 3 above, the lack of harm, or minimal level of harm, to the Company from the violation or competition;
 - the likelihood of success under governing law versus the cost and effort involved and any counter-claims which might be asserted against the Company;
 - whether the assertion of a claim may prejudice the interests of the Company, including the Company's business interests with respect to customers, suppliers, or in any other proceeding or investigation; and/or
 - the unresolved nature of any facts on which a claim would be based.
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Axcelis Technologies, Inc.
Exhibit 21.1 to Form 10-K for the year ended December 31, 2022
Subsidiaries

The following is a list of all direct and indirect wholly-owned subsidiaries of Axcelis Technologies, Inc. as of the date hereof:

Domestic Subsidiaries

1. Axcelis Technologies (Israel) Inc., a Delaware corporation

European Subsidiaries

2. Axcelis Technologies GmbH (Germany)
3. Axcelis Technologies, Srl (Italy)
4. Axcelis Technologies, Sarl (France)

Asian Subsidiaries

5. Axcelis Technologies, KK (Japan)
6. Axcelis Technologies Limited (Korea)
7. Axcelis Technologies, Ltd. (Taiwan)
8. Axcelis Technologies Pte. Ltd. (Singapore)
9. Axcelis Technologies Semiconductor Trading (Shanghai) Co., Ltd. (Peoples Republic of China)

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in the following Registration Statements:

- (1) Registration Statements (Form S-8 Nos. 333-181750, 333-188967, 333-196157, 333-204544, 333-211673, 333-218225 and 333-231634) pertaining to the 2012 Equity Incentive Plan of Axcelis Technologies, Inc.,
- (2) Registration Statement (Form S-8 No. 333-238770) pertaining to the 2020 Employee Stock Purchase Plan of Axcelis Technologies, Inc.,
- (3) Registration Statement (Form S-8 No. 333-120356) pertaining to the 2000 Stock Plan and 2012 Equity Incentive Plan, and
- (4) Registration Statement (Form S-3 No. 333-238772) and related Prospectus of Axcelis Technologies, Inc. for the registration of common stock, preferred stock, warrants, debt securities and units;

of our reports dated February 24, 2023, with respect to the consolidated financial statements and schedule of Axcelis Technologies, Inc. and the effectiveness of internal control over financial reporting of Axcelis Technologies, Inc. included in this Annual Report (Form 10-K) of Axcelis Technologies, Inc. for the year ended December 31, 2022.

/s/ Ernst & Young LLP

Boston, Massachusetts
February 24, 2023

CERTIFICATION
of the Principal Executive Officer
Pursuant to Rule 13a-14(a)/15d-14(a) (implementing Section 302 of the Sarbanes-Oxley Act)

I, Mary G. Puma, certify that:

1. I have reviewed this annual report on Form 10-K of Axcelis Technologies, 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 company as of, and for, the periods presented in this report;
4. The company'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 company 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 company, 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 company'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 company's internal control over financial reporting that occurred during the company'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 company's internal control over financial reporting; and
5. The company's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the company's auditors and the audit committee of the company'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 company's ability to record, process, summarize and report financial information; and
 - (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 24, 2023

/s/ MARY G. PUMA

Mary G. Puma,
Chief Executive Officer and President

CERTIFICATION
of the Principal Financial Officer
Pursuant to Rule 13a-14(a)/15d-14(a) (implementing Section 302 of the Sarbanes-Oxley Act)

I, Kevin J. Brewer, certify that:

1. I have reviewed this annual report on Form 10-K of Axcelis Technologies, 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 company as of, and for, the periods presented in this report;
4. The company'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 company 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 company, 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 company'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 company's internal control over financial reporting that occurred during the company'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 company's internal control over financial reporting; and
5. The company's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the company's auditors and the audit committee of the company'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 company's ability to record, process, summarize and report financial information; and
 - (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 24, 2023

/s/ KEVIN J. BREWER

Kevin J. Brewer,

Executive Vice President and Chief Financial Officer

AXCELIS TECHNOLOGIES, INC.
Certification of the Chief Executive Officer
Pursuant to Section 1350 of Chapter 63 of title 18 of the United States Code

The undersigned Chief Executive Officer of Axcelis Technologies, Inc., a Delaware corporation, hereby certifies, for the purposes of Section 1350 of Chapter 63 of title 18 of the United States Code (as implemented by Section 906 of the Sarbanes-Oxley Act of 2002) as follows:

This Form 10-K annual report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m or 78o(d)) and the information contained herein fairly presents, in all material respects, the financial condition and results of operations of the Company.

IN WITNESS WHEREOF, the undersigned has executed this Certification as of February 24, 2023.

/s/ MARY G. PUMA

Mary G. Puma

*Chief Executive Officer and President of Axcelis
Technologies, Inc.*

AXCELIS TECHNOLOGIES, INC.
Certification of the Chief Financial Officer
Pursuant to Section 1350 of Chapter 63 of title 18 of the United States Code

The undersigned Chief Financial Officer of Axcelis Technologies, Inc., a Delaware corporation, hereby certifies, for the purposes of Section 1350 of Chapter 63 of title 18 of the United States Code (as implemented by Section 906 of the Sarbanes-Oxley Act of 2002) as follows:

This Form 10-K annual report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m or 78o(d)) and the information contained herein fairly presents, in all material respects, the financial condition and results of operations of the Company.

IN WITNESS WHEREOF, the undersigned has executed this Certification as of February 24, 2023.

/s/ KEVIN J. BREWER

Kevin J. Brewer

*Executive Vice President and Chief Financial Officer of
Axcelis Technologies, Inc.*