UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

(Mark One)

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

For the fiscal year ended December 31, 2021

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

For the transition period from __________ to __________

Commission file number: 001-32598

Entegris, Inc.
(Exact name of registrant as specified in its charter)

Delaware	**41-1941551**
(State or Other Jurisdiction of Incorporation or Organization)	**(I.R.S. Employer Identification No.)**

129 Concord Road, Billerica, Massachusetts 01821
(Address of principal executive offices and zip code)

(978) 436-6500
(Registrant's telephone number, including area code)

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

Title of Each Class	Trading Symbol(s)	Name of Exchange on which Registered
Common Stock, $0.01 Par Value	ENTG	The 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 15(d) of the Act. ☐ Yes ☒ No

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

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

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

Large Accelerated Filer	☒	Accelerated Filer	☐
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. ☒

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

The aggregate market value of voting stock held by non-affiliates of the registrant, based on the last sale price of the Common Stock on July 3, 2021, the last business day of registrant's most recently completed second fiscal quarter, was $13,985,301,409. Shares held by each officer and director of the registrant and by each person who owned 10 percent or more of the outstanding Common Stock have been excluded from this computation in that such persons may be deemed to be affiliates of the registrant. The determination of affiliate status for this purpose is not necessarily a conclusive determination for other purposes.

As of January 31, 2022, 135,516,966 shares of the registrant's Common Stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Definitive Proxy Statement for its 2022 Annual Meeting of Stockholders scheduled to be held on April 27, 2022, or the 2022 Proxy Statement, which is scheduled to be filed with the Securities and Exchange Commission, or SEC, not later than 120 days after December 31, 2021, are incorporated by reference into Part III of this Annual Report on Form 10-K. With the exception of the portions of the 2022 Proxy Statement expressly incorporated into this Annual Report on Form 10-K by reference, such document shall not be deemed to constitute part of this Annual Report on Form 10-K.

Auditor Name	Auditor Location	Auditor Firm ID
KPMG LLP	Minneapolis, Minnesota	185

ENTEGRIS, INC.

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FOR THE FISCAL YEAR ENDED DECEMBER 31, 2021

PART I

Item 1. Business.

OUR COMPANY

Entegris, Inc. ("Entegris", "the Company", "us", "we", or "our") is a leading supplier of advanced materials and process solutions for the semiconductor and other high-technology industries. Our mission is to help our customers improve their productivity, performance and technology by providing enhanced materials and process solutions for the most advanced manufacturing environments. We leverage our unique breadth of capabilities to create mission-critical microcontamination control products, specialty chemicals and advanced materials handling solutions that maximize manufacturing yields, reduce manufacturing costs and enable higher device performance for our customers.

Semiconductors, or integrated circuits, are key components in the electronic devices that have changed the way we live, communicate and work. Products and applications like smartphones, 5G wireless technology, cloud computing, the Internet of Things, machine learning and artificial intelligence, autonomous vehicles and virtual reality will increasingly require faster, more powerful and more energy efficient semiconductors and we believe will ultimately drive global chip demand.

To meet the requirements for improved chip performance and density, semiconductor manufacturing processes have rapidly become increasingly complex by moving to smaller geometries, adopting new device architectures and utilizing new and innovative materials. These complex processes require new materials of ever-increasing purity, quality and stability to improve and maximize yields. We expect to benefit from these two intersecting themes of the growing importance of process materials and materials purity, and the impact they have on semiconductor performance, cost and reliability. We believe these trends are leading to increasing materials content per wafer and filtration opportunity per wafer, which are growth opportunities for us.

Our customized materials solutions enable the highest levels of performance essential to the manufacture of semiconductors. As our customers introduce more complex architectures and search for new materials with better electrical and structural properties to improve the performance of their devices, they rely on Entegris as a trusted partner to address these challenges. We understand these challenges and have solutions to address them, such as our advanced deposition materials, implant gases, formulated cleaning chemistries and selective etch chemistries. Our customers also require greater end-to-end materials purity and integrity in their manufacturing processes that, when combined with smaller dimensions and more complex architectures, can be challenging to achieve. To enable the use of new metals and the further miniaturization of chips, and to maximize yield and increase long-term device reliability, we provide products such as our advanced liquid and gas filtration and purification products that help to selectively remove new classes of contaminants throughout the semiconductor supply chain. In addition, to ensure purity levels are maintained across the entire supply chain, from bulk manufacturing, to transportation to and delivery through a fab, to application onto the wafer, we provide high-purity packaging, fluid monitoring and materials handling products.

Our business is organized and operated in three operating segments, which align with the key elements of the advanced semiconductor manufacturing ecosystem. The Specialty Chemicals and Engineered Materials, or SCEM, segment provides high-performance and high-purity process chemistries, gases and materials, and safe and efficient delivery systems to support semiconductor and other advanced manufacturing processes. The Microcontamination Control, or MC, segment offers solutions to filter and purify critical liquid chemistries and gases used in semiconductor manufacturing processes and other high-technology industries. The Advanced Materials Handling, or AMH, segment develops solutions to monitor, protect, transport and deliver critical liquid chemistries, wafers and other substrates for a broad set of applications in the semiconductor industry, life sciences and other high-technology industries. While these segments have separate products and technical know-how, they share common business systems and processes, technology centers and strategic and technology roadmaps. With the technology, capabilities and complementary product portfolios from these three segments, we believe we are uniquely positioned to collaborate across divisions to create new, co-optimized and increasingly integrated solutions for our customers. For example, our SCEM segment offers a highly selective nitride etch chemistry, our MC segment provides a liquid filter that is specifically matched to that formulation and our AMH segment ensures the integrity of the product as it is moved to and through the fab environment.

We believe that our platform is differentiated and resilient for several reasons. First, approximately 69% of our revenue during 2021 was unit driven or recurring in nature, from products consumed as a result of the semiconductor manufacturing process. Our revenue is therefore generally more impacted by overall global semiconductor demand than the sales of semiconductor capital equipment. Second, our solutions are increasingly specified and tailored to meet our customers' unique process conditions, and therefore switching away from our products may be costly and time consuming and may introduce risk to manufacturing yields. Third, our product portfolio is broad and not overly concentrated on any single product or product platform. As of December 31, 2021, we offered over 20,000 standard and customized products, and in 2021 no single product platform represented more than 4% of our net sales. Fourth, our customer base is diverse, and we are not overly dependent on any one single customer. Our customers are represented across the semiconductor supply chain, from chemical manufacturers, to equipment manufacturers, to semiconductor manufacturers. During 2021, only one customer accounted for over 10% of our net sales, while our top 10 customers accounted for approximately 43% of our net sales. Lastly, we believe our strong financial profile will allow us to invest in the research and development and advanced manufacturing capabilities necessary to maintain and expand our technology leadership and to drive organic growth. As we have done in the past, we expect to expand upon our product portfolio, increase our scale and strengthen our position as a leading supplier to our customers.

In recent years, we have also sought to diversify outside of the semiconductor industry by taking advantage of our core capabilities in material science and material purity to provide critical products for the life sciences industry. During that time, we partnered with several leading companies in the life sciences industry to help guide our development efforts. In just a few short years, we brought to market our Aramus high-purity bag assemblies that are used in the production of biologics, including COVID-19 vaccines. Going forward we will seek to expand the use of these solutions into non-COVID biologics. In addition, we expect to provide ancillary solutions around our Aramus bags, and also plan to expand our filter offerings for bioprocessing applications.

PROPOSED MERGER

On December 14, 2021, we entered into a definitive Agreement and Plan of Merger, or the merger agreement, with our wholly-owned subsidiary, Yosemite Merger Sub, Inc, or merger sub, and CMC Materials, Inc., or CMC, a leading global supplier of consumable materials to semiconductor manufacturers and pipeline companies. Pursuant and subject to the terms and conditions of the merger agreement, upon completion of the transaction, merger sub will merge with and into CMC, with CMC surviving and continuing as a wholly-owned subsidiary of Entegris. At the effective time of the proposed merger, each outstanding share of common stock of CMC (with certain exceptions set forth in the merger agreement) will be converted into the right to receive $133.00 in cash and 0.4506 shares of common stock of Entegris, plus cash in lieu of any fractional shares. The transaction is subject to certain conditions, including the affirmative vote of holders of a majority of the outstanding shares of common stock of CMC approving the adoption of the merger agreement and the receipt of approvals under United States and certain foreign antitrust and competition laws. We have agreed to operate our business in the ordinary course during the period between the execution of the merger agreement and the effective time of the proposed merger, subject to specific exceptions set forth in the merger agreement, and have agreed to certain other customary restrictions on operations, as set forth in the merger agreement.

In connection with the proposed merger with CMC, we have entered into an amended and restated commitment letter with Morgan Stanley Senior Funding, Inc. and certain other financial institutions providing for a senior secured first lien term loan B facility in an aggregate principal amount of up to $4 billion and a senior unsecured bridge term loan facility in an aggregate principal amount of up to $895 million. Commitments under the bridge facility will be reduced by, among other things, the aggregate gross cash proceeds in excess of $300 million resulting from any issuance or sale by Entegris of certain securities, including senior unsecured notes or other debt securities or other indebtedness for borrowed money, equity securities and equity-linked securities.

THE SEMICONDUCTOR ECOSYSTEM

The manufacture of semiconductors requires hundreds of highly complex and sensitive manufacturing steps, during which a variety of materials are repeatedly applied to a silicon wafer to build integrated circuits on the wafer surface. We serve the semiconductor ecosystem by providing specialty materials and chemicals utilized in many process steps, offering a broad range of products to monitor, protect, transport and deliver these critical process materials during the manufacturing process and providing systems to purify liquid chemistry and gases throughout the manufacturing process. The areas of the semiconductor ecosystem that rely most heavily on our products and solutions are described below.

Etch and Resist Strip. During the etch process, specific areas of the thin film that have been deposited on the surface of a wafer are removed to leave a desired circuit pattern. After the etch process, the hardened resist needs to be completely removed, which requires the use of ultra-high purity chemicals of precise composition. In order to maintain manufacturing yields and avoid defective products, these chemicals must be maintained at very high purity levels without the presence of foreign material such as particles, ions or organic contaminants. Several of our products are utilized by semiconductor manufacturers during and after the etch process, including:

- Formulated chemical solutions to remove photoresists and post-etch residues;
- Filters and purifiers, which help to ensure the purity of formulated cleaning chemistries and to achieve desired yields in the etch processing steps; and

- Precision-engineered coatings to provide barriers to corrosive chemistries in the etch environment, protect surfaces from erosion and minimize particle generation.

In addition to being utilized throughout the etch process, semiconductor manufacturers require ultra-high purity chemicals of precise composition to clean wafers before and after several of the processes described below. Our proprietary formulated cleaning chemistries are used in these wet cleaning processes, and our liquid filters and purifiers ensure the purity of these chemicals.

Deposition. Deposition is a process during which certain materials are transferred to the surface of a wafer. Deposition processes include physical vapor deposition, or PVD, where a thin film is deposited on a wafer surface in a low-pressure gas environment; chemical vapor deposition, or CVD, where a thin film is deposited on a wafer surface by exposing it to one or more volatile precursors which react with the wafer surface; atomic-layer deposition, or ALD, where a thin film is deposited on a wafer surface by exposing it to one or more precursors which react through a series of sequential, self-limiting reactions; and electro-plating, where a metal layer, such as copper, is deposited on a wafer surface using chemical baths. We provide products that are used during each of these deposition processes that are critical to enabling new device architectures, ensuring device performance and achieving the targeted manufacturing yields of semiconductor manufacturers, including:

- Advanced precursor materials and electro-plating chemicals, which are utilized to meet the semiconductor industry's composition, uniformity and thickness requirements of deposited films; and
- Filtration and purification products, which are used to remove contaminants during the deposition process, consequently reducing defects on wafers.

Photolithography. Photolithography is a process that uses light to print complex circuit patterns onto the wafer and is repeated many times throughout the semiconductor manufacturing process. To print the projected optical pattern, the wafer is coated with a thin film of light-sensitive material, called photoresist. Light is projected to expose the photoresist, which is then developed to create a stenciled image pattern. We offer products that semiconductor manufacturers use throughout the photolithography process, including:

- Liquid filtration and liquid packaging and dispense systems designed to ensure the pure, accurate and uniform dispense of photoresists onto the wafer, enabling manufacturers to achieve acceptable yields in the manufacturing process; and
- Gas microcontamination control systems designed to eliminate airborne contaminants that often disrupt effective photolithography processes.

Ion Implant. Ion implantation is a key technology for forming transistors and is used many times during semiconductor fabrication. During ion implantation, wafers are bombarded by a beam of electrically-charged ions which change the electrical properties of the exposed surface films. Those of our products that are used during the ion implant process include:

- Safe Delivery Source®, or SDS®, and Vacuum Actuated Cylinders, or VAC®, gas delivery systems designed to ensure the safe, effective and efficient delivery of the toxic gases necessary for the implant process; and
- Electrostatic chucks and proprietary low temperature plasma coating processes for core components, which are critical elements of ion implantation equipment.

Chemical Mechanical Planarization. Chemical mechanical planarization, or CMP, is a polishing process used by semiconductor manufacturers to planarize, or flatten, many of the layers of material that have been deposited on silicon wafers. We offer a broad range of products used by semiconductor manufacturers during and immediately following the CMP process, including:

- CMP slurry products, which are used for polishing ultra-hard surface materials, including silicon carbide, or SiC, and gallium nitride, or GaN, substrates;
- Formulated cleaning chemistries, which remove residue from wafer surfaces after the CMP process and prevent subsequent corrosion;
- Filtration and purification solutions, which are used to remove select particles and contaminants from slurries and cleaning chemistries that can cause defects on a wafer's surface;
- Roller brushes, which are used in conjunction with our formulated cleaning chemistries to clean the wafer after completion of the CMP process in order to prepare the wafer for subsequent operations; and
- Pad conditioners, which are used to prepare the surface of the CMP polishing pad prior to every polishing cycle.

Wafer Solutions. Our wafer and reticle carriers are high-purity "micro-environments" that carry wafers between manufacturing process steps. These products protect wafers from damage or abrasion and minimize contamination during transportation and automated processing. Front-end wafer processing can involve hundreds of steps and take several weeks. Protection of the processed wafer between steps is essential, as a single batch of fully processed 200 mm or 300 mm wafers transported in one of our products can be worth over a million dollars.

Chemical Containers. Semiconductor manufacturing and other high-technology manufacturing processes utilize large volumes of high-purity, corrosive and hazardous chemicals. We provide solutions for the handling of such chemicals, including:

- Ultra-high purity chemical container products, such as drums, flexible packaging and associated coded connection systems, which are designed to maintain chemical purity, maximize utilization and ensure safe transport, containment and dispense of valuable, ultra-clean process fluids, from bulk chemical manufacturing to point-of-use in the manufacturing process; and
- Ultra-pure valves, fittings, tubings and sensing and control products, which are used to distribute these chemicals around the fab and in wet process tools.

Other Markets. Many of the processes used to manufacture semiconductors are also used to manufacture flat panel displays, high-purity chemicals, solar cells, optical magnetic storage devices and light-emitting diodes, or LEDs, resulting in the need for similar filtration, purification, control and measurement capabilities. We seek to leverage our products, technologies, expertise and core capabilities to address these important market opportunities and pursue opportunities in certain life sciences applications.

INDUSTRY TRENDS

Emerging Applications. The market for semiconductors has grown significantly over the past few decades, and we expect this trend to continue. We believe that smartphones (including 5G), the Internet of Things and emerging applications in cloud computing, machine learning and artificial intelligence, high performance computing, autonomous vehicles and virtual reality will drive growth in the demand for semiconductors, drive wafer starts and create significant opportunities for our products. Existing applications in data processing, wireless communications, broadband infrastructure, personal computers, handheld electronic devices and other consumer electronics are also expected to drive demand for semiconductors, and in turn, our products, especially in light of the increased prevalence of work-from-home and remote learning caused by the COVID-19 pandemic. For further information about our industries, see the “Risk Factors—Risks Related to Our Business and Industry” section of this Annual Report on Form 10-K, including under the heading “The industries we serve are constantly evolving, and any failure to manage our business effectively during periods of rapid change may adversely affect our business performance and results of operations.”

Manufacturing Complexity and Architecture. The emerging applications described above require more powerful, faster and more energy-efficient semiconductors. Semiconductor architectures are changing, with transistor design increasing in complexity, the use of multilayered patterning (for example, extreme ultraviolet lithography), structures such as FinFET, 3D NAND and gate-all-around, and shrinking dimensions. These advanced architectures require more process steps, more novel materials and more sophisticated contamination control to manufacture semiconductors. We believe that demand for our materials and consumable products will benefit from the increase in process steps in lithography, deposition, CMP and etch and clean required to manufacture leading-edge semiconductors.

Additionally, new materials have played a significant role in enabling improved device performance, and we expect this trend to continue. As dimensions get smaller, more novel materials will be required to enable transistor connectivity. For example, leading-edge semiconductor manufacturers are moving towards atomic layer scale, where the precision of the manufacturing process and purity of the materials used is vital to maintain device integrity. These materials need to be supplied and delivered at ever-increasing levels of purity and control, from point-of-production to point-of-dispense on the wafer. We expect the trend for new materials supplied at high levels of purity to drive demand for our advanced materials and our products and solutions designed to purify, monitor, protect, transport and deliver critical materials. To address the challenges related to advanced technology nodes, we collaborate with our customers to develop new materials, to enhance our filtration and purification capabilities and to introduce advanced materials packaging and monitoring capabilities.

Materials Handling Solutions. To minimize the potential for damage or degradation to their materials and to protect their investment in processed wafers, our semiconductor customers have become increasingly focused on materials handling solutions that enable them to safely store, handle, process and transport critical materials throughout the manufacturing process. We believe that this trend provides opportunities for us to utilize our breadth of capabilities to provide innovative materials management, purification, wafer transport and process solutions to semiconductor customers to enable them to successfully manage this growing complexity.

Reliance on Trusted Suppliers. Our customers require that their key materials suppliers demonstrate greater capabilities and efficiencies in their processes, including sustainability, scalability, flexible manufacturing, quality control, supply chain management and the ability to effectively collaborate on solutions to problems. We have responded to these demands by deploying resources in strategic locations to enable us to align with customer requirements and drive operational excellence. For example, in 2020 we continued to invest in our laboratory in Taiwan by adding key wafer processing and analytical equipment to support clean formulation development and advanced filter evaluations. To continue to accelerate the development cycle, we have focused on building models that simulate the performance of certain of our cleaning products. In China, during 2021 we continued to invest in our manufacturing capabilities and technical applications development. In addition, during 2021 in Taiwan we started construction on a new manufacturing and enhanced technology facility, which we expect will be our largest such facility in the world, adding significant scale in a key region. We believe that, as semiconductor manufacturers require greater capabilities of their supply partners, we will be able to leverage our manufacturing, operational and technical capabilities, along with our broad technology portfolio and expanding scale, to become an increasingly important strategic supplier to our customers.

Continued Consolidation. Our customer base within the semiconductor industry has consolidated in recent years through mergers and acquisitions. As a result, the importance of maintaining and developing strong and close relationships with our customers becomes even more essential. While continuing to strengthen these relationships, we also seek to further broaden our customer base by leveraging our products, technologies, expertise and core capabilities in serving semiconductor applications to address adjacent market opportunities, including in manufacturing processes for flat panel displays, high-purity chemicals, solar cells, optical magnetic storage devices, LEDs and products for life sciences applications. For further information, see the "Risk Factors—Risks Related to Our Business and Industry" section of this Annual Report on Form 10-K under the heading "A significant portion of our sales is concentrated on a limited number of key customers and our net sales and profitability may materially decline if we lost one or more of these customers."

OUR COMPETITIVE STRENGTHS

Strong Technology Portfolio. In the highly competitive semiconductor industry, manufacturers seek partners that are applications experts with broad technology portfolios to collaborate with from product conception to high volume manufacturing. To that end, we are committed to being able to provide our customers with innovative solutions for their manufacturing needs. For example, we have introduced sub-5 nanometer filtration products, advanced deposition materials for next generation transistor and interconnect technologies, advanced reticle pods for extreme ultra-violet, or EUV, photolithography applications, advanced 300 millimeter wafer carriers and advanced coatings to meet the rigorous demands related to the manufacturing of advanced technology nodes faced by our customers. Given the competitive nature of the semiconductor industry, we continuously seek to engage with leading logic and memory manufacturers to further advance their technology roadmaps.

To sustain our competitive advantage, in addition to being applications experts, we must develop, maintain and protect our critical intellectual property, including with patents, know-how and trade secrets. To add to our already robust patent portfolio that consisted of over 2,840 patents worldwide as of December 31, 2021, during 2021 we filed new patent applications across the globe covering inventions and technologies related to EUV, precursors, deposition materials, purification and filtration, micro-environments, delivery systems and life sciences.

Comprehensive and Diverse Product Offerings. As semiconductor manufacturers drive towards more advanced technology nodes, our customers seek suppliers that can provide a broad range of customized, reliable, flexible and cost-effective products and materials, as well as the technological and application design expertise necessary to enhance their productivity, quality and yield. We believe our comprehensive offering of materials and products creates a competitive advantage as it enables us to meet a broad range of customer needs and provide a single source of product offerings for semiconductor device and equipment manufacturers, which can often translate to shorter time-to-solution and time-to-market for our customers. Additionally, our broad product and solution portfolio allows us to serve many aspects of the semiconductor manufacturing ecosystem and to create synergies among some of our products. For example, our highly selective nitride etch formulations used in 3D NAND applications have been co-developed with specifically functionalized filter membranes designed to ensure the highest process performance. Additionally, our sensing technology detects active components in the etch chemistry and allows customers to control the bath lifetime. Further, as the semiconductor industry looks to new metals for interconnect components, for example molybdenum and ruthenium, we believe our portfolio of deposition, clean, filtration and delivery products will become even more critical to enhancing our customers' device performance and yield.

To further strengthen and improve our product offerings, we are committed to significant investment in research and development initiatives, having spent approximately $167.6 million, $136.1 million and $121.1 million on such activities in 2021, 2020 and 2019, respectively, representing 7.3%, 7.3% and 7.6% of our net sales, in 2021, 2020 and 2019, respectively. Our research and development expenditures have been increasingly directed towards innovation for advanced technology nodes, and in 2021, a significant portion of our research and development expenditures were focused at the leading edge. We plan to continue making substantial investments in research and development activities and expect our spending on such initiatives, as a percentage of revenue, to increase in the coming years.

Global Infrastructure. Complementing our strong technology portfolio and diverse product offerings, we have a global infrastructure of design, manufacturing, logistics, distribution, service and technical support facilities to meet the needs of our global customers. For example, during 2021 we started construction on a new manufacturing and enhanced technology facility, which we expect will be our largest such facility in the world, in Taiwan. We expect that initial commissioning operations will begin in late 2022, with production ramping thereafter. The new Taiwan facility will add to various recent and ongoing expansions of and investments in our manufacturing operations and advanced technology centers in the United States, Taiwan, Japan and South Korea designed to increase our local manufacturing capacity and to support our customers in these regions, to be even more responsive to their emerging needs and to help accelerate their development cycles and product ramps. Further, we have established or acquired new facilities in China to serve the semiconductor and life sciences industries in that country, expanded our manufacturing capacity in Malaysia and expanded our presence in Singapore to enhance our global and regional management of supply chain and manufacturing processes. Finally, we have completed a number of new capacity and technology development investments and expansions in the United States to support our customers in the life sciences industry. For more information on our advanced manufacturing capabilities, see the "—Manufacturing" section below. We service our customer relationships in Asia, North America, Europe and the Middle East predominantly via direct sales and support personnel and to a lesser extent through selected independent sales representatives and distributors.

Our expansive global presence allows us to meet our customers where they operate, which has enabled us to build strong relationships with them. Our customers include logic and memory semiconductor manufacturers, original equipment manufacturers, or OEMs, and semiconductor materials suppliers. These customer relationships provide us with significant collaboration opportunities at the early product design stage, which facilitate our ability to introduce new products and applications. For example, we work with our key customers in the development of advanced manufacturing processes to identify and respond to their requests for current and future generations of products for emerging applications requiring cleaner materials. Similarly, we also collaborate with our customers to develop systems that maintain the integrity and stability of materials during transport and throughout the manufacturing process. We believe that our customer base will continue to be an important source of new product development opportunities. Due to the specialized nature of our products, complexity of our customers' manufacturing processes, customer qualification requirements and costs associated with re-formulation and re-qualification, we believe we have a strong position with our customers.

Operational Excellence. Our customers are increasingly focused on the effectiveness, dependability and consistency of their supply chains. We remain committed to operational excellence and are especially focused on the following priorities that we believe enable us to perform at the high level that our customers expect.

- *Use of manufacturing equipment and facilities incorporating leading-edge technology, including advanced cleanroom and cleaning procedures*. As our customers introduce more complex architectures and search for new materials with better electrical and structural properties to improve the performance of their devices, our equipment, technology and processes must evolve to keep pace. In response, we have invested heavily in leading-edge manufacturing facilities, which are located in strategic regions throughout the world. With our global presence, we are able to efficiently utilize our portfolio of manufacturing facilities to meet our customers' needs quickly and efficiently.
- *Implementation of automated manufacturing, quality and supply chain management systems*. In recent years, we have made significant investments in quality systems to help drive automation of our processes. During this time, we have implemented standardized manufacturing systems to stress optimization of equipment effectiveness, predictive maintenance and direct labor productivity, automated quality systems that provide both process monitoring and statistical process control throughout the manufacturing process as well as predictive quality data to mitigate against potential quality deficiencies and supply chain management systems designed to ensure a reliable and responsive supply of high-quality raw materials. These systems generate large amounts of data, which we utilize to further enhance our quality, productivity and stability. Our focus on quality is evidenced by our sigma level moving from less than four in 2010 to greater than five in 2021, which represents a significant improvement in quality performance and reduction in defective parts produced. In addition, over the last several years we have earned awards from our customers for our performance and focus on continuous improvement.
- *Maintaining an agile manufacturing organization*. Our manufacturing workforce is capable of the rapid design and development of prototypes of new and derivative products, as well as promptly responding to customer feedback concerning prototypes so that we can quickly commercialize and ramp our production within very tight process windows required by our customers. We believe that our focus on disciplined execution and timeliness in customer interactions enables us to build even deeper connections with our customers, which in turn allows us to further understand their technical roadmaps and to help them overcome technical hurdles.

OUR BUSINESS STRATEGY

We intend to build upon our position as a leading supplier of advanced materials and process solutions for the semiconductor and other high-technology industries to expand our core business and to grow in other high value-added manufacturing process markets. Our strategy includes the following key elements.

Commitment to Technology Leadership. We seek to continuously improve our products and develop new products as our customers' needs evolve. As semiconductor devices become smaller and more powerful and new materials and processes are deployed to produce them, we seek to expand our technological capabilities by developing advanced products that address our customers' requirements for greater purification, protection and transport of high value-added materials and by developing advanced materials for use in critical fabrication processes.

Leveraging Our Expertise. We leverage our broad expertise across our portfolio of advanced materials, materials handling and purification capabilities to create innovative and new solutions to address unmet customer needs. For example, certain of our formulated cleaning chemistry products are developed and manufactured by our SCEM segment, with collaboration from our MC segment, packaged with our ultra-clean container and connector system made by our AMH segment, and delivered to the process tools through fluid handling systems also made by our AMH segment. Furthermore, in process tools, these chemistries may go through one or several purification systems produced by our MC segment to eliminate particles and contaminants. Similarly, our advanced deposition materials business requires comprehensive capabilities across a number of disciplines, including the synthetization of unique molecules, specialized knowledge of how to purify these materials and the capability to safely transport and deliver them onto the wafer at a high throughput. We seek to utilize our expertise in areas of strategic and increasing importance to semiconductor manufacturers, such as developing advanced materials and ensuring the purity of high-value materials, and our ability to work collaboratively across our three segments enables us to quickly and effectively develop optimized and complementary solutions for our customers.

Operational Excellence. Our strategy is to continue to develop our advanced manufacturing capabilities into a competitive advantage with our customers by conducting our manufacturing operations in a manner that ensures the safety of our employees and of the individuals using our products and by continuing to focus on the other priorities noted in the "—Our Competitive Strengths—Operational Excellence" section above.

Continued Focus on Customers. We view the strong relationships we have with our customers, which include leading logic and memory semiconductor manufacturers, OEMs and semiconductor materials suppliers, as critical to our long-term success. We intend to reinforce and further strengthen these relationships through, among other things, collaborations and joint development. Customer intimacy enables us to respond rapidly and thoroughly to their manufacturing challenges and enables us to bring forth new products that serve existing needs.

Safety. A core component of our strategy is our intense focus on the safety of our employees and of the individuals using our products. With respect to employee safety, we have put in place proactive programs designed to build a culture of safety in our facilities. And while the well-being of our employees is always at the top of our mind, we also design our products with the safety of the people who are using them in mind. To illustrate, our Aramus high-purity bags for biologics are designed to withstand cryogenic temperatures and to not break down in extremely cold environments. By reducing ruptures during transportation, our bags enable the effective distribution of vaccines, including those that may be used in the battle against the COVID-19 pandemic, which may allow quicker access to a vaccine when compared to the use of traditional technologies. Also, our Safe Delivery Source products are designed to minimize potential leaks during transportation and use of hazardous gases, features which provide significant safety, environmental and productivity benefits over traditional high-pressure cylinders.

Corporate Social Responsibility. We are embedding our corporate social responsibility program into our business strategy. Our program is built around the four core pillars of Innovation, Safety, Personal Development and Inclusion and Sustainability. The program includes goals, which are aligned to each of the four pillars, to guide it towards 2030. During 2021, we released our first annual corporate social responsibility report providing a comprehensive overview of our progress toward reaching our 2030 goals and outlining our baseline performance in 2020 across each of the four pillars. The 2020 annual corporate social responsibility report is published on our website at http://www.Entegris.com under "About Us - Corporate Social Responsibility."

Adjacent Markets. We leverage the expertise that we have gained from serving the semiconductor industry to develop products for other industries that employ similar technologies and production processes and that utilize materials integrity management, high-purity fluids and integrated dispense systems. For example, outside of the semiconductor industry our products are used in manufacturing processes for biologics, flat panel displays, high-purity chemicals, solar cells, optical magnetic storage devices, LEDs and products for other life sciences and aerospace applications. We plan to continue to identify and develop products that address needs in adjacent markets. We believe that by utilizing our unique technical capabilities in advanced materials and contamination control and core manufacturing excellence to provide solutions across multiple industries, we are able to increase the total available market for our products and increase our return on R&D investments.

Strategic Acquisitions, Partnerships and Related Transactions. We will continue to pursue strategic acquisitions and business partnerships that enable us to address gaps in our product offerings, secure new customers, diversify into complementary product markets, broaden our technological capabilities and product offerings, access local or regional markets and achieve benefits of increased scale. For example, we strengthened and broadened our specialty chemicals and engineered materials product offerings while also addressing gaps in our portfolio when we acquired BASF's precision microchemicals business in 2021 and Sinmat, Inc., or Sinmat, in 2020 (CMP slurries in hard substrate applications) and Digital Specialty Chemicals, or DSC, and MPD Chemicals, or MPD, in 2019 (specialty chemicals). Similarly, we made several targeted acquisitions to diversify and expand our filtration and purification portfolio with the acquisitions of Hangzhou Anow Microfiltration Co., Ltd., or Anow, in 2019, the SAES Pure Gas business from SAES Getters S.p.A. in 2018, and the water and chemical filtration product line for microelectronics applications from W. L. Gore & Associates, Inc. in 2017. Finally, we added a suite of analytical instruments utilized in chemistry management and monitoring in semiconductor manufacturing processes to our product portfolio with our acquisitions of Global Measurement Technologies, Inc. in 2020 and Particle Sizing Systems, LLC in 2018. Our 2014 acquisition of ATMI, Inc., or ATMI, serves as an example of a strategic transaction that significantly increased our scale, as the acquisition brought a whole new portfolio of technologies and materials products to serve our semiconductor customers. Similarly, our proposed acquisition of CMC would significantly increase our scale and broaden our product and technology portfolio. Further, as the dynamics of the markets that we serve shift, we will reevaluate our existing businesses and may decide to restructure or replace one or more businesses, such as the sale of our small cleaning business in France in 2018 and exiting our small cleaning business in Taiwan in 2020. Finally, we regularly evaluate opportunities for strategic alliances, such as our strategic alliance with Enthone, joint development programs and collaborative marketing efforts with key customers and other industry leaders. For example, we have agreements with local partners to expand our capability to manufacture certain specialty chemical and deposition products locally and shorten our supply chain for our customers in China.

OUR SEGMENTS

Our business is organized and operated in three segments which align with the key elements of the advanced semiconductor manufacturing ecosystem: Specialty Chemicals and Engineered Materials, or SCEM; Microcontamination Control, or MC; and Advanced Materials Handling, or AMH. We leverage our expertise from these three segments to create new and increasingly integrated solutions for our customers. The following is a detailed description of our three segments.

SPECIALTY CHEMICALS AND ENGINEERED MATERIALS SEGMENT

The SCEM segment provides high-performance and high-purity process chemistries, gases and materials that enhance our customers' product performance. These materials are utilized in critical semiconductor manufacturing processes such as deposition, cleaning and integration of complex process materials. Advanced materials, delivered at high purity, are critical to enabling the performance of leading-edge logic and memory applications. We believe the growing demand in the advanced logic and memory market, challenges with metallization schemes and the need for specialized cleaning solutions will drive demand in our SCEM segment. In conjunction with products from our MC and AMH segments, the materials that our SCEM segment produces provide unique solutions to safely and efficiently deliver critical materials to support semiconductor and other advanced manufacturing processes. In addition, certain of the materials that our SCEM segment provides allow for enhanced product performance for our customers in aerospace, medical, pharmaceuticals and other high-technology intensive material segments.

Specialty Gas Products. Our specialty gas solutions provide advanced safety and process capabilities to semiconductor, display and solar panel manufacturers. Our SDS cylinders store and deliver hazardous gases, such as arsine, phosphine, germanium tetrafluoride and boron trifluoride, at sub-atmospheric pressure through the use of our proprietary carbon-based adsorbent materials. These products minimize potential leaks during transportation and use and allow more gas to be stored in the cylinder, features which provide significant safety, environmental and productivity benefits over traditional high-pressure cylinders. New generations of SDS products further increase the gas storage capacity, reducing tool down time and thereby generating significant cost savings for our customers. We also offer VAC, a complementary technology to SDS, where select implant gases and gas mixtures are stored under high pressure but are delivered sub-atmospherically.

Specialty Materials Products. Our specialty materials include specialized graphite, silicon carbide and a variety of unique, high purity coatings for dry or plasma etch, chemical vapor deposition and ion implant applications. Our POCO® premium graphite is used to make precision consumable electrodes for electrical discharge machining, hot glass contact materials for glass product manufacturing and forming and other consumable products for various industrial applications, including aerospace, optical, medical devices, air bearings and printing. Our high-performance specialty coatings, such as our Pegasus™ and Cearus™ coatings, provide erosion resistance, minimize particle generation and prevent contamination on critical components in semiconductor environments and other high-technology manufacturing operations. Our specialty materials provide customized solutions for applications challenged with unique temperature, corrosive, chemical or process environments, such as electrostatic chucks used to hold wafers during processing, plasma etch chamber components, aircraft bearings and ultrasonic transducers.

Advanced Deposition Materials Products. Our advanced deposition materials include advanced liquid, gaseous and solid precursors that are incorporated in CVD and ALD processes by the semiconductor industry, including organometallic precursors for the deposition of tungsten, titanium, cobalt and aluminum containing films and organosilane precursors for the deposition of silicon oxide and silicon nitride films. These precursors are designed in close collaboration with OEM process tool manufacturers and device makers to produce application specific solutions that are compatible with complex integrations of material solutions used to build the semiconductor device. We offer delivery systems and containers that allow for reliable storage and delivery of low volatility solid and liquid precursors required in ALD processes. When combined with our proprietary corrosion-resistant coatings and filtration solutions from our MC segment, our advanced deposition materials enable the industry's highest purity levels, resulting in improved device performance.

Surface Preparation and Integration Products. We offer a range of materials used to prepare the surface of a semiconductor wafer during the manufacturing process and to integrate with materials being used on the wafer. We offer a broad range of cleaning solutions for applications such as semiconductor post-etch residue removal, wafer etching, organics removal, negative resist removal, edge bead removal and corrosion prevention. Our wet chemistry solutions, combined with filtration solutions from our MC segment and fluid handling solutions from our AMH segment, provide enhanced purity, which results in improvements in our customers' processes. Our consumable polyvinyl alcohol roller brush products are used to clean the wafer following the CMP process, and our pad conditioners, based on our silicon carbide capabilities, lengthen CMP pad life. Through the acquisitions of BASF's precision microchemicals business and Sinmat, we now offer slurry products used for polishing ultra-hard surface materials, including SiC and GaN substrates, which are utilized in the power electronics and advanced communications end-markets. We also provide advanced plating solutions, such as our Viaform® product (a trademark of and exclusively licensed from Element Solutions, Inc.), which includes inorganic and proprietary organic molecules that provide the wiring for copper interconnects.

Specialty Chemicals. Our specialty chemicals include advanced liquid and solid materials, which are used in a range of high-performance material applications ranging from medical devices to materials used in semiconductor applications. Our product solutions include organometallic and organosilane materials used in semiconductor device manufacturing, monomers and polymers used in the manufacture of medical devices, polyolefin catalysts used in the manufacture of polyethene and polypropylene, chromic materials used in security dyes and inks, isotopic ally labeled materials used in clinical diagnostics and a range of materials used in the manufacture of pharmaceutical ingredients. In addition, our specialty chemicals business provides materials to a number of our other businesses to enable advanced performance of final product solutions.

MICROCONTAMINATION CONTROL SEGMENT

The MC segment offers solutions to purify critical liquid chemistries and process gases used in semiconductor manufacturing processes and other high-technology industries. The design and performance of our liquid and gas filtration and purification products are important to the semiconductor manufacturing process because they remove contamination, directly reduce defects, improve manufacturing yield and enhance the long-term reliability of the semiconductor device. Our proprietary filters remove organic and inorganic nanometer-sized contaminants from various fluids and gases used in the manufacturing process, including photolithography, deposition, planarization and surface etching and cleaning. As our customers leverage leading-edge lithography tools and multi-patterning technology to enable each subsequent generation of products, our filtration and purification products are utilized to achieve necessary levels of purity and contamination control. We believe demand for purification and filtration products is being driven by the continuous node shrink in logic semiconductors and the ramp in the 3D NAND market, as the risk of yield loss grows with the incremental manufacturing steps needed for the production of these devices. We utilize expertise from the AMH segment in polymer science and from the SCEM segment in formulated cleaning chemistries to develop differentiated filtration and purification solutions for our customers.

Liquid Microcontamination Control Products. We offer a variety of products that control contaminants in our customers' wet processes. For example, our Torrento® series of filters is used for the filtration of aggressive acid and base chemistries for both semiconductor fabs as well as specialty chemical manufacturers, including our SCEM segment. Manufacturers of high purity chemicals and semiconductor fabs use our Trinzik® and Microgard™ products for the filtration of chemicals and ultra-pure water. Our Impact® series of filters are used in point-of-use photochemical dispense applications, including those provided by our AMH segment, where the delivery of superior flow rate performance and reduced microbubble formation is critical. Our Protego® series of liquid purifier/filter products are used to reduce metallic contamination in chemical manufacturing and in critical wafer rinsing and drying applications by our customers. In addition, we provide membrane and liquid filtration offerings serving semiconductor, pharmaceutical and medical applications.

Gas Microcontamination Control Products. We offer a broad portfolio of products designed to remove particulate and molecular contaminants from controlled environments and gas streams in semiconductor, flat panel display and LED fabs. Our

Wafergard® gas filters reduce outgassing and remove particle contamination. Our GateKeeper® gas purifiers and large facility-wide gas purification systems provide continuous purified gas supply to customer fabs from the point of creation on the gas pads to the point-of-use at the wafer by chemically reacting and absorbing contaminants, effectively removing gaseous contaminants down to part-per-trillion levels. Our Chambergard™ gas diffusers provide semiconductor equipment manufacturers with the capability to rapidly vent their tools to atmosphere to dramatically reduce process cycle times without adding particles to the wafers. In addition, our Vaporsorb products are used to eliminate airborne molecular contamination from critical process tool areas or cleanrooms in the fab. These products are used in or alongside critical processing tools to improve yield and reduce tool downtime.

ADVANCED MATERIALS HANDLING SEGMENT

The AMH segment develops solutions to monitor, protect, transport and deliver critical liquid chemistries, wafers and substrates for a broad set of applications in the semiconductor and other high-technology industries. These systems and products improve our customers' yields by protecting wafers from abrasion, degradation and contamination during manufacturing and transportation and by assuring the consistent, clean and safe delivery of advanced chemicals from the chemical manufacturer to the point-of-use in the semiconductor fab. The AMH segment collaborates closely with our SCEM segment in developing products that are compatible with advanced chemistries to enhance yields and integrates liquid filtration technology from our MC segment to deliver consistent and pure chemistry.

Microenvironment Solutions. We lead the market with our high-volume line of Ultrapak® and Crystalpak® products for wafers ranging from 100 to 200 millimeter, which ensure the clean and secure transport of wafers from the wafer manufacturers to the semiconductor fabs. We also offer a front-opening shipping box, or FOSB, for the transportation and automated interface of 300 millimeter wafers. We lead the market for 300 millimeter front-opening unified pods, or FOUPs, wafer transport and process carriers and standard mechanical interface pods, or SMIF pods, for 200 millimeter wafer applications. These microenvironment products safely and accurately deliver wafers within the semiconductor fab environment to the various process fabrication steps. We are a leader in reticle protection products for photolithography, including products that protect the high-value EUV lithography masks during both the mask manufacturing process and their use in the semiconductor fab.

Fluid Management Products. We offer various fluid management products that cover a range of applications, including liquid packaging, fluid handling and process monitoring products. Our broad portfolio of flexible and rigid polymer packaging and container products, from low-volume containers to transport high-value photoresist chemistries, such as our NOWPak® products, to large intermediate bulk containers allow our customers to safely and efficiently transport chemicals in bulk, such as our FluoroPure® products. Our connection systems provide safe and efficient chemical dispense from the container to the fab. Chemical companies utilize our packaging products to ensure the purity of chemistries shipped to semiconductor fabs, resulting in enhanced yields.

In addition, we are a leader in high-purity fluid handling products such as valves, fittings, tubing, pipe, custom fabricated products and associated connection systems, such as our PrimeLock® connections, for high-purity chemical applications and our proprietary digital flow control technology improving the uniformity of chemicals applied on wafers. Our IntelliGen® integrated, high-precision liquid dispense systems enable the uniform application of advanced chemistries during the wafer fabrication process, integrating our valve control expertise with filter device technologies from our MC segment, in order to conserve high-value chemistry and reduce defects on wafers. Our comprehensive product lines provide our customers with a single-source provider for their high-purity chemical management needs throughout the manufacturing process.

Further, we provide market-leading instrumentation solutions to ensure consistency of complex blended chemistries and CMP slurries. For example, our Single Particle Optical Sizing technology accurately determines particle size and counts. We also produce on-tool process monitoring systems that perform automated online particle size and/or counts analysis of suspensions with the Accusizer® system. These applications include real-time monitoring of CMP slurries and other instrumentation for liquid applications in both semiconductor and life science industries. Our SemiChem® systems and Invue® products measure chemical concentration in CMP slurries and formulated cleaning chemistries. These process instruments provide our customers critical process monitoring to enable improved semiconductor device yields.

OUR CUSTOMERS AND MARKETS

Our most significant customers include logic and memory semiconductor device manufacturers, semiconductor equipment makers, gas and chemical manufacturing companies and wafer grower companies serving the global semiconductor industry. We also sell our products to flat panel display equipment makers, panel manufacturers, manufacturers of hard disk drive components and devices and their related ecosystems.

Our other high-technology markets include manufacturers and suppliers in the solar and life science industries, electrical discharge machining customers, glass and glass container manufacturers, aerospace manufacturers and manufacturers of biomedical implantation devices.

In 2021, 2020 and 2019, net sales to our top ten customers accounted for 43%, 46% and 43%, respectively, of our combined net sales. In 2021, 2020 and 2019, Taiwan Semiconductor Manufacturing Company Limited, accounted for $272 million, $208 million and $187 million of our net sales, respectively, or approximately 12%, 11% and 12% of our net sales, respectively, including sales from each of our three reporting segments. In addition, in 2021, 2020 and 2019, Samsung Electronics Co. accounted for $199 million, $172 million and $128 million of our net sales, respectively, or approximately 9%, 9% and 8% of our net sales, respectively, including sales from all of the Company's segments. International net sales represented approximately 77%, 75% and 76%, respectively, of our total net sales in 2021, 2020 and 2019.

We may enter into supply agreements with our customers. These agreements generally have a term of one to three years, but typically do not contain any long-term purchase commitments. Instead, we work closely with our customers to develop non-binding forecasts of the future volume of orders. However, customers may cancel their orders, change production quantities from forecasted volumes or delay production for reasons beyond our control.

SALES, MARKETING AND SUPPORT

We sell our products worldwide, primarily through our direct sales force and strategic independent distributors located in all major semiconductor markets. Independent distributors are also used in other market territories and for specific market segments. As of December 31, 2021, our sales and marketing force consisted of approximately 630 employees worldwide.

Our unique capabilities and long-standing industry relationships have provided us with the opportunity for significant collaboration with our customers at the product design stage, which has facilitated our ability to introduce new materials and new solutions that meet our customers' needs. We are constantly seeking to identify for our customers a variety of materials, contamination and process control challenges that may be addressed by our product solutions. Our sales representatives provide our customers with worldwide technical support and information about our products and materials.

We believe that our technical support services are important to our sales and marketing efforts. These services include assisting in defining a customer's needs, evaluating alternative products and materials, designing a specific system to perform the desired operation, training users and assisting customers in compliance with relevant government regulations. Additionally, our field application engineers, located in all of the major markets we serve, work directly with our customers on product qualification and process improvements in their facilities. We maintain a network of service centers, applications laboratories and technology centers located in all key markets internationally and in the United States to support our products and our customers with their advanced development needs, provide local technical service, application support and ensure fast turnaround time.

COMPETITION

The market for our products is highly competitive. While price is an important factor, we compete primarily on the basis of the following factors:

- technical expertise;
- product quality and performance;
- advanced manufacturing capabilities;
- total cost of ownership;
- historical customer relationships;
- breadth of product line;
- breadth of geographic presence;
- customer service and support; and
- after-sales service.

We believe that we compete favorably with respect to the factors listed above. We believe that our key competitive strengths include our broad product line, our strong research and development infrastructure and investment, our manufacturing excellence, our advanced quality control systems, the low total cost of ownership of our products, our ability to provide our customers with quick order fulfillment and our applications expertise in semiconductor manufacturing processes. However, our competitive position varies depending on the market segment and specific product areas within these segments. While we have longstanding relationships with a number of semiconductor and other electronic device manufacturers, we still face significant competition from companies that also have longstanding relationships with other semiconductor and electronic device manufacturers and, as a result, have been able to have their products specified by those customers for use in manufacturers' fabrication facilities.

The competitive landscape is varied, ranging from large multinational companies to small regional or regionally-focused companies. While product quality and technology remain critical, overall, industry trends are indicating a shift to localized, cost-competitive and consolidated supply chains.

Because of the unique breadth of our capabilities, we believe that there are no global competitors that compete with us across the full range of our product offerings. Many of our competitors are local companies that participate in only a few products or in specific geographies. While there are other larger, broad-based materials suppliers, many are concentrated in specific product areas, such as filtration, specialty chemicals or materials handling. Notable competitors with respect to certain specific product areas include Pall Corporation (part of Danaher Corporation), Shin-Etsu Polymer Co., Ltd., Gemu Valves, Inc., Tokyo Keiso Co., Ltd., Mersen, the EMD Performance Materials division of Merck KGaA, E. I. du Pont de Nemours and Company, Air Liquide, Praxair, Inc. (a subsidiary of Linde plc.), Donaldson Company, Inc. and Parker Hannifin Corp.

ENGINEERING, RESEARCH AND DEVELOPMENT

We believe that technology is important to the success of our businesses, and we plan to continue to devote significant resources to engineering, research and development, or ER&D, balancing efforts between shorter-term market needs and longer-term investments. As of December 31, 2021, we had approximately 1,050 employees in ER&D. We have supplemented and may continue to supplement our internal research and development efforts by licensing technology from third parties and/or acquiring rights with respect to products incorporating externally owned technologies. Our R&D expenses consist of personnel and other direct and indirect costs for internally funded project development, including the use of outside service providers.

We believe we have a rich pipeline of development projects. Our ER&D efforts are directed toward developing and improving our technology platforms for semiconductor and advanced processing applications and identifying and developing products for new applications, often working directly with our customers to address their particular needs.

We have ER&D capabilities in the United States, Canada, China, Japan, South Korea, Taiwan, Singapore and Malaysia to meet the global needs of our customers. We use sophisticated methodologies to research, develop and characterize our materials and products. Our capabilities to test and characterize our materials and products are focused on continuously reducing risks and threats to the integrity of the critical materials that our customers use in their manufacturing processes.

In addition, we collaborate with leading universities and industry consortia, such as the University of California, Yale University, Pennsylvania State University, the Interuniversity Microelectronics Center (imec®) and CEA-LETI. We undertake this work to extend the reach of our internal R&D and to gain access to leadership ideas and concepts beyond the time horizon of our internal development activities.

PATENTS AND OTHER INTELLECTUAL PROPERTY RIGHTS

As of December 31, 2021, we owned approximately 2,840 active patents worldwide, of which about 630 were United States patents. Additionally, we owned about 1,300 pending patent applications globally. In addition, we license certain patents owned by third parties. We rely on a combination of patent, copyright, trademark and trade secret laws and license agreements to establish and protect our proprietary rights. We seek to refresh our intellectual property on an ongoing basis through continued innovation. While we license and expect to continue to license technology used in the manufacture and distribution of products from third parties, we do not consider any particular patent or license to be material to our business.

We vigorously protect and defend our intellectual property. We require each of our employees, including our executive officers, to enter into agreements with us pursuant to which the employee agrees to keep our proprietary information confidential and to assign to us inventions made during the course of employment. We also require outside scientific collaborators, sponsored researchers and other advisors and consultants who are provided confidential information to execute confidentiality agreements with us. These agreements generally provide that all confidential information developed or made known to the entity or individual during the course of the entity's or individual's relationship with the Company is to be kept confidential and not disclosed to third parties except in specific limited circumstances.

MANUFACTURING

Our customers rely on our products and materials to ensure the integrity of the critical materials used in their manufacturing processes by providing purity, cleanliness, consistent performance, dimensional precision and stability. Our ability to meet our customers' expectations, combined with our substantial investments in worldwide manufacturing capacity, position us well to respond to the increasing demands from our customers for yield-enhancing materials and solutions.

To meet our customers' needs worldwide, we have established an extensive global manufacturing network with facilities in the United States, Canada, Japan, Taiwan, Malaysia, South Korea and China. Because we work in an industry where contamination control is paramount, we maintain Class 100 to Class 10,000 cleanrooms for manufacturing and assembly. We believe that our worldwide advanced manufacturing capabilities are important competitive advantages. These include:

- engineered polymer conversion and processing;
- advanced membrane modification and cleaning;
- chemical distillation, synthesis and purification;
- gas delivery systems;
- high-purity gas handling and transfilling;
- high-purity materials packaging;
- membrane casting;
- cartridge manufacturing and assembly;
- specialty coating capabilities;
- solids and powders compounding and handling;
- graphite synthesis;
- blow molding;
- rotational molding;
- machining; and
- assembly.

We have made significant investments in systems and equipment to create innovative products and tool designs, including metrology and 3D printing capabilities for rapid analysis and prototype production. In addition, we use contract manufacturers for certain of our products both in the United States and Asia.

RAW MATERIALS

Our products are made from a wide variety of raw materials that are generally available from multiple sources of supply. While we seek to have several sources of supply for raw materials, certain materials included in our products, such as certain filtration membranes in our MC segment, petroleum coke and specialty and commodity chemicals in our SCEM segment and certain polymer resins in our AMH segment, are obtained from a single source or a limited group of suppliers or from suppliers in a single country. We have entered into multi-year supply agreements with a number of suppliers for the purchase of raw materials in the interest of supply assurance and to control costs.

GOVERNMENTAL REGULATION

Our operations are subject to federal, state and local regulatory requirements relating to environmental, waste management and health and safety matters, including measures relating to the release, use, storage, treatment, transportation, discharge, disposal and remediation of contaminants, hazardous substances and wastes, as well as practices and procedures applicable to the construction and operation of our plants. Although some risk of costs and liabilities related to these matters is inherent in our business, as with many similar businesses, we believe that our business is operated in substantial compliance with applicable regulations. However, new, modified or more stringent requirements or enforcement policies could be adopted, which could adversely affect us. While we expect that capital expenditures will be necessary to ensure that any new manufacturing facility is in compliance with environmental and health and safety laws, we do not expect these expenditures to be material.

HUMAN CAPITAL RESOURCES

We believe that our employees are a critical asset in achieving our mission of helping our customers improve their productivity, performance and technology by providing enhanced materials and process solutions for the most advanced manufacturing environments. In order to attract and retain top talent, we are focused on creating a diverse, inclusive and safe workplace and are committed to providing competitive total rewards and quality development and training opportunities for our employees.

As of December 31, 2021, we had approximately 6,850 employees, of whom approximately 53%, 18%, 9%, 7%, 6%, 5% and 2% are located in North America, Southeast Asia, Japan, China, South Korea, Taiwan and Europe, respectively. Given the variability of business cycles in the semiconductor industry and the quick response time required by our customers, it is critical that we be able to quickly adjust the size of our production staff to maximize efficiency. Therefore, we use skilled temporary labor as required. None of our employees is represented by a labor union or covered by a collective bargaining agreement other than statutorily mandated programs in certain international jurisdictions.

Culture. Our organization is built around what we call our PACE values: our core values of treating people with respect and dignity, acting honestly and consistently, encouraging creativity and innovation and a dedication to excellence. We believe that by continuing to focus on these values, we provide our employees with a positive work environment that encourages them to continue innovating.

We regularly conduct surveys of our employees to understand their perspectives on a number of topics. During 2021, these topics included commitment to Entegris' core values, safety and general employee satisfaction. Management uses the information gathered from these surveys to inform its decision making with respect to employee matters, aiming to continue to be an employer of choice in our industries.

Diversity and Inclusion. We believe that maintaining a culture of diversity and inclusion helps enable us to innovate more effectively. To that end, we seek to promote diverse perspectives throughout our organization and are an equal opportunity employer committed to making employment decisions without regard to race, religion, national or ethnic origin, sex, sexual orientation, gender identity or expression, age, disability, protected veteran status or other characteristics protected by law.

Our commitment to diversity and inclusion is evidenced by the creation and support of our Employee Networks, which are networks of our employees who share a common interest and are designed to advance diversity and inclusion and to promote our workplaces as environments where all individuals are valued for their talents and empowered to reach their fullest potential. As of December 31, 2021, our Employee Networks included groups focused on gender identity, sexual orientation, age and veteran status.

Health, Safety and Wellness. Our success depends on the well-being of our employees. We maintain a culture focused on safety and strive to identify, eliminate and control risk in the workplace in an effort to prevent injury and illness. Our employees have access to a global safety management system and are encouraged to report incidents, near misses or other observations in the system. The system has been widely adopted in our manufacturing locations across the globe, and management uses the information generated by it to set safety-related policies and to set goals for future performance. Further, we provide our employees with a comprehensive benefits package that includes health insurance and other resources that support their physical and mental well-being.

In response to the COVID-19 pandemic, we have taken proactive, aggressive actions to protect the health and safety of our employees, customers, partners and suppliers, consistent with the latest and evolving governmental guidelines. We expect to continue to implement appropriate measures until the COVID-19 pandemic is adequately contained. We continue to monitor the rapidly evolving situation and guidance from international and domestic authorities, including federal, state and local public health authorities, and may take additional actions based on their recommendations or as we otherwise see fit to protect the health and safety of our employees, customers, partners and suppliers.

Total Rewards. We are focused on enhancing our high-performing organization. To achieve this, we seek to attract and retain talented employees by providing compelling total rewards, encompassing pay, benefits and other programs, that enrich our employees, both personally and professionally. Our total rewards program is designed to be attractive and competitive and to enable our employees to reach their highest potential by directly impacting their financial security, career growth opportunities and the health and well-being of them and their families.

Talent Development and Training. We are committed to the continued development and training of our employees. We conduct formal evaluations with each of our employees on an annual basis, and managers provide feedback directly to employees through informal review sessions periodically throughout the year. Our formal evaluation process requires employees to track whether they met certain development goals that are set at the beginning of the review period. While we continue to search for new perspectives and insights with external hires, we also seek to provide opportunities for our employees to grow their careers and regularly fill open vacancies with internal candidates. In addition, management periodically assesses succession planning for certain key positions and reviews our workforce to identify high potential employees for future growth and development.

We also provide formal and informal training opportunities for our employees covering a variety of professional, technical and leadership topics. Our training opportunities are designed to promote learning across all levels of our organization, and in 2021 our formal training offerings included management trainings and the development of both technical and soft skills.

OUR HISTORY

The Company was incorporated in Delaware on March 17, 2005 in connection with a merger between Entegris, Inc., a Minnesota corporation, and Mykrolis Corporation, a Delaware corporation. On April 30, 2014, the Company acquired ATMI, based in Danbury, CT. Entegris has been helping its customers solve their critical materials challenges and enhance their manufacturing yields for over 50 years, tracing its corporate origins back to Fluoroware, Inc., which began operating in 1966.

AVAILABLE INFORMATION

Our Internet address is www.entegris.com. On this website, under the “About Us—Investor Relations—Financial Information” section, we post the following filings as soon as reasonably practicable after they are electronically filed with, or furnished to, the U.S. Securities and Exchange Commission, or SEC: our annual, quarterly, and current reports on Forms 10-K, 10-Q, and 8-K; our proxy statements; any amendments to those reports or statements, and Form SD. All such filings are available on our website free of charge. The SEC also maintains a website (www.sec.gov) that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC. The content on our website and any other website as referred to in this Form 10-K is not incorporated by reference into this Form 10-K unless expressly noted.

Item 1A. Risk Factors.

In addition to the other information in this Annual Report on Form 10-K, the following risk factors should be carefully considered in evaluating us and our common stock. Any of the following risks, many of which are beyond our control, could materially and adversely affect our financial condition, results of operations or cash flows or cause our actual results to differ materially from those projected in any forward-looking statements. We may also face other risks and uncertainties that are not presently known, are not currently believed to be material or are not identified below because they are common to all businesses. Past financial performance may not be a reliable indicator of future performance and historical trends should not be used to anticipate results or trends in future periods. For more information, see "Cautionary Statement" in Item 7 of this Annual Report on Form 10-K.

Risk Factor Summary

Risks Related to Our Business and Industry

- The impact of the COVID-19 pandemic.
- The impact of declines in industry or worldwide economic conditions.
- Variability of revenues and operating results.
- The evolving nature of the industries we serve and the impact of changes in products and technology.
- Supply chain risks.
- Operation of a global business.
- The impact of tariffs, export controls and other trade laws and restrictions, especially with respect to China.
- Customer concentration.
- Continuing innovation and introduction of new products.
- Risks related to competition.
- Our ability to successfully acquire other business, form joint ventures or divest businesses.
- The impact of disruptions to our operations.
- The use of hazardous materials in our operations.
- Loss of key employees.
- Our ability to obtain, protect and enforce intellectual property rights.
- The impact of information technology system failures, network disruptions and breaches in data security.
- The impact of climate change.

Risks Related to Government Regulation

- The impact of environmental laws and regulations.
- Risks related to the regulatory environment.
- Changes in taxation or adverse tax rulings.

Risks Related to Our Indebtedness

- The impact of our indebtedness.
- Restrictions on our operations as a result of the terms of the Credit Agreement.

Risks Related to Owning our Common Stock

- The volatility of the price of our common stock.
- Changes in capital allocation strategy.
- Provisions in our charter documents and Delaware law may delay or prevent an acquisition of us.

Risks Related to Our Pending Merger with CMC Materials, Inc.

- Failure to complete the merger and termination thereof.
- The impact of the merger on the market price of shares of our common stock.

- Restrictions on our operations until the completion of the merger.
- Employee-related risks, including retention.
- Retention of customers or suppliers.
- Risks related to debt of the combined company.

Risks Related to Our Business and Industry

The COVID-19 pandemic and continuing governmental responses could materially adversely affect our financial condition and results of operations.

The COVID-19 pandemic continues to impact the global economy and cause significant macroeconomic uncertainty. Infection rates vary across the countries in which we operate. As we are currently experiencing with the omicron variant, there may be additional waves of infection, which could be more contagious than prior waves. We have taken proactive measures to protect the safety of our employees at all of our global facilities. Governmental authorities continue to implement numerous and constantly evolving measures to try to contain the virus, such as travel bans and restrictions, masking recommendations and mandates, vaccine recommendations and mandates, limits on gatherings, quarantines, shelter-in-place orders and business shutdowns. Measures providing for business shutdowns have generally excluded certain essential services, including critical infrastructure and the businesses that support that critical infrastructure. While all of our facilities currently remain operational, these measures have impacted and may further impact our workforce and operations, as well as those of our customers, suppliers and other third parties with which we do business. For example, in March 2020 the government of Malaysia issued an order that significantly reduced the number of employees who could be physically present to operate our Malaysian plant, which temporarily reduced the productivity of that plant. During 2021, we experienced brief interruptions in operations at several of our sites across the world.

Constraints and limitations imposed on our operations or modifications on our business practices, or those of our suppliers, may limit our ability to meet customer demand, cause us to increase our safety stock of certain materials, reduce our productivity, slow or diminish our research and development activities, make our products less competitive, or cause our customers to seek alternative suppliers and delay customer qualification activities, any of which could harm our business, reduce our profitability or have a material adverse effect on our financial condition and results of operations. For example, employees working remotely may not be able to maintain the same level of productivity and efficiency and employees may face additional demands on their time, such as increased responsibilities resulting from school closures or the illness of family members. Absenteeism caused by the COVID-19 pandemic may increase in the future and may harm our productivity. We have incurred and may continue to incur incremental compensation expense related to the COVID-19 pandemic. Furthermore, restrictions or disruptions of transportation, such as reduced availability of air transport, port closures and increased border controls or closures, have in certain instances resulted in higher costs and delays both in obtaining materials and shipping finished goods to customers. The pandemic and related restrictions have placed considerable strain on us, our suppliers and other third parties with which we do business. The increased reliance on remote access to information systems by us and our customers, suppliers and other third parties with which we do business increases the risk of exposure of our information and systems to potential cybersecurity breaches. There is no certainty that additional measures required by government authorities or as we determine to be in the best interests of our employees, customers, partners and suppliers will be sufficient to mitigate the risks posed by the virus and we may be unable to respond to the needs of our global business. Furthermore, we cannot predict with certainty the impact that future government, restrictions, mandates or related measures may have on our workforce and operations. These may require significant time and attention from management to implement, increase our operating costs, reduce productivity, result in attrition of our employees or hinder our ability to recruit and retain our employees.

The degree to which COVID-19 impacts our results will depend on future developments, which are highly uncertain and cannot be predicted, including, but not limited to, the duration and spread of outbreaks, their severity, potential additional waves of infection, the emergence of more virulent or more dangerous strains of the virus, the actions to mitigate the virus and its impact, the development, distribution, efficacy and acceptance of vaccines and how quickly and to what extent normal economic and operating conditions can resume. The prolonged implementation, or re-implementation, of measures by governments to try to contain the virus may lead to fatigue in complying with COVID-19 restrictions among the public, which in turn may further exacerbate its spread. Furthermore, the COVID-19 pandemic makes it more difficult for us to forecast demand and provide guidance for upcoming periods. Accordingly, any guidance we provide is likely to be less reliable than usual, and actual results are more likely to differ from any such guidance. In light of the foregoing, investors are urged to put the guidance in context and not to place undue reliance on it.

Declines in the semiconductor industry or worldwide economic conditions may cause demand for our products to decrease and may adversely affect our business.

Declines in industry or worldwide economic conditions may adversely affect our business. Our revenue is primarily dependent upon demand from semiconductor manufacturers, which is largely driven by the current and anticipated demand for electronic products that utilize semiconductors. Despite recent increases in demand for semiconductors in applications such as smartphones, 5G wireless technology, cloud computing, the Internet of Things, machine learning and artificial intelligence, autonomous vehicles and virtual reality, the semiconductor industry has historically been, and is likely to continue to be, cyclical with periodic significant downturns, resulting in significantly decreased demand for products such as ours. While demand for semiconductors has remained robust, the COVID-19 pandemic has significantly increased economic and demand uncertainty and contributed to substantial volatility and inflationary pressure in global markets, including those in which we participate. We anticipate that the pandemic will continue to adversely affect the global economy, and it is possible that it could cause a global recession, each of which may adversely affect our business. We have previously experienced significant revenue deterioration and operating losses due to severe downturns in the semiconductor industry, which often occur suddenly. The semiconductor industry is also affected by seasonal shifts in demand. We are unable to predict the timing, duration or severity of any future downturns in the semiconductor industry. As a result, we could underperform the market or our peers.

During downturns and periods of soft demand, our revenue is reduced and we typically experience greater pricing pressure and shifts in product and customer mix, which often adversely affect our gross margin and net income. Furthermore, to remain competitive, we must maintain a satisfactory level of engineering, research and development activity, invest in our infrastructure and maintain the ability to respond to any increases in demand and, as a result, a lower volume of sales can have a large and disproportionate impact on our profitability. Even moderate seasonality can cause our operating results to fluctuate significantly from one period to the next. Uncertain and volatile economic, political, public health or business conditions in any of our key sales regions can cause or exacerbate negative trends in business and consumer spending and have historically impacted customer demand for our products. These conditions can cause material adverse changes in our results of operations and financial condition, including:

- a decline in demand for our products would have an immediate impact on our revenues;
- an increase in reserves for accounts receivable due to our customers' inability to pay us;
- lower utilization of our manufacturing facilities, which could lead to lower margins;
- an increase in write-offs for excess or obsolete inventory that we cannot sell;
- potential impairment charges relating to goodwill, intangible assets, manufacturing equipment or other long-lived assets, to the extent that any downturn indicates that the carrying amount of the asset may not be recoverable;
- greater challenges in forecasting operating results, making business decisions and identifying and prioritizing business risks; and
- additional cost reduction efforts, including additional restructuring activities, which may adversely affect our ability to capitalize on opportunities.

We anticipate that the ongoing COVID-19 pandemic may cause us to experience at least some of these adverse changes, but we cannot predict the timing or degree to which they will occur, if at all.

Our revenues and operating results are variable.

Our revenues and operating results may fluctuate significantly from quarter-to-quarter or year-to-year due to a number of factors, many of which are outside our control. We manage our expenses based in part on our expectations of future revenues. Because some of our expenses are relatively fixed in the short term, a change in the timing of revenue or the amount of profit we generate from a small number of transactions can unfavorably affect operating results in a particular period. Factors that may cause our financial results to fluctuate unpredictably include:

- economic conditions in the semiconductor industry or in the other industries we serve;
- the impact of the COVID-19 pandemic on the global economy, the semiconductor industry, the other industries we serve, our manufacturing capabilities or our supply chain;
- the size and timing of customer orders;
- consolidation of our customers, which could impact their purchasing decisions and negatively affect our revenues;
- procurement shortages;
- the failure of our suppliers or outsource providers to perform their obligations;
- manufacturing difficulties;

- additional expenses we would expect to incur in our efforts to respond promptly to any supply shortages, manufacturing difficulties or other supplier problems;
- decisions to increase or accelerate our purchasing of raw materials, components or other supplies in an effort to mitigate supply risk;
- customer decisions to decelerate orders in order to draw down their inventory;
- customer cancellations of or delays in shipments, installations or customer acceptances or, alternatively, acceleration of orders from customers to increase their inventory;
- our customers' rate of replacement of our consumable products;
- changes in average selling prices, customer mix and product mix;
- our ability to develop, introduce and market new, enhanced and competitive products in a timely manner;
- our competitors' introduction of new products;
- legal or technical challenges to our products or technologies;
- disruptions in transportation, communication, demand, information technology or supply, including strikes, acts of God, wars, terrorist activities and natural or man-made disasters;
- legal, tax, accounting or regulatory changes (including changes in import/export regulations and tariffs) or changes in the interpretation or enforcement of existing requirements;
- changes in our estimated tax rate; and
- foreign currency exchange rate fluctuations.

The COVID-19 pandemic is likely to exacerbate the adverse impact of many of these factors on our revenues and results of operations, at least in the short term.

The industries we serve are constantly evolving, and any failure to manage our business effectively during periods of rapid change may adversely affect our business performance and results of operations.

Intense competition in the semiconductor industry often leads to rapid changes in products and technology. These changes can significantly alter demand for our products and the amount and mix of customers' spending on our products and solutions can significantly impact our results of operations. Changes in demand may arise from factors such as advances in fabrication processes, new and emerging technologies, end-user demand, customers' production capacity and customers' capacity utilization. We must accurately forecast demand for each of our products and effectively manage our resources and production capacity across our various businesses. Although we regularly reassess our allocation of resources in response to the changing business environment, we may incur unexpected or additional costs to align our operations with demand, If we do not adequately anticipate changes in our business environment, we may lack the infrastructure, manufacturing capacity and resources to scale up our business to meet customer expectations and compete successfully during a period of growth, or we may expand our capacity too rapidly, resulting in excess fixed costs. Even with effective allocation of resources and management of costs, during periods of decreasing demand, our gross margins and earnings will usually be adversely impacted. Especially during transitional periods, resource allocation decisions can have a significant impact on our future performance, particularly if we have not accurately anticipated the correct mix of industry changes. Our success will depend, to a significant extent, on our management's ability to identify and respond to these challenges effectively.

Our ability to increase sales of our products, particularly our capital equipment products, depends in part upon our ability in a very short timeframe to ramp up our manufacturing capacity and to mobilize our supply chain. If we are unable to expand our manufacturing capacity on a timely basis, manage the expansion effectively and obtain larger quantities of raw materials, our customers could obtain products from our competitors, which would reduce our market share, harm our reputation as a trusted partner and impact our results of operations. These challenges have been exacerbated by the COVID-19 pandemic. In 2021, we faced several instances where our manufacturing capacity was constrained and the lead time to manufacture and deliver our customers' products was extended. If we are unable to meet our customers' demand for our products or deliver our products within their required lead times, our customers may seek to replace us with alternative suppliers. Additionally, although we have been increasing inventory levels to support strong demand in a challenging supply chain environment, historically we have operated our business on a just-in-time shipment basis with a modest level of inventory, ordering supplies and planning production based on internal demand forecasts. The failure to accurately forecast demand for our products, in terms of both volume and product type, has in the past led to, and may in the future lead to, delays in product shipments and disappointment of customer expectations, as well as an increased risk of excess and obsolete inventory.

We depend on single and limited source suppliers, and an interruption in our ordinary sources of supply could affect our ability to manufacture our products and have an adverse effect on our results of operations.

We rely on single or limited source suppliers for certain raw materials that are critical to the manufacturing of our products, such as plastic polymers, filtration membranes, petroleum coke and other materials. If we were to lose any one of these sources, it could be difficult for us to find an alternative supplier and we would need to qualify this new source through our customers' rigorous qualification processes. Although we seek to reduce our dependence on single and limited source suppliers, the partial or complete loss of any of these sources could interrupt our manufacturing operations and result in a material adverse effect on our results of operations**.**

At times, we have experienced a limited supply of certain raw materials, which has resulted in delays, lost revenue, increased costs and risks associated with qualifying products that are manufactured using such new raw materials with our customers. Events such as an industry-wide increase in demand for, or the discontinuation of, raw materials used in our products could harm our ability to acquire sufficient quantities of such raw materials, and our manufacturing operations may be interrupted. For example, in 2021 we experienced a disruption in the supply of certain ceramic material for use in our coatings business in our SCEM division when the supplier was unable to produce these materials at the required specifications. When these events occur, we work collaboratively with the supplier to determine the root cause and to solve the manufacturing issue in order to reestablish the supply of these materials. We may be unable to successfully reestablish our raw material supply in the future, in which case shortages may adversely affect our operations. Additionally, our suppliers may not have the capacity to meet increases in our demand for raw materials, in turn, making us unable to meet demand from our customers. Prices for our raw materials can vary widely. While we have long-term arrangements with certain key suppliers that fix our price for the purchase of certain raw materials, if the cost of our raw materials increases, as we have seen recently due to inflationary pressure, and we are unable to correspondingly increase the sales price of our products or find other cost savings, our profit margins will decline.

The COVID-19 pandemic has caused a difficult and dynamic supply chain and global logistics environment, and we have experienced instances of raw material constraints and shortages, higher freight costs and delivery delays in both inbound shipments of raw materials and outgoing shipments of finished products to customers. If our suppliers or sub-suppliers are unable to maintain their operations or COVID-19 related restrictions become more severe, we may encounter difficulties obtaining raw materials, which may cause us to fail to meet customer demand or require us to pay higher prices for these materials, either of which could harm our business and profitability. To mitigate the risk of potential supply interruptions from the COVID-19 pandemic, during 2021, we chose to increase certain inventory levels, causing us to hold more inventory than we might have otherwise maintained. Additionally, an economic slowdown caused by the COVID-19 pandemic or otherwise could harm the financial health of our suppliers and sub-suppliers. Although we regularly monitor the financial health of companies in our supply chain, financial hardship on our suppliers or sub-suppliers could cause a disruption in our ability to obtain raw materials or components or adversely affect our operations. We may increase our safety stocks of raw materials or components or alter our payment terms with certain suppliers, including prepaying for raw materials, any of which could put downward pressure on our cash flow.

We are exposed to the risks of operating a global business as a significant amount of our sales and manufacturing activity occur outside the United States.

Sales to customers outside the United States accounted for approximately 77%, 75% and 76% of our net sales in 2021, 2020 and 2019, respectively. We anticipate that international sales will continue to account for a majority of our net sales. In addition, a number of our key domestic customers derive a significant portion of their revenues from sales in international markets. We also manufacture a significant portion of our products outside the United States and depend on international suppliers for many of our parts and raw materials. We intend to continue to pursue opportunities in both sales and manufacturing internationally. Our international operations are subject to a number of risks and potential costs that could adversely affect our revenue and profitability, including:

- border closures, travel bans, entry limitations or inspections and other restrictions on the international movement of goods, including actions to limit the export of goods in order to secure a domestic supply in light of actual or anticipated global shortages, as well as the potential exercise of governmental power to requisition or prioritize the production of specified goods or to commandeer facilities in the public interest, such as in the effort to combat the COVID-19 pandemic, any of which could adversely affect our ability to obtain supplies and deliver our products to customers;
- the implementation of laws, rules, regulations, policies and other government actions, such as "trade wars," tariffs, sanctions or other changes in international trade requirements that affect our business and that of our customers and suppliers, any of which could impose additional costs on our operations and limit our ability to operate our business;
- challenges in hiring and integrating workers in different countries;

- challenges in managing a diverse workforce with different experience levels, languages, cultures, customs, business practices and worker expectations, along with differing employment practices and labor issues;
- challenges of maintaining appropriate business processes, procedures and internal controls and complying with legal, environmental, health and safety, anti-bribery, anti-corruption and other regulatory requirements that vary by jurisdiction, including new and evolving requirements for social distancing and other measures to minimize the spread of COVID-19;
- challenges in developing relationships with local customers, suppliers and governments;
- fluctuating pricing and availability of raw materials and supply chain interruptions or slowdowns, including as a result of difficulties, financial or otherwise, faced by segments of the transportation industry;
- public health crises, such as the COVID-19 pandemic;
- expense and complexity of complying with U.S. and foreign import and export regulations, including the ability to obtain required import and export licenses;
- fluctuations in interest rates and currency exchange rates, including the relative strength or weakness of the U.S. dollar against foreign currencies that are important to our business, including the Japanese yen, euro, Taiwanese dollar, Korean won, Chinese renminbi, Singapore dollar, Malaysian ringgit, Canadian dollar or Israeli shekel, which could cause our sales and profitability to decline;
- liability for foreign taxes assessed at rates higher than those applicable to our domestic operations;
- challenges and costs associated with the protection of our intellectual property throughout the world;
- customer or government efforts to encourage operations and sourcing in a particular country, such as Korea or China, including efforts to develop and grow local competitors, require local manufacturing, and provide special incentives to government-backed local customers to buy from local competitors; and
- political and economic instability and uncertainty, which may result in severely diminished liquidity and credit availability, rating downgrades of sovereign debt, declining valuation of certain investments, declines in consumer confidence, declines in economic growth, volatility in unemployment rates and uncertainty about economic stability.

In the past, these factors have disrupted our operations and increased our costs, and we expect that these factors will continue to do so in the future.

Tariffs, export controls and other trade laws and restrictions resulting from international trade disputes, strained international relations and changes to foreign and national security policy, especially as they relate to China, could have an adverse impact on our operations.

Tariffs, additional taxes, trade barriers and other measures, particularly those arising out of relations between the United States and China, may increase costs of raw materials and our manufacturing costs, decrease margins, reduce the competitiveness of our products or inhibit our ability to sell products or purchase necessary equipment and supplies, any of which could have a material adverse effect on our business, results of operations or financial condition. For example, both the United States and China have implemented several rounds of tariffs and retaliations with respect to certain products imported from the other country, some of which have impacted certain raw materials we use. We have made operational changes in an effort to mitigate the impact of these tariffs on our products, but our efforts may not be successful.

In addition, we are subject to export control and economic sanctions laws and regulations that restrict the delivery of some of our products and services to certain end users, countries and nationals of certain countries. In certain circumstances, these restrictions may prohibit the transfer of certain of our products, services and technologies, and in other circumstances they may require us to obtain a license from the U.S. government before delivering the controlled item or service. We must also comply with export control and economic sanctions laws and regulations imposed by other countries. Although we maintain an export and trade control compliance program, it may be ineffective or circumvented, exposing us to legal liabilities. Compliance with these laws could significantly limit our sales in the future. Changes in, and responses to, U.S. trade controls could reduce the competitiveness of our products and cause our sales to drop, which could have a material adverse effect on our business, financial condition and results of operations.

In addition to the tariffs mentioned above, over the last several years, the U.S. government has significantly expanded export controls on certain technologies and commodities to certain markets, particularly with respect to semiconductor and other high technology exports to China. For example, effective June 29, 2020, the U.S. Department of Commerce imposed new export controls on the transfer of many U.S. products and technologies, including many commercial-grade electronics, to “military end users” in China, a term which may include many Chinese commercial companies that sell products to or do business with the military. Likewise, beginning in May 2019, the U.S. Department of Commerce imposed significant restrictions on the transfer of any products from the United States, as well as many products produced overseas that incorporate U.S. content or rely on U.S. software or technology, to Huawei Technologies Co., Ltd. and several of its overseas affiliates, including HiSilicon, and took similar action against Semiconductor Manufacturing International Corporation in December 2020. The U.S. Department of Commerce continues to impose similar export-related restrictions against other Chinese companies for their support of the military, for business activities, including supply chain activities, related to the Xinjiang region of China, and for other actions found to be contrary to U.S. national security or foreign policy. The U.S. government also continuously assesses which “emerging and foundational technologies” warrant new or additional controls, which could subject additional U.S.-origin products and services to more stringent export restrictions. It is possible that these modified regulations, and any future regulations, could reduce demand for our products. As a result of these restrictive measures, certain of our customers have made efforts to source products domestically in order to mitigate perceived risks to their supply chain. If these efforts are successful, are widespread amongst our customers and expand to our products and solutions broadly, overall global demand for our customers’ products or for other products produced or manufactured in the United States or based on U.S. technology may be reduced, in turn reducing demand for our products, which could have a material adverse effect on our business, financial condition and results of operations. Such risks may be especially exacerbated as they relate to China, a market that is important to our business, representing approximately 16% of our sales in 2021.

A significant portion of our sales is concentrated on a limited number of key customers, and our net sales and profitability may materially decline if we were to lose one or more of these customers.

Sales to a limited number of large customers constitute a significant portion of our overall revenue, shipments, cash flows, collections and profitability. Our top ten customers accounted for 43%, 46% and 43% of our net sales in 2021, 2020 and 2019, respectively. Our customers could stop using our products in their manufacturing processes with limited advance notice to us, and we would have limited or no contractual recourse. The cancellation, reduction or deferral of purchases of our products by any one of these customers could significantly reduce our revenues in any particular quarter. If we were to lose any of our significant customers, if our products are not specified for our significant customers’ products or if we suffer a material reduction in their purchase orders, our revenue could decline and our business, financial condition and results of operations could be materially and adversely affected. Due to the long design and development cycle and lengthy customer product qualification periods required for most of our products, we may be unable to replace these customers quickly, if at all.

Furthermore, the semiconductor industry has been undergoing, and is expected to continue to undergo, consolidation. If any of our customers merge or are acquired, we may experience lower overall sales from the merged or combined companies. In addition, our principal customers also hold considerable purchasing power and may be able to negotiate sales terms that result in decreased pricing, increased costs, and/or lower margins for us, and limitations on our ability to share jointly developed technology with others.

If we are unable to anticipate and respond to rapid technological change and customer requirements by continuing to innovate and introduce new and enhanced products and solutions, our business could be seriously harmed.

The semiconductor industry is subject to rapid technological change, changing customer requirements and frequent new product introductions. In our industry, the first company to introduce an innovative product that addresses an identified market need will often have a significant advantage over competing products. For this reason, we make significant expenditures to research, develop, engineer and market new products and make significant capital investments in technology and manufacturing capacity in anticipation of future business and without any purchase commitment from our customers. We incurred $167.6 million, $136.1 million and $121.1 million for engineering, research and development expense in 2021, 2020 and 2019, respectively, to support new product and technology development. Following development, it may take several years for sales of a new product to reach a substantial level, if ever. If a product concept does not progress beyond the development stage or only achieves limited acceptance in the marketplace, we may not receive a direct return on our expenditures, we may lose market share and our revenue and our profitability may decline. For example, in the past, we incurred significant impairment charges for capital expenditures related to developing the capability to manufacture shippers and FOUPs for 450 mm wafers, which major semiconductor manufacturers announced that they would not initiate manufacturing for in the foreseeable future.

We believe that our future success will depend upon our ability to continue to develop mission-critical solutions to maximize our customers’ manufacturing yields and enable higher performance semiconductor devices. A failure to successfully anticipate and respond to technological changes by developing, marketing and manufacturing new products or enhancements to our existing products could harm our business prospects and significantly reduce our sales. For example, as 3D NAND technology advances to higher densities, the conventional process used to etch critical features no longer works. Recognizing the need for a new chemistry, we developed a series of prototype formulations for highly selective nitride etch and developed a specialized liquid filter that removes contaminants while simultaneously maintaining the critical components that make the chemistry function. While we have achieved process-of-record for these specific etch processes with certain customers and we are preparing for rapid, high-volume ramp, we may not generate significant revenue from these solutions. We cannot assure you that the new products and technology we choose to develop and market will be successful. In addition, if new products have reliability or quality problems, we may experience reduced orders, higher manufacturing costs, delays in acceptance and payment, additional service and warranty expense and damage to our reputation.

Competition from new or existing companies could harm our financial condition, results of operations and cash flow.

We operate in a highly competitive industry. We face many competitors, some of which have substantially greater manufacturing, financial, research and development and marketing resources than we do. In addition, some of our competitors may have better-established customer relationships than we do, which may enable them to have their products specified for use more frequently and more quickly by these customers. We also face competition from smaller, regional companies that focus on serving customers in their regions. Further, customers continually evaluate the benefits of internal manufacturing versus outsourcing, and a customer's decision to internally manufacture products that we provide may negatively impact us. If we are unable to maintain our competitive position, we could experience downward pressure on prices, fewer customer orders, reduced margins, the inability to take advantage of new business opportunities and a loss of market share, any of which could have a material adverse effect on our results of operations. Further, we expect that existing and new competitors will improve their products and introduce new products with enhanced performance characteristics. The introduction of new products or more efficient production of existing products by competitors could diminish our market share and increase pricing pressure on our products.

We may acquire other businesses, form joint ventures or divest businesses, which could negatively affect our financial performance.

We intend to continue to engage in business combinations, acquisitions, joint ventures, investments or other types of collaborations to address gaps in our product offerings, adjust our business and product portfolio to meet our ongoing strategic objectives, diversify into complementary markets, increase our scale or accomplish other strategic objectives. These transactions involve numerous risks to our business, financial condition and operating results, including but not limited to:

- experiencing difficulty in identifying suitable acquisition candidates and completing transactions at appropriate valuations, in a timely manner, on a cost-effective basis or at all, due to substantial competition for acquisition targets;
- inability to successfully integrate any acquired businesses into our business operations;
- failure to realize the anticipated synergies or other benefits of any such transaction;
- entering into markets in which we have limited or no prior experience;
- finding acquirors and obtaining adequate value for businesses that no longer meet our objectives;
- inability to complete proposed transactions due to the failure to obtain regulatory or other approvals;
- requirements imposed by government regulators in connection with their review of a transaction, which may include, among other things, divestitures and restrictions on the conduct of our existing business or the acquired business;
- undertaking multiple transactions at the same time in order to take advantage of acquisition opportunities that do arise, which could strain our ability to effectively execute and integrate such transactions;
- diversion of management's attention from our day-to-day business due to dedication of significant management resources to such transactions;
- employee uncertainty and lack of focus during the integration process that may also disrupt our business;
- the risk of litigation or claims associated with a proposed or completed transaction;
- challenges associated with managing new, more diverse and more widespread operations, projects and people, potentially located in regions where we have not historically conducted or operated our business;
- dependence on unfamiliar or less secure supply chains and inefficient scale of the acquired entity;
- increasing costs of performing due diligence to meet the expectations of investors and government regulators;
- despite our due diligence, we could assume unknown, underestimated or contingent liabilities, such as potential environmental, health and safety liabilities, any of which could lead to costly litigation or mitigation actions;
- an acquired technology or product may have inadequate or invalid intellectual property protection or may be subject to claims of infringement by a third party, which may result in claims for damages and lower than anticipated revenue;
- we could experience negative effects on our reported results of operations from dilutive results from operations and/or from future potential impairment of acquired assets, including goodwill, related to acquisitions;

- an acquired company may have inadequate or ineffective internal controls over financial reporting, disclosure controls and procedures, cybersecurity, privacy, environmental, health and safety, anti-bribery, anti-corruption, human resource or other policies or practices, which may require unexpected or additional integration, mitigation and remediation costs;
- reductions in cash or increases in debt to finance transactions, which reduce the cash flow available for general corporate or other purposes, including share repurchases and dividends; and
- difficulties in retaining key employees or customers of an acquired business.

Manufacturing interruptions or delays, or other disruptions to our operations, could adversely affect our business, financial condition and results of operations.

Our manufacturing processes are complex and require the use of expensive and technologically sophisticated equipment and materials. These processes are frequently modified to improve manufacturing yields, process stability and product quality. We have, on occasion, experienced manufacturing difficulties, such as critical equipment breakdowns or the introduction of impurities in the manufacturing process. Any future difficulties could cause lower yields, make our products unmarketable and/or delay deliveries to customers. In addition, any modification to the manufacturing process of a product could require that the product be re-qualified by customers, which can increase our costs and delay our ability to sell this product to our customers. These and other manufacturing difficulties may result in the loss of sales and exposure to warranty and product liability claims.

Some of our products are manufactured at only one or two facilities in different countries, many of which are subject to severe weather events and natural catastrophes, such as typhoons in Taiwan, Malaysia and China, earthquakes in Japan and Taiwan, hurricanes in east Texas and Florida, severe winter weather in Texas, wildfires in California and Colorado and flooding in Arkansas. Our suppliers and customers face similar dangers. Although we have continuity plans designed to mitigate the impact of natural disasters on our operations, those plans may be insufficient, and any catastrophe may disrupt our ability to manufacture and deliver products to our customers, resulting in an adverse impact on our business and results of operations. A disruption at our manufacturing facilities could impact sales of the products manufactured at those facilities until another facility could commence or expand production of those products, and disruptions at our other facilities may similarly adversely affect our operations. In addition to natural disasters, disruptions may be caused by other factors, including civil unrest, outbreaks of disease, terrorist actions or other events outside our control. We have moved, and we may again move, the manufacture of certain products from one plant to another. If we fail to transfer and re-establish the manufacturing processes in the destination plant efficiently and effectively, we may not be able to meet customer demand, we may lose credibility with our customers and our business may be harmed. Even if we successfully move our manufacturing processes, we may not achieve the anticipated levels of cost savings or efficiencies, if any.

Our operations use hazardous materials that expose us to various risks, including potential liability for personal injury and potential remediation obligations.

Our operations involve, and we are exposed to the risks associated with, the use and manufacture of hazardous materials. In particular, we manufacture specialty chemicals, which is an inherently hazardous process that may result in accidents, and store and transport hazardous raw materials, products and waste in, to and from various facilities. Potential risks that may disrupt our operations or expose us to significant losses and liabilities include explosions and fires, chemical spills and other discharges, releases of toxic or hazardous substances or gases, and pipeline and storage tank leaks and ruptures. These and other hazards may result in liability for personal injury, death, damage to property and contamination of the environment; suspension of operations; the imposition of civil or criminal fines, penalties and other sanctions; cleanup costs; claims by governmental entities or third parties; reputational harm; increases in our insurance costs; and other adverse impacts on our results of operations. Moreover, a failure of one of our products at a customer site could interrupt the business operations of the customer. For example, while we believe that our SDS and VAC delivery systems are safe to transport, store and deliver toxic gases, any leakage could cause serious damage, including injury or death, to any person exposed to those toxic gases, potentially creating significant product liability exposure for us. Our insurance coverage may be inadequate to satisfy any such liabilities, and our financial results or financial condition could be adversely affected.

Loss of any of our key personnel could harm our business, and our inability to attract and retain new qualified personnel could inhibit our ability to operate and grow our business successfully.

Many of our key personnel have significant experience in the semiconductor industry and deep technical expertise. The loss of the services of any of our key employees or an inability to attract, train and retain qualified and skilled employees, particularly research and development and engineering personnel, could inhibit our ability to operate and grow our business. As the semiconductor industry has grown in recent years, competition for qualified talent, particularly those with significant industry experience, has intensified. During 2021 we experienced, and may in the future continue to experience, an increasingly competitive and constrained labor market, which may limit our ability to add headcount required to meet our customers' demand, decrease our productivity due to an influx of inexperienced workers and cause our labor costs to increase and our profitability to decline. As a result, the difficulty and costs associated with attracting and retaining employees has risen and may continue to rise.

If we fail to obtain, protect and enforce intellectual property rights, our business and prospects could be harmed.

Our future success and competitive position depend in part upon our ability to obtain, maintain and enforce intellectual property rights. We rely on patent, trade secret and trademark laws to protect many of our major product platforms. Although we often file applications for additional patents, our pending applications may not be approved. Moreover, any patents that we own or obtain may not provide us with any competitive advantage, and these patents may expire or be challenged, invalidated, circumvented, rendered unenforceable or otherwise compromised by third parties. We may not develop additional proprietary technology. In addition, any failure to obtain intellectual property protection in the international jurisdictions we serve could expose us to increased competition, which could limit our growth and future revenue. Although we enter into confidentiality agreements with our employees and certain third parties to protect our proprietary information and technology, these agreements may be inadequate to protect our interests, and the remedies available to us for any breach may not adequately mitigate any breach. Furthermore, third parties may be able to replicate or obtain our confidential and proprietary information and technology through lawful means, and they may also be able to design around our patents. Additionally, we may lose trade secret protection as a result of the actions or omissions of us, our employees or third parties. Any weakness in our ability to protect our intellectual property could adversely affect our business, financial condition and results of operations.

Third parties may misappropriate our intellectual property rights, and disputes regarding intellectual property rights may arise. We may bring litigation in order to enforce our patents, copyrights or other intellectual property rights, to protect our trade secrets, to determine the validity and scope of the proprietary rights of others or to defend against claims of infringement. Such litigation could result in substantial costs and diversion of resources and could negatively affect our sales, profitability and prospects regardless of whether our efforts are successful. For example, from 2015 until 2020, we were party to litigation to enforce our intellectual property rights against Gudeng Precision Industrial Co., Ltd. for their patent infringement. We settled this dispute in 2020 by licensing certain of our intellectual property rights to Gudeng. In 2021, Gudeng filed a patent lawsuit against us and the lawsuit is pending. We continue to vigorously defend our patents and rights, which will cause us to incur costs. We may initiate other costly litigation against our competitors or other third parties in order to protect our intellectual property rights. We cannot predict how any existing or future litigation will be resolved or what impact it may have on us.

Our commercial success also depends, in part, on our ability to avoid infringing or misappropriating any patents or other proprietary rights of third parties. If we infringe or misappropriate a third party’s patent or other proprietary rights, we could be required to pay damages, alter our products or processes, obtain a license to continue use of a proprietary right or cease utilizing such proprietary rights, including making or selling products utilizing such proprietary rights. If we are required to obtain a license, we may be unable to do so on commercially acceptable terms, or at all.

We may be subject to information technology system failures, network disruptions and breaches in data security, which could damage our reputation and adversely affect our financial condition, results of operations and cash flows, and new laws and regulations regarding data privacy may increase our costs.

We collect and store sensitive data, including our financial information, intellectual property, confidential information, proprietary business information and personally identifiable information of our employees and others, as well as similar information of our customers, suppliers and business partners. We maintain this information in our data centers, on our networks and on information technology, or IT, systems owned and maintained by third parties. The secure processing, maintenance and transmission of this information is critical to our operations. All IT systems are subject to disruption, breach or failure. Data breaches, including those sponsored by state actors, have become increasingly common in recent years. For example, during 2020 the United States government was hacked via third-party software applications by hackers suspected of being sponsored by a foreign intelligence agency. While we and our third-party providers have implemented network security procedures, virus protection software, intrusion prevention systems, access control, emergency recovery processes and internal control measures, we and they have experienced, and expect to continue to be subject to, cybersecurity threats and incidents ranging from employee error or misuse, to individual attempts to gain unauthorized access to systems, to sophisticated and targeted measures known as advanced persistent threats. Despite the precautions undertaken by us and our third-party providers, IT system failures, network disruptions and breaches of data security could cause disruption in our operations, issues with customer communication and order management, the unauthorized or unintentional disclosure of sensitive information, disruptions in our transaction processing or undermine the integrity of our disclosure controls and procedures and our internal control over financial reporting, which could affect our reputation, result in significant liabilities and expenses, adversely affect our ability to report our financial results in a timely manner and could have a material adverse effect on our financial condition, results of operations and cash flows. These risks may be further amplified by the increased reliance on remote access to IT systems by us and our customers, suppliers and other third parties with which we do business as a result of employees working remotely in response to the COVID-19 pandemic.

Moreover, new laws and regulations, such as the European Union's General Data Protection Regulation, the California Consumer Privacy Act and China's Personal Information Protection Law, add to the complexity of our compliance obligations, which increases our compliance costs. Although we have established internal controls and procedures intended to achieve compliance with such laws and regulations, a failure to fully comply could result in significant penalties.

Climate change may have a long-term impact on our business.

There are inherent climate-related risks wherever our business is conducted. Changes in market dynamics, stakeholder expectations, local, national and international climate change policies, and the frequency and intensity of extreme weather events on critical infrastructure in the United States and abroad, all have the potential to disrupt our business and operations. Such events could result in a significant increase in our costs and expenses and harm our future revenue, cash flows and financial performance. Global climate change is resulting in, and may continue to result, in certain natural disasters and adverse weather events, such as drought, wildfires, storms, sea-level rise and flooding, occurring more frequently or with greater intensity, which could cause business disruptions and impact employees' abilities to commute or to work from home effectively. Government failure to address climate change in line with the Paris Agreement could result in greater exposure to economic and other risks from climate change and impact our ability to achieve climate goals.

Risks Related to Government Regulation

We are subject to a variety of environmental laws and regulations that could cause us to incur significant liabilities and expenses.

Failure to comply with the wide variety of federal, state, local and non-U.S. regulatory requirements relating to the release, use, storage, treatment, transportation, discharge, disposal and remediation of, and human exposure to, hazardous chemicals could result in future liabilities or the suspension of production or shipment. These requirements have become stricter over time. These laws and regulations, among others, increase the complexity and costs of transporting our products from the country in which they are manufactured to our customers. Further changes to these and similar regulations could restrict our ability to expand, build or acquire new facilities, require us to acquire costly control equipment, cause us to incur expenses associated with remediation of contamination, cause us to modify our manufacturing or shipping processes or otherwise increase our cost of doing business and have a negative impact on our financial condition, results of operations and cash flows. In addition, the potential adoption of new laws, rules or regulations related to climate change poses risks that could harm our results of operations or affect the way we conduct our businesses. For example, new or modified regulations could require us to make substantial expenditures to enhance our environmental compliance efforts.

We are exposed to various risks from our regulatory environment.

We are subject to risks related to new, different, inconsistent, or even conflicting laws, rules, and regulations that may be enacted by legislative or executive bodies and/or regulatory agencies in the countries where we operate; disagreements or disputes related to international trade; and the interpretation and application of laws, rules, and regulations. As a public company with global operations, we are subject to the laws of multiple jurisdictions and the rules and regulations of various governing bodies, including those related to health and safety, export controls, financial and other disclosures, corporate governance, privacy, anti-corruption, such as the Foreign Corrupt Practices Act and other local laws prohibiting corrupt payments to governmental officials or customers, conflict minerals or other social responsibility legislation, employment practices, immigration or travel regulations and antitrust regulations, among others. Each of these laws, rules and regulations imposes costs on our business, including financial costs and potential diversion of our management's attention, and may present risks to our business, including potential fines, restrictions on our actions and reputational damage if we do not fully comply. The volume of changes to such laws, rules and regulations may increase in the United States over the next several quarters as the Biden administration continues to implement its policies.

To maintain high standards of corporate governance and public disclosure, we intend to invest in appropriate resources to comply with evolving standards. Changes in or ambiguous interpretations of laws, regulations and standards may create uncertainty regarding compliance matters. Efforts to comply with new and changing regulations have resulted in, and are likely to continue to result in, increased administrative expenses and diversion of management's time and attention from revenue-generating activities to compliance activities. If we are found by a court or regulatory agency not to be in compliance with laws and regulations, our reputation, business, financial condition and/or results of operations could be adversely affected, we may be disqualified or barred from participating in certain activities and we may be forced to modify our operations to achieve full compliance.

Changes in taxation or adverse tax rulings could adversely affect our results of operations.

We operate in many foreign countries and are subject to taxation at various rates and audit by multiple taxing authorities. Our results of operations could be affected by tax audits, changes in tax rates, changes in laws and regulations governing the calculation, location and taxation of earned profit, changes in laws and regulations affecting our ability to realize deferred tax assets on our balance sheet and changes in laws and regulations relating to the repatriation of cash into the United States. Each quarter we forecast our tax liability based on our forecast of our performance for the year in each tax jurisdiction. If our performance forecast changes, our forecasted tax liability would also likely change, perhaps materially.

We have undertaken and expect to continue to undertake a number of complex internal reorganizations of our foreign subsidiaries in order to rationalize and streamline our foreign operations, focus our management efforts on certain local opportunities and take advantage of favorable business conditions in certain localities. These or any future reorganizations could result in adverse tax consequences in one or more jurisdictions, which could adversely impact our profitability from foreign operations and result in a material reduction in our results of operations.

Various other jurisdictions, including members of the Organization for Economic Cooperation and Development, are considering changes to their tax laws, including provisions intended to address base erosion and profit shifting by taxpayers. Any tax reform adopted in these or other countries may exacerbate the risks described above.

Risks Related to Our Indebtedness

We have a substantial amount of indebtedness and may in the future incur substantially more debt, each of which could adversely affect our ability to obtain financing in the future and react to changes in our business.

As of December 31, 2021, we had an aggregate principal amount of $945.0 million of indebtedness outstanding, including our 4.375% senior unsecured notes due April 15, 2028 and our 3.625% senior unsecured notes due May 1, 2029, or collectively the Notes, and our senior secured term loan facility due 2025, or the Term Loan Facility. In addition, we have approximately $400 million of unutilized capacity under our senior secured revolving credit facility due 2026, or the Revolving Facility. We refer to the Term Loan Facility and the Revolving Facility as the Credit Facilities, and the credit agreement that governs the Credit Facilities as the Credit Agreement.

Further, we may incur significant additional secured and unsecured indebtedness in the future. For example, in connection with our proposed merger with CMC, we have entered into an amended and restated commitment letter with Morgan Stanley Senior Funding, Inc. and certain other financial institutions providing for a senior secured first lien term loan B facility in an aggregate principal amount of up to $4 billion and a senior unsecured bridge term loan facility in an aggregate principal amount of up to $895 million. Commitments under the bridge facility will be reduced by, among other things, the aggregate gross cash proceeds in excess of $300 million resulting from any issuance or sale by Entegris of certain securities, including senior unsecured notes or other debt securities or other indebtedness for borrowed money, equity securities and equity-linked securities.

Although the indentures governing the Notes, or the Indentures, and the Credit Agreement restrict our ability to incur additional indebtedness, the restrictions have a number of significant qualifications and exceptions. For example, the Credit Agreement provides that we can request additional loans and commitments up to the greater of $400 million or 100% of our EBITDA, as well as additional amounts if our secured net leverage ratio is less than a specified ratio. Further, these restrictions do not prevent us from incurring monetary obligations that do not constitute indebtedness. If we add new indebtedness and other monetary obligations to our current debt levels, the related risks that we now face would intensify.

Our debt could have important consequences, including:

- limiting our ability to obtain additional financing to fund future working capital, capital expenditures, acquisitions or other general corporate purposes;
- requiring a substantial portion of our cash flow to be dedicated to debt service payments instead of other purposes;
- increasing our vulnerability to adverse changes in general economic, industry and competitive conditions;
- exposing us to increased interest expense for borrowings with variable interest rates, including borrowings under the Credit Facilities; and
- placing us at a disadvantage compared to other, less leveraged competitors or competitors with comparable debt having more favorable terms.

We may be unable to generate sufficient cash to service our indebtedness and may be forced to take other actions, which may not be successful, to satisfy our obligations under our indebtedness.

We may be unable to maintain sufficient cash flow from operating activities to permit us to pay the principal of, premium, if any, and interest on our indebtedness. Our ability to make scheduled payments on or to refinance our debt obligations depends on our financial condition and operating performance and the condition of the capital markets, which are subject to prevailing economic, industry and competitive conditions, as well as many financial, business, legislative, political, regulatory and other factors beyond our control. If our cash flow and capital resources are insufficient to fund our debt service obligations, we could face substantial liquidity problems, be forced to reduce or delay investments and capital expenditures, dispose of material assets or operations, seek additional debt or equity capital or restructure or refinance our indebtedness, any of which could have a material adverse effect on our business, financial position and results of operations.

Any refinancing of our debt could be at higher interest rates and may require us to comply with more onerous covenants, which could further restrict our business operations. We may not be able to implement any refinancing on commercially reasonable terms or at all and, even if successful, a refinancing may not allow us to meet our scheduled debt service obligations. The agreements governing our indebtedness restrict our ability to dispose of assets and use the proceeds of such dispositions, and we may be unable to consummate any dispositions or generate proceeds sufficient to meet our debt service obligations.

If we cannot make scheduled payments on our debt, holders of the Notes and lenders under the Credit Facilities could declare all outstanding principal and interest to be due and payable, the lenders under the Revolving Facility could terminate their commitments to advance further loans, our secured lenders could foreclose against the assets securing their borrowings and we could be forced into bankruptcy or liquidation.

The terms of the Credit Agreement may restrict our operations, particularly our ability to respond to changes or raise additional funds.

The Credit Agreement contains restrictive covenants that impose significant operating and financial restrictions that may limit our ability to take actions that may be in our long-term best interest, including restrictions on our ability to:

- incur additional indebtedness and guarantee indebtedness;
- pay dividends or make other distributions in respect of, or repurchase or redeem, capital stock;
- prepay, redeem or repurchase certain debt;
- make investments, loans, advances and acquisitions;
- sell or otherwise dispose of assets, including capital stock of our subsidiaries;
- enter into transactions with affiliates;
- alter the businesses we conduct; and
- merge or sell all or substantially all of our assets or incur a change of control in our capital stock ownership.

In addition, the restrictive covenants may, depending on the amount of revolving borrowings, unreimbursed letter of credit drawings and undrawn letters of credit, require us to maintain a secured net leverage ratio, which we may be unable to meet. Also, the Indentures contain limited covenants, such as a covenant restricting our ability and certain of our subsidiaries' ability to incur certain debt secured by liens. Our failure to comply with these covenants could result in the acceleration of some or all of our indebtedness, which could lead to bankruptcy, reorganization or insolvency.

Risks Related to Owning our Common Stock

The price of our common stock has been and may remain volatile.

The price of our common stock has been volatile. In 2021, the closing price of our stock on The Nasdaq Global Select Market, or Nasdaq, ranged from a low of $93.99 to a high of $154.75, and, as in past years, the price of our common stock may show even greater volatility in the future. The trading price of our common stock is subject to significant volatility in response to numerous factors, many of which are beyond our control or may be unrelated to our operating results, including the following:

- the significant increase in volatility in the stock market in general as a result of the COVID-19 pandemic;
- any changes to our financial guidance, as well as potential decreased confidence in any guidance we do provide;
- changes in global economic conditions, including those resulting from trade tensions or the COVID-19 pandemic;
- the failure to meet the expectations of securities analysts, which may vary significantly from our actual results;
- changes in financial estimates by securities analysts;
- press releases or announcements by, or changes in market values of, comparable companies;
- high volatility in price and volume in the markets for high-technology stocks;
- the public perception of equity values of publicly traded companies;
- fluctuations in our results of operations; and
- the other risks and uncertainties described in this Annual Report on Form 10-K and in our other filings with the SEC.

Fluctuations in our results of operations could cause our stock price to decline significantly. We believe that period-to-period comparisons of our results of operations may not be meaningful, and you should not rely upon them as indicators of our future performance. Future decreases in our stock price may adversely impact our ability to raise sufficient additional capital in the future, if needed.

There can be no assurance that we will continue to declare cash dividends or that we will recommence the repurchase of our shares in any particular amounts or at all.

In connection with our proposed acquisition of CMC, we have suspended our previously announced share repurchase program. Future payments of quarterly dividends and any future repurchases of shares of our common stock are subject to capital availability and periodic determinations by our board of directors that they are in the best interest of our stockholders and comply with all laws and applicable agreements. Future dividends and any future share repurchases may be affected by, among other factors, potential capital requirements for acquisitions and the funding of our research and development activities; legal risks; changes in federal and state income tax laws or corporate laws; contractual restrictions, such as financial or operating covenants in our debt arrangements; availability of domestic cash flow; and changes to our business model. The amounts of our dividend payments may change from time to time, and we may decide at any time to reduce, suspend or discontinue the payment of dividends or the repurchase of shares. A reduction, suspension or discontinuation of our dividend payments or the cessation of our share repurchase program could have a negative effect on the price of our common stock and may harm our reputation.

Provisions in our charter documents and Delaware law may delay or prevent an acquisition of us, which could decrease the value of our shares.

Our certificate of incorporation, our by-laws and Delaware law contain provisions that could make it harder for a third party to acquire us without the consent of our board of directors. These provisions include limitations on actions by written consent of our stockholders.

Our certificate of incorporation makes us subject to the anti-takeover provisions of Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits publicly held Delaware corporations from engaging in a “business combination” with an “interested stockholder” for a period of three years after the date of the transaction in which the person became an interested stockholder, unless the business combination is approved in a prescribed manner. This provision could discourage parties from bidding for our shares of common stock and could, as a result, reduce the likelihood of an increase in the price of our common stock that would otherwise occur if a bidder sought to buy our common stock.

Our certificate of incorporation authorizes our board of directors to issue, without further stockholder approval, up to 5,000,000 shares of preferred stock in one or more series and to fix and designate the rights, preferences, privileges and restrictions of the preferred stock, including dividend rights, conversion rights, voting rights, redemption rights and liquidation preferences. The holders of any shares of preferred stock could have preferences over the holders of our common stock with respect to dividends and liquidation rights. Any issuance of preferred stock may have the effect of delaying, deterring or preventing a change in control. Any issuance of preferred stock could decrease the amount of earnings and assets available for distribution to the holders of common stock and could adversely affect the rights and powers, including voting rights, of the holders of common stock. The issuance of preferred stock could have the effect of decreasing the market price of our common stock.

Risks Related to Our Pending Merger with CMC Materials, Inc.

Failure to complete our pending merger with CMC Materials, Inc. could have a materially adverse effect on our financial condition and results of operations and could negatively impact our stock price.

On December 14, 2021, we entered into an agreement and plan of merger with merger sub and CMC, pursuant to which merger sub will merge with and into CMC, with CMC surviving the merger as a wholly-owned subsidiary of Entegris. We will incur significant transaction costs relating to the merger, including legal, accounting, financial advisory, regulatory and other expenses. In general, these expenses are payable by us whether or not the merger is completed. The payment of such transaction costs could have an adverse effect on our financial condition, results of operations or cash flows. In addition, we could be subject to litigation in the event the merger is not consummated, which could subject us to significant liability for damages and result in the incurrence of substantial legal fees. The current market price of our stock may reflect an assumption that the pending merger will occur and failure to complete the merger could result in a decline in our stock price.

The merger may not be completed and the merger agreement may be terminated in accordance with its terms.

The merger is subject to a number of conditions that must be satisfied, including the approval by CMC stockholders of the merger agreement proposal, or waived (to the extent permissible), in each case before the completion of the merger. These conditions to the completion of the merger, some of which are beyond our control and that of CMC, may not be satisfied or waived in a timely manner or at all, and, accordingly, the merger may be delayed or not completed.

Additionally, either we or CMC may terminate the merger agreement under certain circumstances, including, among other reasons, if the merger is not completed by December 14, 2022 (which date may be extended to March 14, 2023, under certain circumstances. In addition, if the merger agreement is terminated under certain circumstances specified in the merger agreement, CMC may be required to pay us a termination fee of $187 million, including certain circumstances in which the CMC board of directors effects an adverse recommendation change or CMC enters into an agreement with respect to a superior proposal following the termination of the merger agreement.

The announcement and pendency of the merger agreement and any subsequent termination of the merger agreement could negatively impact us or CMC.

Whether or not the merger is completed, the announcement and pendency of the merger could cause disruptions in our businesses. If the merger is not completed for any reason, including as a result of a failure to obtain the required CMC stockholder vote or the failure to obtain the requisite regulatory approvals, our ongoing businesses may be adversely affected. We may be subject to a number of risks, including the following:

- we may experience negative reactions from the financial markets, including negative impacts on our stock price;
- we may experience negative reactions from our suppliers and customers;
- our current and prospective employees and those of CMC may experience uncertainty about their future roles with the combined company, which might adversely affect our or CMC's abilities to retain key managers and other employees;
- the merger agreement places certain restrictions on the conduct of each company's business prior to completion of the merger and such restrictions, the waiver of which is subject to the consent of the other company (not to be unreasonably withheld, conditioned or delayed), which may prevent us or CMC from taking certain other specified actions during the pendency of the merger; and
- matters relating to the merger (including integration planning) will require substantial commitments of time and resources by our management and CMC management, which could otherwise have been devoted to day-to-day operations or to other opportunities that may have been beneficial to us or CMC, as applicable, as an independent company.

The market price for shares of our common stock following the completion of the merger may be affected by factors different from, or in addition to, those that historically have affected or currently affect the market price of shares of our common stock.

Upon consummation of the merger, our stockholders and CMC stockholders will both hold shares of common stock in Entegris. Our businesses differ from those of CMC, and CMC's businesses differ from those of our business, and, accordingly, the results of operations of the combined company will be affected by some factors that are different from those currently or historically affecting our results of operations and those currently or historically affecting the results of operations of CMC. The results of operations of the combined company may also be affected by factors different from those that currently affect or have historically affected either us or CMC.

Until the completion of the merger or the termination of the merger agreement in accordance with its terms, we and CMC are each prohibited from entering into certain transactions and taking certain actions that might otherwise be beneficial to us or CMC and our or their respective shareholders.

From and after the date of the merger agreement and before completion of the merger, the merger agreement restricts us and CMC from taking specified actions without the consent of the other party (with CMC being restricted from taking a broader set of specified actions than us) and requires that the business of each company and its respective subsidiaries be conducted in all material respects in the ordinary course of business consistent with past practice. These restrictions may prevent us or CMC from making appropriate changes to our or their respective businesses or organizational structures or from pursuing attractive business opportunities that may arise before the completion of the merger, and could have the effect of delaying or preventing other strategic transactions. Adverse effects arising from the pendency of the merger could be exacerbated by any delays in consummation of the merger or termination of the merger agreement.

Failure to attract, motivate and retain executives and other key employees could diminish the anticipated benefits of the merger.

The success of the merger will depend in part on the retention of personnel critical to the business and operations of the combined company due to, for example, their technical skills or management expertise. Competition for qualified personnel can be intense.

Our current and prospective employees and those of CMC may experience uncertainty about their future role with us and the combined company until strategies with regard to these employees are announced or executed, which may impair our and

CMC's ability to attract, retain and motivate key management, sales, marketing, technical and other personnel before and following the merger. Employee retention may be particularly challenging during the pendency of the merger, as employees may experience uncertainty about their future roles with the combined company. If we or CMC are unable to retain personnel, including our and CMC's key management, who are critical to the successful integration and future operations of the companies, we and the combined company could face disruptions in our operations, loss of existing customers or loss of sales to existing customers, loss of key information, expertise or know-how, and unanticipated additional recruitment and training costs. In addition, the loss of key personnel could diminish the anticipated benefits of the merger.

If our key employees or CMC's key employees depart, the integration of the companies may be more difficult and the combined company's business following the merger may be harmed. Furthermore, the combined company may have to incur significant costs in identifying, hiring and retaining replacements for departing employees and may lose significant expertise and talent relating to our business or CMC's business, and the combined company's ability to realize the anticipated benefits of the merger may be adversely affected. In addition, there could be disruptions to or distractions for the workforce and management associated with activities of labor unions or integrating employees into the combined company. No assurance can be given that the combined company will be able to attract or retain our key employees and those of CMC to the same extent that the separate companies have been able to attract or retain their respective employees in the past.

The failure to successfully combine our and CMC's businesses may adversely affect our future results.

The success of the merger will depend, in part, on our ability to realize anticipated benefits from integrating CMC into the Company. To realize these anticipated benefits, our business and CMC must be successfully combined. If we are not able to achieve these objectives, the anticipated benefits of the merger may not be realized fully or at all, or may take longer to realize than expected.

We may not be able to retain customers or suppliers, or customers or suppliers may seek to modify contractual obligations with us, which could have an adverse effect on our business and operations. Third parties may terminate or alter existing contracts or relationships with us or CMC.

As a result of the merger, we may experience impacts on relationships with customers or suppliers that may harm our business and results of operations. Certain customers or suppliers may seek to terminate or modify contractual obligations following the merger whether or not contractual rights are triggered as a result of the merger. There can be no guarantee that customers or suppliers will remain with or continue to have a relationship with us or do so on the same or similar contractual terms following the merger. If any customers or suppliers seek to terminate or modify contractual obligations or discontinue the relationship with us, then our business and results of operations may be harmed. If certain of our suppliers were to seek to terminate or modify an arrangement with us, then we may be unable to procure necessary supplies from other suppliers in a timely and efficient manner and on acceptable terms, or at all.

We and CMC also have contracts with vendors, landlords, licensors and other business partners which may require us or CMC, as applicable, to obtain consent from these other parties in connection with the merger. If these consents cannot be obtained, we may suffer a loss of potential future revenue, incur costs, and lose rights that may be material to its business. In addition, third parties with whom we or CMC currently have relationships may terminate or otherwise reduce the scope of their relationship with either party in anticipation of the merger. Any such disruptions could limit our ability to achieve the anticipated benefits of the merger. The adverse effect of any such disruptions could also be exacerbated by a delay in the completion of the merger or by a termination of the merger agreement.

The combined company's debt may limit our financial flexibility following the merger.

We expect to incur a substantial amount of debt in connection with the merger and have entered into an amended and restated commitment letter with Morgan Stanley Senior Funding, Inc. and certain other financial institutions providing for a senior secured first lien term loan B facility in an aggregate principal amount of up to $4 billion and a senior unsecured bridge term loan facility in an aggregate principal amount of up to $895 million. We expect to use a portion of the proceeds from such facilities to repay and terminate both our and CMC's existing credit facilities (or, amend or otherwise refinance, our Revolving Facility) substantially concurrently with the completion of the merger. Accordingly, as of September 30, 2021, the combined company would have had approximately $5.6 billion of total debt, after giving pro forma effect to the merger, the refinancing of our and CMC's existing credit facilities and certain other adjustments.

Following the merger, the combined company's substantial indebtedness could have adverse effects on the combined company's financial condition and results of operations, including:

- increasing its vulnerability to changing economic, regulatory and industry conditions;
- limiting its ability to compete and its flexibility in planning for, or reacting to, changes in its business and the industry;

- limiting its ability to pay dividends to its stockholders;
- limiting its ability to borrow additional funds; and
- increasing its interest expense and requiring it to dedicate a substantial portion of its cash flow from operations to payments on its debt, thereby reducing funds available for working capital, capital expenditures, acquisitions, share repurchases, dividends and other purposes.

The combined company's ability to make scheduled payments of the principal of, and to pay interest on or to refinance its indebtedness following the merger will depend on, among other factors, the combined company's respective financial positions and performance, as well as prevailing market conditions and other factors beyond its control. Our combined business may not continue to generate cash flow from operations in the future sufficient to service the combined company's debt and make necessary capital expenditures and meet its other liquidity needs. If the combined company is unable to generate such cash flow, it may be required to adopt one or more alternatives, such as selling assets, restructuring debt or obtaining additional equity capital or debt refinancing on terms that may be onerous. The combined company may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on its debt obligations which, if not cured or waived, could accelerate the combined company's repayment obligations under all of its outstanding debt which could have a material adverse effect on the combined company's business, results of operations or financial condition.

In addition, the level and quality of the combined company's earnings, operations, business and management, among other things, will impact the determination of the combined company's credit ratings. A decrease in the ratings assigned to the combined company by the ratings agencies may negatively impact the combined company's access to the debt capital markets and increase the combined company's cost of borrowing. There can be no assurance that the combined company will be able to obtain any future required financing on acceptable terms or at all. In addition, there can be no assurance that the combined company will be able to maintain the current credit worthiness or prospective credit rating of the Company. Any actual or anticipated changes or downgrades in such credit rating may have a negative impact on the liquidity, capital position or access to capital markets of the combined company.

The covenants contained in the agreements governing the combined company's indebtedness following the merger will impose restrictions on the combined company and certain of its subsidiaries that may affect their ability to operate their businesses.

The agreements that will govern the indebtedness of the combined company following the merger, including the indebtedness to be incurred pursuant to the commitment letter (or any indebtedness that may refinance or replace the bridge facility as set forth in the commitment letter) will contain various affirmative and negative covenants. Such covenants may, subject to certain significant exceptions, restrict the ability of the combined company and certain of its subsidiaries after the merger to, among other things, incur liens, incur debt, engage in mergers, consolidations and acquisitions, transfer assets outside the ordinary course of business, make loans or other investments, pay dividends, repurchase equity interests, make other payments with respect to equity interests, repay or repurchase subordinated debt and engage in affiliate transactions. In addition, such agreements may also contain financial covenants that would require the combined company to maintain certain financial ratios under certain circumstances. The ability of the combined company and its subsidiaries to comply with these provisions after the merger may be affected by events beyond their control. Failure to comply with these covenants could result in an event of default, which, if not cured or waived, could accelerate the combined company's repayment obligations under all of its outstanding debt which could have a material adverse effect on the combined company's business, results of operations or financial condition.

Item 1B. Unresolved Staff Comments.

Not Applicable.

Item 2. Properties.

Our principal executive offices are located in Billerica, Massachusetts. Information about our principal and certain other facilities is set forth below:

Location	Principal Function	Approximate Square Feet	Leased/ Owned	Reporting Segment
Bedford, Massachusetts	Research & Manufacturing	80,000	Owned	MC & SCEM
Billerica, Massachusetts[1]	Executive Offices, Research & Manufacturing	175,000	Leased	MC, SCEM & AMH
Burnet, Texas	Research & Manufacturing	86,000	Owned	SCEM
Chaska, Minnesota	Executive Offices, Research & Manufacturing	186,000	Owned	AMH
Colorado Springs, Colorado	Manufacturing	82,000	Owned	AMH
Danbury, Connecticut	Research & Manufacturing	73,000	Leased	SCEM
Decatur, Texas	Manufacturing	359,000	Owned	SCEM
Hsin-chu, Taiwan	Executive Offices, Sales Research & Manufacturing	146,330	Leased	MC, SCEM & AMH
JangAn, South Korea	Manufacturing	127,000	Owned	MC, SCEM & AMH
Kulim, Malaysia	Manufacturing	195,000	Owned	SCEM & AMH
San Luis Obispo, California	Manufacturing	37,000	Owned	MC
San Luis Obispo, California	Manufacturing	34,000	Leased	MC
Suwon, South Korea	Executive Offices & Research	42,000	Leased	MC & SCEM
Yonezawa, Japan	Manufacturing	185,000	Owned	MC & AMH

[1] This lease has been extended through September 30, 2026 and is subject to one five-year renewal option.

In addition, we own and lease space for manufacturing, distribution, technical support, sales, service, repair, and general administrative purposes in the United States, Canada, China, Germany, France, Israel, Japan, Malaysia, Singapore, South Korea and Taiwan. Leases for our facilities expire through December 2031. We currently expect to be able to extend the terms of expiring leases or to find suitable replacement facilities on reasonable terms. We believe that our facilities are well-maintained and suitable for their respective operations. We regularly assess the size, capability and location of our global infrastructure and periodically make adjustments based on these assessments.

Item 3. Legal Proceedings.

As of December 31, 2021, we were not involved in any legal proceedings that we believe will have a material impact on our consolidated financial position, results of operations or cash flows. From time to time the Company may be a party to litigation involving claims against the Company arising in the ordinary course of our business. We are not aware of any material potential litigation or claims against us which would have a material adverse effect upon our financial statements.

For purposes of this disclosure, we have determined that legal proceedings that involve governmental authorities and that relate to environmental matters are not material to our business or financial condition in circumstances where we reasonably believe that such proceedings will result in either no monetary sanctions or potential monetary sanctions of less than $1.0 million, exclusive of interest and costs.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

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

Market Information and Holders

Entegris' common stock, $0.01 par value per share, trades on the Nasdaq Global Select Market under the symbol "ENTG". As of January 31, 2022, there were 861 shareholders of record.

Dividend Policy

Holders of the Company's common stock are entitled to receive dividends when and if they are declared by the Company's board of directors. The Company's board of directors declared cash dividends of $0.08 per share during each of the first, second, third and fourth quarters of 2021, which totaled $43.6 million.

On January 19, 2022, the Company's board of directors declared a quarterly cash dividend of $0.10 per share to be paid on February 23, 2022 to shareholders of record as of February 2, 2022.

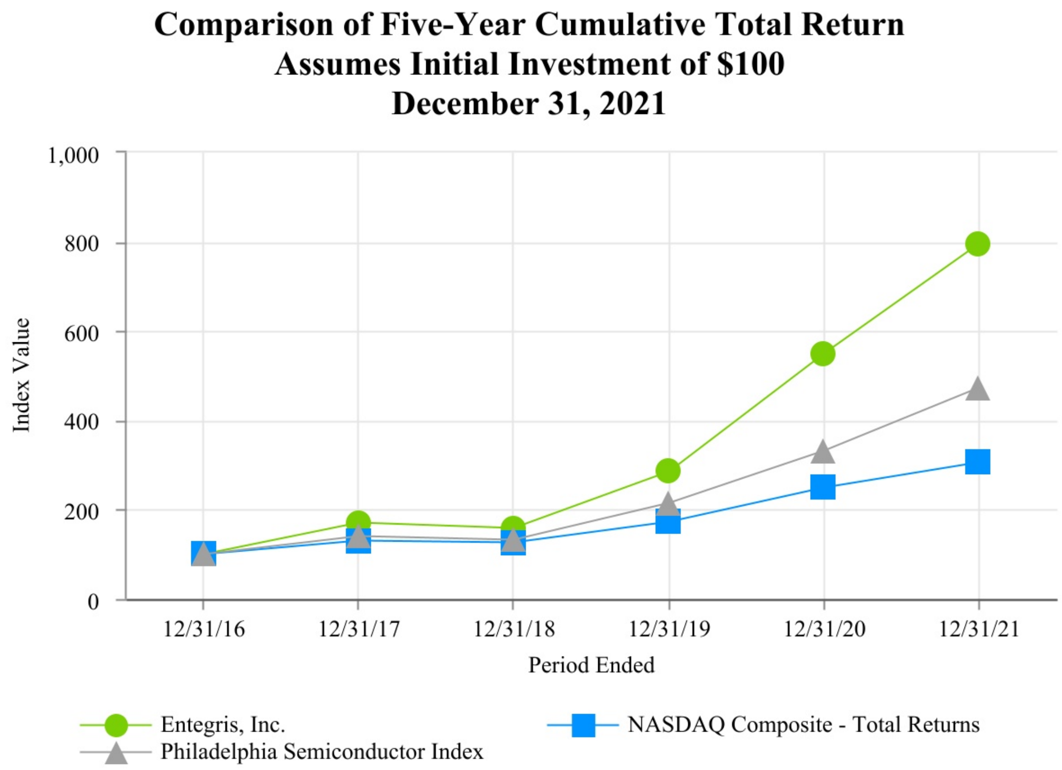
Future dividend declarations, if any, as well as the record and payment dates for such dividends, are subject to the final determination of our board of directors. Furthermore, the credit agreement governing the Credit Facilities contains restrictions that may limit our ability to pay dividends.

Issuer Sales of Unregistered Securities During the Past Three Years

None.

Comparative Stock Performance

The following graph compares the cumulative total shareholder return on the common stock of Entegris, Inc. from December 31, 2016 through December 31, 2021 with the cumulative total return of (1) The Nasdaq Composite Index, and (2) The Philadelphia Semiconductor Index, assuming $100 was invested at the close of trading on December 31, 2016 in Entegris, Inc. common stock, the Nasdaq Composite Index and the Philadelphia Semiconductor Index and that all dividends are reinvested.



	December 31, 2016	December 31, 2017	December 31, 2018	December 31, 2019	December 31, 2020	December 31, 2021
Entegris, Inc.	$100.00	$170.48	$157.56	$284.98	$549.59	$794.70
Nasdaq Composite	100.00	129.64	125.96	172.18	249.52	304.85
Philadelphia Semiconductor Index	100.00	140.55	132.05	215.58	331.27	473.22

Issuer Purchases of Equity Securities

On December 14, 2020, the Company's board of directors authorized a repurchase program, effective February 16, 2021, covering the repurchase of up to an aggregate of $125 million of the Company's common stock during a period of twelve months, in open market transactions and in accordance with one or more pre-arranged stock trading plans to be established in accordance with Rule 10b5-1 under the Securities Exchange Act of 1934, as amended, or the Exchange Act. This repurchase program will expire pursuant to its terms on February 15, 2022. In connection with its proposed acquisition of CMC, the Company suspended its previously announced share repurchase program and does not anticipate authorizing a new repurchase program in 2022.

The following table provides information concerning shares of the Company's common stock, $0.01 par value per share, purchased by the Company during the three months ended December 31, 2021:

Period	(a) Total Number of Shares Purchased	(b) Average Price Paid per Share	(c) Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	(d) Maximum Number (or Approximate Dollar Value) of Shares that May Yet Be Purchased Under the Plans or Programs
October 3, 2021 - November 6, 2021	62,500	$131.64	62,500	$73,559,663
November 7, 2021 - December 4, 2021	41,800	$150.9	41,800	$67,252,095
December 5, 2021 - December 31, 2021	17,600	$146.24	17,600	$64,678,249
Total	121,900	$140.35	121,900	$64,678,249

The Company issues common stock awards under its equity incentive plans. In the consolidated financial statements, the Company treats shares of common stock withheld for tax purposes on behalf of its employees in connection with the vesting or exercise of the awards as common stock repurchases because they reduce the number of shares that would have been issued upon vesting or exercise. These withheld shares of common stock are not considered common stock repurchases under the Company's authorized common stock repurchase plan and accordingly are not included in the common stock repurchase totals in the preceding table.

Item 6. Reserved.

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

The following discussion and analysis of the Company’s consolidated financial condition and results of operations should be read along with the consolidated financial statements and the accompanying notes thereto included elsewhere in this Annual Report on Form 10-K. This discussion contains forward-looking statements that involve numerous risks and uncertainties, including, but not limited to, those described in Item 1A, “Risk Factors” and the “Cautionary Statements” section of this Item 7 below. You should review Item 1A “Risk Factors” of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis. The Company has elected to omit discussion of the earliest of the three years covered by the consolidated financial statements presented. Information pertaining to fiscal year 2019 results of operations and the year-over-year comparison of changes in our Financial Condition and Results of Operations as of and for the year ended December 31, 2020 and 2019 can be found in Part II, Item 7, “Management’s Discussion and Analysis of Financial Condition and Results of Operations” of our Annual Report on Form 10-K for the year ended December 31, 2020, filed on February 4, 2021.

Cautionary Statements

This Annual Report on Form 10-K and the portions of the Company’s Definitive Proxy Statement incorporated by reference in this Annual Report on Form 10-K contain “forward-looking statements.” The words “believe,” “expect,” “anticipate,” “intend,” “estimate,” “forecast,” “project,” “should,” “may,” “will,” “would” or the negative thereof and similar expressions are intended to identify such forward-looking statements. These forward-looking statements may include statements about the impact of the Company’s pending merger with CMC; the COVID-19 pandemic on the Company’s operations and markets, including supply chain issues related thereto; future period guidance or projections; the Company’s performance relative to its markets, including the drivers of such performance; market and technology trends, including the duration and drivers of any growth trends and the impact of the COVID-19 pandemic on such trends; the development of new products or new applications for existing products and the success of their introductions; the focus of the Company’s engineering, research and development projects and levels of spending related thereto; the Company’s ability to execute on its business strategies, including with respect to the Company’s expansion of its manufacturing presence in Taiwan; the Company’s capital allocation strategy, which may be modified at any time for any reason, including share repurchases, dividends, debt repayments and potential acquisitions; the impact of the acquisitions the Company has made and commercial partnerships the Company has established; future capital and other expenditures, including estimates thereof; the Company’s expected tax rate; the impact, financial or otherwise, of any organizational changes; the impact of accounting pronouncements; quantitative and qualitative disclosures about market risk; and other matters. These forward-looking statements are based on current management expectations and assumptions only as of the date of this Annual Report on Form 10-K, are not guarantees of future performance and involve substantial risks and uncertainties that are difficult to predict and that could cause actual results to differ materially from the results expressed in, or implied by, these forward-looking statements. These risks and uncertainties include, but are not limited to, the risk factors and additional information described in this Annual Report on Form 10-K under the caption “Risk Factors,” elsewhere in this Annual Report on Form 10-K and in the Company’s other periodic filings. Except as required under the federal securities laws and the rules and regulations of the SEC, the Company undertakes no obligation to update publicly any forward-looking statements or information contained herein, which speak as of their respective dates.

Overview

This overview is not a complete discussion of the Company’s financial condition, changes in financial condition and results of operations; it is intended merely to facilitate an understanding of the most salient aspects of its financial condition and operating performance and to provide a context for the detailed discussion and analysis that follows, and must be read in its entirety in order to fully understand the Company’s financial condition and results of operations.

The Company is a leading supplier of advanced materials and process solutions for the semiconductor and other high-technology industries. Our mission is to help our customers improve their productivity, performance and technology by providing enhanced materials and process solutions for the most advanced manufacturing environments. We leverage our unique breadth of capabilities to create mission-critical microcontamination control products, specialty chemicals and advanced materials handling solutions that maximize manufacturing yields, reduce manufacturing costs and enable higher device performance for our customers.

Our customized materials solutions enable the highest levels of performance essential to the manufacture of semiconductors. As our customers introduce more complex architectures and search for new materials with better electrical and structural properties to improve the performance of their devices, they rely on Entegris as a trusted partner to address these challenges. We understand these challenges and have solutions to address them, such as our advanced deposition materials, implant gases, formulated cleaning chemistries and selective etch chemistries. Our customers also require greater end-to-end materials purity and integrity in their manufacturing process that, when combined with smaller dimensions and more complex architectures, can be challenging to achieve. To enable the use of new metals and the further miniaturization of chips, and to maximize yield and increase long-term device reliability, we provide products such as our advanced liquid and gas filtration and purification products that help to selectively remove new classes of contaminants throughout the semiconductor supply chain. In addition, to ensure purity levels are maintained across the entire supply chain, from bulk manufacturing, to transportation to and delivery through a fab, to application onto the wafer, we provide high-purity packaging and materials handling products.

Our business is organized and operated in three operating segments, which align with the key elements of the advanced semiconductor manufacturing ecosystem. The Specialty Chemicals and Engineered Materials, or SCEM, segment provides high-performance and high-purity process chemistries, gases, and materials, and safe and efficient delivery systems to support semiconductor and other advanced manufacturing processes. The Microcontamination Control, or MC, segment offers solutions to filter and purify critical liquid chemistries and gases used in semiconductor manufacturing processes and other high-technology industries. The Advanced Materials Handling, or AMH, segment develops solutions to monitor, protect, transport, and deliver critical liquid chemistries, wafers and other substrates for a broad set of applications in the semiconductor industry, life sciences and other high-technology industries. While these segments have separate products and technical know-how, they share common business systems and processes, technology centers, and strategic and technology roadmaps. With the technology, capabilities and complementary product portfolios from these three segments, we are uniquely positioned to collaborate across divisions to create new, co-optimized and increasingly integrated solutions for our customers. For example, our SCEM segment offers a highly selective nitride etch chemistry, our MC segment provides a liquid filter that is specifically matched to that formulation and our AMH segment ensures the integrity of the product as it is moved to and through the fab environment.

Key operating factors Key factors which management believes have the largest impact on the overall results of operations of the Company include:

- ***Level of sales*** Since a significant portion of the Company’s product costs (except for raw materials, purchased components and direct labor) are largely fixed in the short-to-medium term, an increase or decrease in sales affects gross profits and overall profitability significantly. Also, increases or decreases in sales and operating profitability affect certain costs such as incentive compensation and commissions, which are highly variable in nature. The Company’s sales are subject to the effects of industry cyclicality, technological change, substantial competition, pricing pressures and foreign currency fluctuation.
- ***Variable margin on sales*** The Company’s variable margin on sales is determined by selling prices and the costs of manufacturing and raw materials. This is affected by a number of factors, which include the Company’s sales mix, purchase prices of raw material (especially polymers, membranes, stainless steel and purchased components), domestic and international competition, direct labor costs, and the efficiency of the Company’s production operations, among others.
- ***Fixed cost structure*** The Company’s operations include a number of large fixed or semi-fixed cost components, which include salaries, indirect labor and benefits, facility costs, lease expenses, and depreciation and amortization. It is not possible to vary these costs easily in the short term as volumes fluctuate. Accordingly, increases or decreases in sales volume can have a large effect on the usage and productivity of these cost components, resulting in a large impact on the Company’s profitability.

Impact of COVID-19 on our Business

The COVID-19 pandemic continues to impact the global economy and cause significant macroeconomic uncertainty. Infection rates vary across the countries in which we operate. Governmental authorities have continued to implement numerous and constantly evolving measures to try to contain the virus, such as travel bans and restrictions, masking recommendations and mandates, vaccine recommendations and mandates, limits on gatherings, quarantines, shelter-in-place orders and business shutdowns. We have taken proactive, aggressive action to protect the health and safety of our employees, customers, partners and suppliers, consistent with the latest and evolving governmental guidelines. We expect to continue to implement appropriate measures until the COVID-19 pandemic is adequately contained. We continue to monitor the rapidly evolving situation and guidance from international and domestic authorities, including federal, state and local public health authorities, and may take additional actions based on their recommendations and requirements or as we otherwise see fit to protect the health and safety of our employees, customers, partners and suppliers.

While certain of our operations have from time-to-time been temporarily affected by government-mandated restrictions, to date we have not experienced significant adverse impacts to our global operations as a result of the COVID-19 pandemic. Broader impacts of the pandemic have included a more dynamic supply chain and global logistics environment, and we have experienced instances of raw material constraints, higher freight costs and delivery delays in both inbound shipments of raw materials and outgoing shipments of finished products to customers. While we continue to focus on mitigating risks to our operations and supply chain in the current industry environment, we expect some of the foregoing challenges to linger. From a demand perspective, during 2021 we continued to see strong demand for our leading-edge products, largely driven by accelerated digitalization, 5G applications and high-performance computing.

In the current circumstances, given the dynamic nature of the situation, any impact on our financial condition, results of operations or cash flows in the future continues to be difficult to estimate and predict, as it depends on future events that are highly uncertain and cannot be predicted with accuracy, including, but not limited to, the duration and continued spread of the outbreak, its severity, potential additional waves of infection, the emergence of more virulent or more dangerous strains of the virus, the actions taken to mitigate the virus or its impact, the development, distribution, efficacy and acceptance of vaccines worldwide, how quickly and to what extent normal economic and operating conditions can resume, the broader impact that the pandemic is having on the economy and our industry and specific implications the pandemic may have on our suppliers and on global logistics. See Item 1A, "Risk Factors," for additional information regarding risks associated with the COVID-19 pandemic, including under the caption "The COVID-19 pandemic and continuing governmental responses could materially adversely affect our financial condition and results of operations."

Overall Summary of Financial Results for the Year Ended December 31, 2021

Total net sales for 2021 were $2,298.9 million, up $439.6 million, or 24%, from sales of $1,859.3 million for 2020.

Total net sales increased primarily as a result of an increase in overall demand for the Company's products from semiconductor industry customers, particularly in the sale of liquid filtration, advanced deposition materials, selective etch and other areas of increasing importance to our customers. Total net sales also reflected net sales associated with acquisitions of $8.6 million and favorable foreign currency translation effects of $2.7 million.

The Company's gross profit increased by $209.9 million for 2021 to $1,059.7 million, up from $849.7 million for 2020. Accordingly, the Company reported a 46.1% gross margin rate compared to 45.7% in 2020. The increases in gross profit and gross margin primarily reflect higher factory utilization associated with stronger sales levels.

The Company's selling, general and administrative, or SG&A, expenses increased in 2021 by $27.3 million, mainly reflecting higher employee costs.

The Company's engineering, research and development, or ER&D, expenses increased in 2021 by $31.6 million, mainly reflecting higher employee costs of $17.3 million and project related costs of $10.8 million.

As a result of the aforementioned and other factors discussed below, net income for 2021 was $409.1 million, or $3.00 per diluted share, compared to net income of $295.0 million, or $2.16 per diluted share, in 2020.

In 2021, the Company acquired BASF's Precision Microchemicals business for $89.7 million in cash, net of cash acquired. The transaction is described in further detail in note 3 to the Company's consolidated financial statements.

On December 14, 2021, the Company entered into the merger agreement with merger sub and CMC. Pursuant and subject to the terms and conditions of the merger agreement, upon completion of the transaction, merger sub will merge with and into CMC, with CMC surviving and continuing as a wholly-owned subsidiary of the Company. At the effective time of the proposed merger, each outstanding share of common stock of CMC (with certain exceptions set forth in the merger agreement) will be converted into the right to receive $133.00 in cash and 0.4506 shares of common stock of Entegris, plus cash in lieu of any fractional shares. The transaction is subject to certain conditions, including the affirmative vote of holders of a majority of the outstanding shares of common stock of CMC approving the adoption of the merger agreement and the receipt of approvals under United States and certain foreign antitrust and competition laws. The Company has agreed to operate its business in the ordinary course during the period between the execution of the merger agreement and the effective time of the proposed merger, subject to specific exceptions set forth in the merger agreement, and has agreed to certain other customary restrictions on operations, as set forth in the merger agreement. The Company has obtained fully committed debt financing from Morgan Stanley Senior Funding, Inc. and certain other financial institutions.

During 2021, the Company's operating activities provided cash flow of $400.5 million. Cash and cash equivalents were $402.6 million at December 31, 2021 compared with $580.9 million at December 31, 2020. The Company had long-term borrowings, including current maturities, of $937.0 million at December 31, 2021 compared with $1,085.8 million at December 31, 2020.

Critical Accounting Policies and Estimates

Management's discussion and analysis of financial condition and results of operations are based upon the Company's consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States, or GAAP. The preparation of these consolidated financial statements requires the Company to make estimates, assumptions and judgments that affect the reported amounts of assets, liabilities, revenues and expenses and related disclosure of contingent assets and liabilities. At each balance sheet date, management evaluates its estimates, including, but not limited to, those related to long-lived assets (property, plant and equipment, and identified intangible assets), goodwill and income taxes. The Company bases its estimates on historical experience and various other assumptions that management believes to be reasonable under the circumstances. Management’s utilization of different judgments or estimates could result in material differences in the amount and timing of the Company’s results of operations for any period. In addition, actual results could be different from the Company’s current estimates, possibly resulting in increased future charges to earnings.

Our critical accounting policies that are most significantly affected by estimates, assumptions and judgments used in the preparation of the Company's consolidated financial statements relate to business acquisitions and are discussed below. See note 1 to the Company’s consolidated financial statements for additional information about the Company’s other significant accounting policies.

Business Acquisitions

The Company accounts for acquired businesses using the acquisition method of accounting which requires that the assets acquired and liabilities assumed be recorded at the date of acquisition at their respective fair values. The judgments made in determining the estimated fair value assigned to each class of assets acquired and liabilities assumed, as well as asset lives, can materially impact net income. Accordingly, for significant items the Company typically obtains assistance from a third-party valuation firm.

There are several methods that can be used to determine the fair value of assets acquired and liabilities assumed in a business combination. For intangible assets, the Company normally utilizes the “income method,” which starts with a forecast of all of the expected future net cash flows attributable to the subject intangible asset. These cash flows are then adjusted to present value by applying an appropriate discount rate that reflects the risk factors associated with the cash flow streams. Depending on the asset valued, the key assumptions included one or more of the following: (1) future revenue growth rates, (2) future gross margin, (3) future selling, general and administrative expenses, (4) royalty rates, and (5) discount rates.

Estimating the useful life of an intangible asset also requires judgment. For example, different types of intangible assets will have different useful lives, influenced by the nature of the asset, competitive environment, and rate of change in the industry. Certain assets may even be considered to have indefinite useful lives. All of these judgments and estimates can significantly impact the determination of the amortization period of the intangible asset, and thus net income.

Results of Operations

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

The following table sets forth the results of operations and the relationship between various components of operations, stated as a percent of net sales, for 2021 and 2020.

(Dollars in thousands)	2021	% of net sales	2020	% of net sales
Net sales	$ 2,298,893	100.0 %	$ 1,859,313	100.0 %
Cost of sales	1,239,229	53.9	1,009,591	54.3
Gross profit	1,059,664	46.1	849,722	45.7
Selling, general and administrative expenses	292,408	12.7	265,128	14.3
Engineering, research and development expenses	167,632	7.3	136,057	7.3
Amortization of intangible assets	47,856	2.1	53,092	2.9
Operating income	551,768	24.0	395,445	21.3
Interest expense	41,240	1.8	48,600	2.6
Interest income	(243)	—	(786)	—
Other expense (income), net	31,695	1.4	(6,656)	(0.4)
Income before income taxes	479,076	20.8	354,287	19.1
Income tax expense	69,950	3.0	59,318	3.2
Net income	$ 409,126	17.8	$ 294,969	15.9

Net sales For 2021, net sales were $2,298.9 million, up $439.6 million, or 24%, from 2020. An analysis of the factors underlying the increase in net sales is presented in the following table:

(In thousands)	
Net sales in 2020	$ 1,859,313
Increase mainly associated with customer demand	428,258
Increase associated with acquired businesses	8,591
Increase associated with effect of foreign currency translation	2,731
Net sales in 2021	$ 2,298,893

The Company's net sales reflected an increase in overall demand for the Company's products from semiconductor industry customers, particularly in the sale of liquid filtration, advanced deposition materials, selective etch and other areas of increasing importance to our customers. Total net sales also reflected net sales associated with acquisitions of $8.6 million and favorable foreign currency translation effects of $2.7 million.

In addition to our semiconductor focused products, during 2021 we reached over $50 million of sales of Aramus "high purity bags", used for COVID-19 vaccines. We will seek to expand the use of these solutions into non-COVID biologics.

Sales percentage on a geographic basis for 2021 and 2020 and the percentage increase in sales for 2021 compared to sales for 2020 were as follows:

	Year ended		
	December 31, 2021	December 31, 2020	Percentage increase in sales
North America	23 %	25 %	13 %
Taiwan	20 %	20 %	22 %
China	16 %	13 %	47 %
South Korea	14 %	15 %	16 %
Japan	13 %	13 %	25 %
Europe	9 %	8 %	36 %
Southeast Asia	5 %	5 %	23 %

The increase in sales for all geographic areas was primarily driven by a general increase in demand for products in all three of the Company's segments.

Gross margin

The following table sets forth gross margin as a percentage of net revenues:

	2021	2020	Percentage point change
Gross margin as a percentage of net revenues:	46.1 %	45.7 %	0.4

Gross margin increased by 0.4 percentage points for 2021 compared to 2020, primarily due to higher factory utilization associated with stronger sales levels.

Selling, general and administrative expenses

Selling, general and administrative expenses consist primarily of payroll and related expenses for the sales and administrative staff, professional fees (including accounting, legal and technology costs and expenses), and sales and marketing costs. SG&A expenses for 2021 increased $27.3 million, or 10%, to $292.4 million from $265.1 million in 2020. SG&A expenses, as a percent of net sales, decreased to 12.7% from 14.3% a year earlier, primarily reflecting the increase in sales.

An analysis of the factors underlying the increase in SG&A expenses is presented in the following table:

(In thousands)		
Selling, general and administrative expenses in 2020	$	265,128
Employee costs		30,858
Other decreases, net		(3,578)
Selling, general and administrative expenses in 2021	$	292,408

Engineering, research and development expenses

Engineering, research and development expenses consist of expenses for the support of current product lines and the development of new products and manufacturing technologies. These expenses were $167.6 million in 2021 and $136.1 million in 2020. ER&D expenses as a percent of net sales remained flat at 7.3% compared to a year earlier.

An analysis of the factors underlying the increase in ER&D expenses is presented in the following table:

(In thousands)		
Engineering, research and development expense in 2020	$	136,057
Employee costs		17,324
Project related costs		10,811
Professional fees		1,240
Other increases, net		2,200
Engineering, research and development expense in 2021	$	167,632

The Company's overall ER&D efforts will continue to focus on developing and improving its technology platforms for semiconductor and advanced processing applications and identifying and developing products for new applications, and the Company often works directly with its customers to address their particular needs. As a percentage of revenue, the Company expects to increase ER&D expenses in the coming years.

Amortization of intangible assets Amortization of intangible assets was $47.9 million in 2021 compared to $53.1 million for 2020. The decrease primarily reflects the elimination of amortization expense of $6.8 million for identifiable intangible assets acquired in acquisitions that became fully amortized in previous periods, partially offset by additional amortization expense of $1.7 million associated with recent acquisitions as discussed in note 3 to the consolidated financial statements.

Interest expense Interest expense was $41.2 million in 2021 and $48.6 million in 2020. Interest expense includes interest associated with debt outstanding and the amortization of debt issuance costs associated with such borrowings. The decrease primarily reflects lower average debt levels and interest rates in 2021.

Interest income Interest income was $0.2 million in 2021 and $0.8 million in 2020. The decrease reflects lower average interest rates and cash balances.

Other expense (income), net Other expense, net, was $31.7 million in 2021 compared to other income, net, of $6.7 million in 2020.

In 2021, other expense, net consisted mainly of a loss on extinguishment of debt of $23.1 million associated with the redemption of the Company's $550 million aggregate principal amount of senior unsecured notes due 2026, or the 2026 Notes (see note 8 to the Company's consolidated financial statements), and foreign currency transaction losses of $7.9 million.

In 2020, other income, net consisted mainly of foreign currency transaction gains of $9.8 million, partially offset by loss on debt extinguishment costs of $2.4 million associated with payments on the Term Loan Facility.

Income tax expense The Company recorded income tax expense of $70.0 million in 2021 compared to income tax expense of $59.3 million in 2020. The Company's effective tax rate was 14.6% in 2021 compared to an effective tax rate of 16.7% in 2020.

The decrease in the effective tax rate from 2020 to 2021 is primarily due to a benefit related to the reversal of a valuation allowance on federal foreign credits generated in 2020 of $6.2 million. Additionally, the Company recognized a net capital loss tax benefit of $5.1 million during the tax year ended December 31, 2021. These benefits were partially offset by tax recorded on the sale of intangible property of $3.5 million in 2021. The 2020 tax rate included a benefit of $1.5 million related to additional R&D tax credits, an increase in discrete benefits related to share-based compensation of $8.8 million, and lower accrued withholding taxes on foreign earnings. These decreases were partially offset by a valuation allowance on federal foreign tax credits generated during the year of $6.2 million.

Net income Net income was $409.1 million, or $3.00 per diluted share, in 2021 compared to net income of $295.0 million, or $2.16 per diluted share, in 2020. The increase reflects the Company's aforementioned operating results described in greater detail above.

Non-GAAP Financial Measures Information The Company's consolidated financial statements are prepared in conformity with accounting principles generally accepted in the United States. The Company also utilizes certain non-GAAP financial measures as a complement to financial measures provided in accordance with GAAP in order to better assess and reflect trends affecting the Company's business and results of operations. See "Non-GAAP Information" included below in this section for additional detail, including the reconciliation of the Company's non-GAAP measures to the most directly comparable GAAP measures.

The Company's non-GAAP financial measures include adjusted EBITDA and adjusted operating income, together with related percentage changes, and non-GAAP earnings per share, or EPS.

Adjusted EBITDA increased to $699.4 million in 2021, compared to $542.5 million in 2020. Adjusted EBITDA as a percent of net sales was 30.4% in 2021 compared to 29.2% in 2020. Adjusted operating income increased 32.7% to $609.1 million in 2021, compared to $459.0 million in 2020. Adjusted operating income as a percent of net sales was 26.5% in 2021 compared to 24.7% in 2020. Non-GAAP EPS increased 35.4% to $3.44 in 2021, compared to $2.54 in 2020. The increases in adjusted EBITDA and adjusted operating income as a percentage of net sales reflect the increases in sales and gross profit.

Segment Analysis

The Company reports its financial performance based on three reporting segments. See note 16 to the consolidated financial statements for additional information on the Company's three segments.

The following table and discussion concern the results of operations of the Company's three reportable segments for the years ended December 31, 2021 and 2020.

(In thousands)	2021	2020
Specialty Chemicals and Engineered Materials		
Net sales	$ 711,291	$ 609,532
Segment profit	167,807	127,969
Microcontamination Control		
Net sales	$ 919,363	$ 742,186
Segment profit	321,300	248,910
Advanced Materials Handling		
Net sales	$ 704,946	$ 538,682
Segment profit	159,995	111,028
Unallocated general and administrative expenses	$ 49,478	$ 39,370

Specialty Chemicals and Engineered Materials (SCEM)

For 2021, SCEM net sales increased to $711.3 million, up 17% from $609.5 million in 2020. The sales increase was mainly due to increased sales of specialty gases and advanced deposition materials, formulated cleaning chemistries and advanced coatings, as well as additional sales of $1.2 million attributable to the acquisition of BASF’s Precision Microchemicals business in the fourth quarter of 2021.

SCEM reported a segment profit of $167.8 million for 2021, up 31% compared to $128.0 million in 2020. The increase in SCEM’s profit in 2021 was primarily due to higher sales levels and a gain on a sale of non-core intangibles, partially offset by higher operating expenses of 11% mainly due to higher compensation costs.

Microcontamination Control (MC)

For 2021, MC net sales increased to $919.4 million, up 24% from $742.2 million in 2020. The sales increase was due to improved performance across substantially all platforms, with growth especially strong in liquid filtration and gas filtration products.

MC reported a segment profit of $321.3 million for 2021, up 29% compared to $248.9 million in 2020. The increase in MC’s profit in 2021 was primarily due to higher gross profit related to the increased sales volume, partially offset by higher operating expenses of 13%, primarily due to higher compensation costs.

Advanced Materials Handling (AMH)

For 2021, AMH net sales increased 31% to $704.9 million from $538.7 million in 2020. The sales increase was mainly due to improved sales from wafer handling, fluid handling and measurement products and sales of our Aramus high purity bags, as well as additional sales of $6.8 million attributable to the acquisition of Global Measurement Technologies, Inc. and its manufacturing partner Clean Room Plastics, Inc., which are referred to collectively herein as GMTI.

AMH reported a segment profit of $160.0 million for 2021, up 44% compared to $111.0 million in 2020. The increase in AMH’s profit in 2021 was primarily due to higher sales volume, favorable product mix, partially offset by a 16% increase in operating expenses, primarily due to higher compensation costs.

Unallocated general and administrative expenses

Unallocated general and administrative expenses for 2021 totaled $49.5 million compared to $39.4 million for 2020. The $10.1 million increase mainly reflects the increase in compensation costs of $8.2 million and deal and integration costs of $2.1 million.

Liquidity and Capital Resources

We consider the following when assessing our liquidity and capital resources:

In thousands	December 31, 2021	December 31, 2020
Cash and cash equivalents	$ 402,565	$ 580,893
Working capital	934,369	931,631
Total debt	937,027	1,085,783

The Company has historically financed its operations and capital requirements through cash flow from its operating activities, long-term loans, lease financing and borrowings under domestic and international short-term lines of credit. On April 30, 2021, the Company issued $400.0 million aggregate principal amount of 3.625% senior unsecured notes due May 1, 2029, or the 2029 Notes. The Company used the net proceeds of the offering, together with cash on hand and borrowings under the Revolving Facility, to redeem all of the 2026 Notes. The redemption of the 2026 Notes resulted in a loss on extinguishment of debt of $23.1 million. In connection with our issuance of the 2029 Notes, we amended the Revolving Facility to provide for, among other things, lending commitments in an aggregate principal amount of up to $400.0 million (up from $300.0 million) and to extend the maturity date to April 30, 2026.

Based on our analysis, we believe our existing balances of domestic cash and cash equivalents and our currently anticipated operating cash flows will be sufficient to meet our cash needs arising in the ordinary course of business for the next twelve months and for the longer term.

We may seek to take advantage of opportunities to raise additional capital through additional debt financing or through public or private sales of securities. If in the future our available liquidity is not sufficient to meet the Company’s operating and debt service obligations as they come due, management would need to pursue alternative arrangements through additional equity or debt financing in order to meet the Company’s cash requirements. There can be no assurance that any such financing would be available on commercially acceptable terms, or at all. In 2021, we did not experience difficulty accessing the capital and credit markets, but future volatility in the capital and credit markets may increase costs associated with issuing debt instruments or affect our ability to access those markets. In addition, it is possible that our ability to access the capital and credit markets could be limited at a time when we would like, or need, to do so, which could have an adverse impact on our ability to refinance maturing debt and/or react to changing economic and business conditions.

In summary, our cash flows for each period were as follows:

(in thousands)	Year ended December 31, 2021	Year ended December 31, 2020
Net cash provided by operating activities	$ 400,454	$ 446,674
Net cash used in investing activities	(298,118)	(243,326)
Net cash (used in) provided by financing activities	(276,497)	22,149
(Decrease) increase in cash and cash equivalents	(178,328)	228,982

Operating activities

Cash provided by operating activities is net income adjusted for certain non-cash items and changes in assets and liabilities.

Compared to 2020, the $46.2 million decrease in cash provided by operating activities in 2021 was primarily due to changes in working capital, partially offset by higher net income. Changes in working capital for 2021 were driven by higher trade accounts receivables and notes receivables, inventory and lower income taxes payable. The change for trade accounts receivables and notes receivables was primarily due to increased sales activity compared to the prior year. The change for inventory is due to an increase in raw material purchases to mitigate potential supply chain issues related to COVID-19 and increased business activity. The change for taxes was primarily driven by higher tax payments compared to the prior year.

Investing activities

Investing cash flows consist primarily of capital expenditures, cash used for acquisitions and proceeds from sales of property and equipment.

The increase in cash used in investing activities in 2021 compared to 2020 was primarily due to higher cash paid for acquisitions of property, plant and equipment. This was partially offset by decreased cash paid for acquisitions.

Acquisition of property and equipment totaled $210.6 million in 2021, which primarily reflected investments in facilities, equipment and tooling, compared to $131.8 million in 2020, which primarily reflected investments in equipment and tooling. Capital expenditures in 2021 generally reflected more spending related to growth capacity investments and the investment in our previously announced investment in our new facility in Taiwan.

In 2021, the Company acquired BASF's Precision Microchemicals business and certain assets of another company in an immaterial transaction. The cash used to acquire these assets was $91.9 million, net of cash acquired. The transactions are described in further detail in note 3 to the Company's consolidated financial statements.

In 2020, the Company acquired Sinmat and GMTI. The cash used to acquire Sinmat and GMTI was $111.9 million, net of cash acquired. The transactions are described in further detail in note 3 to the Company's consolidated financial statements.

Financing activities

Financing cash flows consist primarily of repurchases of common stock, payment of dividends to stockholders, issuance and repayment of short-term and long-term debt, and proceeds from the sale of shares of common stock through employee equity incentive plans.

In 2021, there was $276.5 million of cash used in financing activities compared to $22.1 million cash provided by financing activities in 2020. The change was primarily due to a $318.1 million increase in payments on long-term debt and debt extinguishment and a $22.5 million increase in repurchase and retirement of common stock. The Company made a payment of $569.1 million related to the redemption of the $550.0 million aggregate principal amount of 2026 Notes during 2021, compared to a payment of $251.0 million of outstanding borrowings under the Term Loan Facility in 2020. The increase in cash flows used in financing activities was offset in part by the absence of a $16.1 million deferred acquisition payment related to our acquisition of Digital Specialty Chemicals in 2020, a $16.0 million increase in proceeds from the issuance of common stock from employee stock plans and a $8.7 million decrease in taxes paid related to net share settlement of equity awards.

The Company's total dividend payments were $43.5 million in 2021 compared to $43.2 million in 2020. The Company has paid a cash dividend in each of the past 17 quarters. On January 19, 2022, the Company's board of directors declared a quarterly cash dividend of $0.10 per share to be paid on February 23, 2022 to shareholders of record as of February 2, 2022.

Other Liquidity and Capital Resources Considerations

Debt

(In thousands)	December 31, 2021	December 31, 2020
Total debt (par value)	$ 945,000	$ 1,095,000

In connection with the proposed merger, on December 31, 2021, Entegris entered into an amended and restated commitment letter, which amended and restated the commitment letter with Morgan Stanley Senior Funding, Inc. and certain other financial institutions, which are referred to collectively herein as the financing sources, dated as of December 14, 2021, among Entegris and the financing sources. Such commitment letter as amended and restated is referred to herein as the commitment letter. Pursuant to the commitment letter, the financing sources (a) committed to provide to Entegris (i) a senior secured first lien term loan B facility in an aggregate principal amount of up to $4.0 billion, which is referred to herein as the term loan B facility and (ii) a senior unsecured bridge term loan facility in an aggregate principal amount of up to $895.0 million, which is referred to as the bridge facility and, together with the term loan B facility, the facilities and (b) to the extent that such financing sources are revolving lenders under Entegris' existing credit agreement, (i) consented to the merger and certain amendments to the terms the Revolving Facility and (ii) committed to provide to Entegris, additional revolving credit commitments in an aggregate principal amount of $175.0 million. See note 8 to the Company's consolidated financial statements for additional discussion.

On April 30, 2021, the Company issued $400.0 million aggregate principal amount of the 2029 Notes. The Company used the net proceeds of the offering, together with cash on hand and borrowings under the Revolving Facility, to redeem all of the 2026 Notes. We capitalized $4.1 million of third-party expenses related to the issuance of the 2029 Notes as debt issuance costs. At December 31, 2021, we had $400.0 million aggregate principal amount of 3.625% senior unsecured notes outstanding on the 2029 Notes.

The Company voluntarily redeemed its $550.0 million aggregate principal amount of 2026 Notes at a redemption price of 103.469% (expressed as percentage of principal amount), plus accrued and unpaid interest of $5.6 million. The redemption of the 2026 Notes resulted in a loss on extinguishment of debt of $23.1 million.

In connection with our issuance of the 2029 Notes, we amended the Revolving Facility to provide for, among other things, lending commitments in an aggregate principal amount of up to $400.0 million (up from $300.0 million) and to extend the maturity date to April 30, 2026. The Revolving Facility bears interest at a rate per annum equal to, at the Company's option, either a base rate (such as prime rate) or LIBOR, plus, in each case, an applicable margin. At December 31, 2021, there was no balance outstanding under the Revolving Facility and we had undrawn outstanding letters of credit of $0.2 million.

The Company's Term Loan Facility matures on November 6, 2025 and bears an interest rate of 2.10% at December 31, 2021. As of December 31, 2021, the aggregate principal amount outstanding under the Term Loan Facility was $145.0 million.

As of December 31, 2021, we had $400 million aggregate principal amount of 4.375% senior unsecured notes due April 15, 2028 outstanding.

Through December 31, 2021, the Company was in compliance with all applicable financial covenants included in the terms of its credit facilities.

The Company also has lines of credit with one bank that provide for borrowings of Japanese yen for the Company's Japanese subsidiary equivalent to an aggregate of approximately $8.7 million. There were no outstanding borrowings under these lines of credit at December 31, 2021.

Cash and cash requirements

(In thousands)	December 31, 2021	December 31, 2020
Cash and cash equivalents	$ 402,565	$ 580,893
U.S.	107,814	268,135
Non-U.S.	294,751	312,758

Our cash and cash equivalents include cash on hand and highly liquid debt securities with original maturities of three months or less, which are valued at cost and approximate fair value. We utilize a variety of funding strategies in an effort to ensure that our worldwide cash is available in the locations in which it is needed. We have accrued taxes on any earnings that are not indefinitely reinvested. We estimate that no material withholding taxes would be incurred if any indefinitely reinvested earnings were distributed.

Cash requirements

We have cash requirements to support working capital needs, capital expenditures, business acquisitions, contractual obligations, commitments, principal and interest payments on debt and other liquidity requirements associated with our operations. We generally intend to use available cash and funds generated from our operations to meet these cash requirements, but in the event that additional liquidity is required we may also borrow under our revolving credit facility.

The following table summarizes our short and long-term cash requirements as of December 31, 2021:

(In thousands)	Total	Due within one year of December 31, 2021	Due later than one year from December 31, 2021
Long-term debt	$ 945,000	$ —	$ 945,000
Interest payments on long-term debt	229,059	35,051	194,008
Capital purchase obligations	307,685	274,144	33,541
Supply purchase obligations	18,600	9,300	9,300
Operating leases	86,449	13,340	73,109
Other liabilities reflected on our consolidated balance sheet	464,276	362,290	101,986
Total	$ 2,051,069	$ 694,125	$ 1,356,944

Long-term debt and interest payments on long-term debt. We have contractual obligations for principal and interest payments on our long-term debt. See note 8 of the consolidated financials for additional information. Debt obligations are classified based on their stated maturity date, regardless of their classification on the Company's consolidated balance sheets. Interest projections on both variable and fixed rate long-term debt are based on interest rates effective as of December 31, 2021 and do not include $8.0 million for net unamortized discounts and debt issuance costs.

Capital purchase obligations. We have capital purchase obligations that represent commitments for the construction or purchase of property, plant and equipment. They were not recorded as liabilities on the Company's consolidated balance sheet as of December 31, 2021, as the Company had not yet received the related goods or taken title to the property.

We expect capital expenditure spending to be approximately $500.0 million in 2022 for growth capacity investments and the construction of our new manufacturing and enhanced technology facility in Taiwan. Of this amount, approximately $225 million will be spent for the new facility in Taiwan. This new facility will ultimately support all three of our divisions.

Supply purchase obligations. We have commitments, including take-or-pay contracts, that are not presented as capital purchase commitments above. They were not recorded as liabilities on the Company's consolidated balance sheet as of December 31, 2021, as the Company had not yet received the related goods or taken title to the property.

Operating lease commitments. Commitments under operating leases primarily relate to leasehold properties. See note 10 of the consolidated financials for additional information.

Other liabilities. Other liabilities primarily includes employee compensation and benefits, contract liabilities, pension liabilities, net tax liabilities, and other accrued liabilities. The timing of cash flows associated with these obligations is based upon management's estimates over the terms of these arrangements and is largely based upon historical experience. Included in our other liabilities due within one year is our employee incentive payout of $86.5 million, which will be paid in the first quarter of 2022.

Of the tax liabilities included in the table above, $23.8 million relates to uncertain tax positions. We are unable to accurately predict when these amounts will be realized or released. However, it is reasonably possible that there could be significant changes to our unrecognized tax benefits in the next twelve months due to a tax audit settlement or some other unforeseeable event. See note 12 of the consolidated financials for additional information.

Other Planned Uses of Capital. On December 14, 2021, we entered into the merger agreement, with merger sub and CMC. Pursuant and subject to the terms and conditions of the merger agreement, upon completion of the transaction, merger sub will merge with and into CMC, with CMC surviving and continuing as a wholly-owned subsidiary of Entegris. At the effective time of the proposed merger, each outstanding share of common stock of CMC (with certain exceptions set forth in the merger agreement) will be converted into the right to receive $133.00 in cash and 0.4506 shares of common stock of Entegris, plus cash in lieu of any fractional shares. The transaction is subject to certain conditions, including the affirmative vote of holders of a majority of the outstanding shares of common stock of CMC approving the adoption of the merger agreement and the receipt of approvals under United States and certain foreign antitrust and competition laws. We have agreed to operate our business in the ordinary course during the period between the execution of the merger agreement and the effective time of the proposed merger, subject to specific exceptions set forth in the merger agreement, and have agreed to certain other customary restrictions on operations, as set forth in the merger agreement. Entegris has obtained fully committed debt financing from Morgan Stanley Senior Funding, Inc. and certain other financial institutions.

As of December 31, 2021, we believe our cash and cash equivalents, cash generated from operations, and our ability to access capital markets will satisfy our cash needs for the foreseeable future both globally and domestically.

New Accounting Pronouncements

Recently adopted accounting pronouncements Refer to note 1 to the Company's consolidated financial statements for a discussion of accounting pronouncements implemented in 2021. Other than the adoption of ASU No. 2019-12, "Simplifying the Accounting for Income Taxes", there were no recently issued accounting pronouncements adopted in 2021.

Recently issued accounting pronouncements Refer to note 1 of the Company's consolidated financial statements for a discussion of accounting pronouncements recently issued but not yet adopted.

Non-GAAP Information The Company's consolidated financial statements are prepared in conformity with GAAP.

The Company also utilizes certain non-GAAP financial measures as a complement to financial measures provided in accordance with GAAP in order to better assess and reflect trends affecting the Company's business and results of operations. These non-GAAP financial measures include adjusted EBITDA and adjusted operating income, together with related measures thereof, and non-GAAP earnings per share, as well as certain other supplemental non-GAAP financial measures included in the discussion of the Company's financial results.

Adjusted EBITDA is defined by the Company as net income before (1) income tax expense, (2) interest expense, (3) interest income, (4) other expense (income), net, (5) charge for fair value write-up of acquired inventory sold, (6) deal and transaction costs, (7) integration costs, (8) severance and restructuring costs, (9) amortization of intangible assets and (10) depreciation. Adjusted operating income is defined by the Company as adjusted EBITDA exclusive of the depreciation addback noted above. The Company also utilizes non-GAAP financial measures whereby adjusted EBITDA and adjusted operating income are each divided by the Company's net sales to derive adjusted EBITDA margin and adjusted operating margin, respectively.

Non-GAAP EPS is defined by the Company as net income before, as applicable, (1) charge for fair value write-up of acquired inventory sold, (2) deal and transaction costs, (3) integration costs, (4) severance and restructuring costs, (5) loss on extinguishment of debt and modification, (6) amortization of intangible assets and (7) the tax effect of the foregoing adjustments to net income, stated on a per share basis, divided by diluted weighted average shares outstanding.

The Company provides supplemental non-GAAP financial measures to help management and investors to better understand its business and believes these measures provide investors and analysts additional and meaningful information for the assessment of the Company's ongoing results. Management also uses these non-GAAP measures to assist in the evaluation of the performance of its business segments and to make operating decisions.

Management believes the Company's non-GAAP measures help indicate the Company's baseline performance before certain gains, losses or other charges that may not be indicative of the Company's business or future outlook and offer a useful view of business performance in that the measures provide a more consistent means of comparing performance. The Company believes the non-GAAP measures aid investors' overall understanding of the Company's results by providing a higher degree of transparency for such items and providing a level of disclosure that will help investors understand how management plans, measures and evaluates the Company's business performance. Management believes that the inclusion of non-GAAP measures provides greater consistency in its financial reporting and facilitates investors' understanding of the Company's historical operating trends by providing an additional basis for comparisons to prior periods.

Management uses adjusted EBITDA and adjusted operating income to assist it in evaluations of the Company's operating performance by excluding items that management does not consider as relevant in the results of its ongoing operations. Internally, these non-GAAP measures are used by management for planning and forecasting purposes, including the preparation of internal budgets; for allocating resources to enhance financial performance; for evaluating the effectiveness of operational strategies; and for evaluating the Company's capacity to fund capital expenditures, secure financing and expand its business.

In addition, and as a consequence of the importance of these non-GAAP financial measures in managing its business, the Company's board of directors uses non-GAAP financial measures in the evaluation process to determine management compensation.

The Company believes that certain analysts and investors use adjusted EBITDA, adjusted operating income and non-GAAP EPS as supplemental measures to evaluate the overall operating performance of firms in the Company's industry. Additionally, lenders or potential lenders use adjusted EBITDA measures to evaluate the Company's creditworthiness.

The presentation of non-GAAP financial measures is not meant to be considered in isolation, as a substitute for, or superior to, financial measures or information provided in accordance with GAAP. Management strongly encourages investors to review the Company's consolidated financial statements in their entirety and to not rely on any single financial measure.

Management notes that the use of non-GAAP measures has limitations, including but not limited to:

First, non-GAAP financial measures are not standardized. Accordingly, the methodology used to produce the Company's non-GAAP financial measures is not computed under GAAP and may differ notably from the methodology used by other companies. For example, the Company’s non-GAAP measure of adjusted EBITDA may not be directly comparable to EBITDA or an adjusted EBITDA measure reported by other companies.

Second, the Company’s non-GAAP financial measures exclude items such as amortization and depreciation that are recurring. Amortization of intangibles and depreciation have been, and will continue to be for the foreseeable future, significant recurring expenses with an impact upon the Company’s results of operations, notwithstanding the lack of immediate impact upon cash flows.

Third, there is no assurance that the Company will not have future charges for fair value write-up of acquired inventory, restructuring activities, deal and transaction costs, integration costs or similar items and, therefore, may need to record additional charges (or credits) associated with such items, including the tax effects thereon. The exclusion of these items in the Company’s non-GAAP measures should not be construed as an implication that these costs are unusual, infrequent or non-recurring.

Management considers these limitations by providing specific information regarding the GAAP amounts excluded from these non-GAAP financial measures and evaluating these non-GAAP financial measures together with their most directly comparable financial measures calculated in accordance with GAAP. The calculations of adjusted EBITDA, adjusted operating income, and non-GAAP EPS, and reconciliations between these financial measures and their most directly comparable GAAP equivalents, are presented below in the accompanying tables.

The reconciliation of GAAP measures to adjusted operating income and adjusted EBITDA for the years ended December 31, 2021 and 2020 are presented below:

In thousands	2021	2020
Net sales	$ 2,298,893	$ 1,859,313
Net income	$ 409,126	$ 294,969
Net income - as a % of net sales	17.8 %	15.9 %
Adjustments to net income		
Income tax expense	69,950	59,318
Interest expense	41,240	48,600
Interest income	(243)	(786)
Other expense (income), net	31,695	(6,656)
GAAP – Operating income	551,768	395,445
Operating margin - as a % of net sales	24.0 %	21.3 %
Charge for fair value write-up of acquired inventory sold	428	590
Deal and transaction costs	4,744	2,576
Integration costs	3,780	2,963
Severance and restructuring costs	529	4,364
Amortization of intangible assets	47,856	53,092
Adjusted operating income	609,105	459,030
Adjusted operating margin	26.5 %	24.7 %
Depreciation	90,311	83,430
Adjusted EBITDA	$ 699,416	$ 542,460
Adjusted EBITDA – as a % of net sales	30.4 %	29.2 %

The reconciliation of GAAP measures to non-GAAP earnings per share for the years ended December 31, 2021 and 2020 are presented below:

In thousands, except per share data	2021	2020
Net income	$ 409,126	$ 294,969
Adjustments to net income:		
Charge for fair value write-up of acquired inventory sold	428	590
Deal and transaction costs	4,744	2,576
Integration costs	3,780	2,963
Severance and restructuring costs	529	4,364
Loss on debt extinguishment and modification	23,338	2,378
Amortization of intangible assets	47,856	53,092
Tax effect of adjustments to net income and discrete tax items(1)	(20,411)	(15,197)
Non-GAAP net income	$ 469,390	$ 345,735
Diluted earnings per common share	$ 3.00	$ 2.16
Effect of adjustments to net income	$ 0.44	$ 0.37
Diluted non-GAAP earnings per common share	$ 3.44	$ 2.54

[1]The tax effect of pre-tax adjustments to net income was calculated using the applicable marginal tax rate for each respective year.

Item 7A. Quantitative and Qualitative Disclosure About Market Risks.

Entegris' principal financial market risks are sensitivities to interest rates and foreign currency exchange rates. The Company's interest-bearing cash and cash equivalents and variable rate debt are subject to interest rate fluctuations. The Company's cash and cash equivalents include cash on hand and highly liquid debt securities with original maturities of three months or less are instruments with maturities of three months or less. A 100-basis point change in interest rates would potentially increase or decrease annual net income by approximately $2.6 million and $3.4 million annually for the years ended December 31, 2021 and 2020, respectively.

The cash flows and results of operations of the Company’s foreign-based operations are subject to fluctuations in foreign currency exchange rates. Approximately 23.5% and 23.6% of the Company’s sales during 2021 and 2020 were collectively denominated in the South Korean Won, New Taiwan Dollar, Chinese Renmibi, Canadian Dollar, Malaysian Ringgit, Singapore Dollar, Euro, Israeli Shekel and the Japanese Yen. Financial results therefore will be affected by changes in currency exchange rates. If all foreign currencies were to see a 10% reduction versus the U.S. dollar during the years ended December 31, 2021 and 2020, revenue would be negatively impacted by approximately $52.4 million and $43.8 million, respectively.

The Company occasionally uses derivative financial instruments to manage the foreign currency exchange rate risks associated with its foreign-based operations. At December 31, 2021 and 2020, the Company had no net exposure to any foreign currency forward contracts.

Item 8. Financial Statements and Supplementary Data.

The information called for by this item is set forth in the Consolidated Financial Statements covered by the Report of Independent Registered Public Accounting Firm at the end of this report.

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

This item is not applicable.

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Based on management’s evaluation (with the participation of our principal executive officer and principal financial officer), as of the end of the period covered by this report, our principal executive officer and principal financial officer have concluded that our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act), are effective to provide reasonable assurance that information required to be disclosed by us in reports that we file or submit under the Exchange Act is recorded, processed, summarized, and reported within the time periods specified in SEC rules and forms, and is accumulated and communicated to management, including our principal executive officer and principal financial officer, as appropriate, to allow timely decisions regarding required disclosure.

Changes in Internal Control Over Financial Reporting

There were no changes to our internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) that occurred during the quarter ended December 31, 2021 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Management Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) to provide reasonable assurance regarding the reliability of our financial reporting and the preparation of consolidated financial statements for external purposes in accordance with GAAP.

Management assessed our internal control over financial reporting as of December 31, 2021. Management based its assessment on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework). Management’s assessment included evaluation of elements such as the design and operating effectiveness of key financial reporting controls, process documentation, accounting policies, and our overall control environment.

The Company completed its acquisition of BASF’s Precision Microchemicals business on November 30, 2021. The Company is continuing to integrate Precision Microchemicals into its internal control over financial reporting, and management’s evaluation of the effectiveness of the Company’s internal control over financial reporting excluded Precision Microchemicals. Precision Microchemicals had total assets of approximately $92 million at December 31, 2021 and net sales of $1 million in 2021.

Based on its assessment, management has concluded that our internal control over financial reporting was effective as of the end of the fiscal year to provide reasonable assurance regarding the reliability of financial reporting and the preparation of consolidated financial statements for external reporting purposes in accordance with GAAP. We reviewed the results of management's assessment with the Audit Committee of our board of directors.

KPMG LLP, the independent registered public accounting firm which audited the consolidated financial statements included in this annual report, has issued an attestation report on our internal control over financial reporting.

Inherent Limitations on Effectiveness of Controls

Our management, including our principal executive officer and principal financial officer, does not expect that our disclosure controls and procedures or our internal control over financial reporting will prevent or detect all errors and all fraud. A control system, no matter how well-designed and operated, can provide only reasonable, not absolute, assurance that the control system's objectives will be met. The design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Further, because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud, if any, have been detected.

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

Entegris, Inc.:

Opinion on Internal Control Over Financial Reporting

We have audited Entegris Inc. and subsidiaries' (the Company) internal control over financial reporting as of December 31, 2021, based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2021, based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2021 and 2020, the related consolidated statements of operations, comprehensive income, equity, and cash flows for each of the years in the three-year period ended December 31, 2021, and the related notes (collectively, the consolidated financial statements), and our report dated February 4, 2022 expressed an unqualified opinion on those consolidated financial statements.

The Company acquired Precision Microchemicals during 2021, and management excluded from its assessment of the effectiveness of the Company’s internal control over financial reporting as of December 31, 2021, Precision Microchemicals’s internal control over financial reporting associated with total assets of $92 million and total revenues of $1 million included in the consolidated financial statements of the Company as of and for the year ended December 31, 2021. Our audit of internal control over financial reporting of the Company also excluded an evaluation of the internal control over financial reporting of Precision Microchemicals.

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

Definition and Limitations of Internal Control Over Financial Reporting

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/ KPMG LLP

Minneapolis, Minnesota
February 4, 2022

Item 9B. Other Information.

None.

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

Not Applicable.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

Except as set forth below, the information required by this Item 10 has been omitted from this report, and is incorporated by reference to our Definitive Proxy Statement for the Entegris, Inc. Annual Meeting of Stockholders, which is currently scheduled to be held on April 27, 2022, and to be filed with the Securities and Exchange Commission pursuant to Regulation 14A within 120 days after the end of our 2021 fiscal year.

In 2005, our board of directors adopted a code of business ethics, The Entegris, Inc. Code of Business Ethics, applicable to all of our executives, directors and employees, as well as a set of corporate governance guidelines, which have been updated from time to time. The Entegris, Inc. Code of Business Ethics, the Corporate Governance Guidelines and the charters for our Audit & Finance Committee, Governance & Nominating Committee and our Management Development & Compensation Committee all appear on our website at http://www.Entegris.com under "Investor Relations - Corporate Governance". The Entegris, Inc. Code of Business Ethics, Corporate Governance Guidelines and committee charters are also available in print to any shareholder that requests a copy. Copies may be obtained by contacting our Secretary through our corporate headquarters. The Company intends to comply with the requirements of Item 5.05 of Form 8-K with respect to any amendment to or waiver of the provisions of the Entegris, Inc. Code of Business Ethics applicable to the registrant's Chief Executive Officer, Chief Financial Officer, Chief Accounting Officer or Controller by posting notice of any such amendment or waiver at the same location on our website.

INFORMATION ABOUT OUR EXECUTIVE OFFICERS

The following is a list of our Executive Officers, their ages and their offices, as of the date of this Annual Report on Form 10-K.

Name	Age	Office
Bertrand Loy	56	*President & Chief Executive Officer*
Gregory B. Graves	61	*Executive Vice President, Chief Financial Officer & Treasurer*
Todd Edlund	59	*Executive Vice President & Chief Operating Officer*
Sue Rice	63	*Senior Vice President, Global Human Resources*
Joe Colella	40	*Senior Vice President, General Counsel & Secretary*
Jim O'Neill	57	*Senior Vice President, Chief Technology Officer*
Corey Rucci	62	*Senior Vice President, Business Development*
Olivier Blachier	48	*Senior Vice President, Business and New Markets Development*
Bruce W. Beckman	54	*Senior Vice President, Finance*
Stuart Tison	58	*Senior Vice President & General Manager, Specialty Chemicals and Engineered Materials*
Clint Haris	49	*Senior Vice President & General Manager, Microcontamination Control*
William Shaner	54	*Senior Vice President & General Manager, Advanced Materials Handling*
Michael D. Sauer	56	*Vice President, Controller & Chief Accounting Officer*

Bertrand Loy has been our Chief Executive Officer, President and a director since November 2012. From July 2008 to November 2012, he served as our Executive Vice President and Chief Operating Officer. From August 2005 until July 2008, he served as our Executive Vice President in charge of our information technology, global supply chain and manufacturing operations. He served as the Vice President and Chief Financial Officer of Mykrolis, a company spun out of Millipore Corporation, a life science products company, from January 2001 until August 2005. Prior to that, Mr. Loy served as the Chief Information Officer of Millipore Corporation during 1999 and 2000, and previously served in various strategic planning, global supply chain and financial roles with Millipore and Sandoz Pharmaceuticals (now Novartis), a pharmaceutical company. He has served on the board of directors of Harvard Bioscience, Inc. (scientific equipment) since November 2014 and is now its lead independent director. Since July 2013, Mr. Loy has also been on the board of directors of SEMI, the global industry association representing the electronics manufacturing supply chain, and currently acts as the chairman of the association.

Gregory B. Graves has served as our Executive Vice President and Chief Financial Officer since July 2008. Prior to that, he served as Senior Vice President and Chief Financial Officer since April 2007. Prior to April 2007, he served as Senior Vice President, Strategic Planning & Business Development since the effectiveness of the merger with Mykrolis in August 2005. Mr. Graves served as the Chief Business Development Officer of Entegris Minnesota starting in September 2002 and from September 2003 until August 2004 he also served as Senior Vice President of Finance. Prior to joining Entegris Minnesota in September 2002, Mr. Graves held positions in investment banking and corporate development, including at U.S. Bancorp Piper Jaffray from June 1998 to August 2002 and at Dain Rauscher from October 1996 to May 1998. Mr. Graves has served as a director of Laird Superfood, Inc. (a plant-based food company) since September 2018, and was a member of the board of directors of Plug Power Inc. (an energy solutions provider) from May 2017 to June 2019.

Todd Edlund has been our Executive Vice President and Chief Operating Officer since July 2016. Prior to that, he was our Senior Vice President and Chief Operating Officer since November 2014. After the merger with ATMI in April 2014, Mr. Edlund served as Senior Vice President and General Manager of our Critical Materials Handling business and prior to that merger, he was the Vice President and General Manager of our Contamination Control Solutions division since December 2007. He served as the Vice President and General Manager of our Liquid Systems business unit from 2005 to 2007, and prior to that, as Entegris Minnesota's Vice President of Sales for semiconductor markets from 2003 to 2005. Prior to 2003, Mr. Edlund held a variety of positions with our predecessor companies since 1995.

Sue Rice has been our Senior Vice President of Global Human Resources since September 2017. Prior to that, Ms. Rice served as Senior Vice President and Chief Human Resources Officer for Thermo Fisher Scientific, a scientific equipment company, from 2013 to 2017, Region Vice President HR Asia Pacific & Emerging Markets from 2009 to 2013 and Group Vice President, HR Analytical Technologies Group from 2006 to 2009. Prior to that, Ms. Rice held senior human resource positions with Fidelity Human Resources Services Company and Sherbrooke Associates.

Joe Colella has been our Senior Vice President, General Counsel and Secretary since April 2020. Previously, Mr. Colella served as our Vice President, Deputy General Counsel from December 2018 until April 2020, Assistant General Counsel from April 2018 until December 2018 and Senior Corporate Counsel from December 2013 until April 2018. Prior to joining Entegris, Mr. Colella served as an associate at an international law firm from 2007 until 2013.

Jim O'Neill has been our Senior Vice President, Chief Technology Officer since September 2019, having previously served as our Vice President, Chief Technology Officer since April 2014 when he joined Entegris as part of our acquisition of ATMI. At ATMI, Dr. O'Neill was Senior Vice President of Electronic Materials from January 2012 to April 2014. Prior to that, he held numerous technical and leadership roles in semiconductor research and development with over 23 years at IBM.

Corey Rucci has served as our Senior Vice President, Business Development since January 2018, having served as Vice President, Business Development since February 2014. Prior to that, he served as Vice President and General Manager of our Specialty Materials Division since 2011 and as General Manager of Poco Graphite, Inc. (POCO) since 2008 when we acquired POCO. Prior to joining Entegris, Mr. Rucci served POCO as the President and Chief Operating Officer since 2007, Chief Operating Officer since 2005, Chief Financial Officer since 2001 and Vice President of Business Development since 1998. Prior to that, he worked at UNOCAL Corp. for 17 years in a variety of accounting, marketing and business development roles.

Olivier Blachier has been our Senior Vice President, Business and New Markets Development since November 2021 and is responsible for the company's merger and acquisition activities and for the commercialization of emerging businesses. Before joining Entegris, Mr. Blachier held various senior leadership positions between 2007 and 2021 at Air Liquide Group, a global leader in gases, technologies, and services for the industrial and healthcare sectors. Since 2018, he has been based in Taiwan and most recently served as APAC vice president for the Hydrogen and Energy Transition business and also led the implementation of capital projects. Previously, he was president of Air Liquide Far Eastern (ALFE) and vice president of Electronics where he led the growth of the company's electronics business in Greater China as well as the hydrogen energy business across Asia. He also served as group vice president for Air Liquide Industrial Merchant in prior years. From 1997 to 2007, Mr. Blachier worked for Edwards, Ltd., a global vacuum and abatement process leader and subsidiary of BOC Group, where he held multiple roles in the U.S. and U.K., including leading multiple acquisitions and joint ventures. Mr. Blachier holds a Master of Sciences in Fluid and Chemical Engineering from Grenoble Poly-technique National Institute in France and obtained a certificate in Strategy & Organization from Stanford University Graduate School of Business.

Bruce W. Beckman has been our Senior Vice President, Finance since February 2018. Prior to that, Mr. Beckman served as Vice President, Finance since joining Entegris in April 2015. From 1990 to 2015, Mr. Beckman worked in numerous capacities for General Mills, Inc., including Vice President, Finance, Meals Division from July 2012 to January 2015, Director of Corporate Planning & Analysis from July 2008 to July 2012 and Director of Internal Controls from 2003 to 2005.

Stuart Tison has been our Senior Vice President, Specialty Chemicals and Engineered Materials since July 2016. Prior to that, Mr. Tison served as Vice President, Specialty Gas Solutions since February 2015, as Vice President, Business Development since January 2010 and as Vice President, Corporate Development since July 2007. Prior to that, he served Celerity, Inc. as Vice President, Engineering and served Entegris predecessor companies Mykrolis and Millipore in a variety of sales, marketing, business development and engineering roles.

Clint Haris has been our Senior Vice President, Microcontamination Control since July 2016. Prior to that, Mr. Haris served as our Vice President, Liquid Microcontamination Control since August 2014. Prior to joining Entegris, Mr. Haris served in a variety of executive roles at Brooks Automation Inc. including Senior Vice President, Life Science Systems from 2010 to 2014 and Senior Vice President and General Manager, Systems Solutions from 2009 to 2010.

William Shaner has been our Senior Vice President, Advanced Materials Handling since July 2016. Prior to that, Mr. Shaner served as our Senior Vice President, Global Operations since February 2014 and, prior to that, as our Vice President and General Manager, Microenvironments division since 2007. He has served in a variety of sales, marketing, business development and engineering roles since joining Entegris in 1995.

Michael D. Sauer has been our Vice President, Controller and Chief Accounting Officer since June 2012. Prior to that, he served as the Corporate Controller since 2008. From the time of the merger with Mykrolis in August 2005 until April 2008, Mr. Sauer served as Director of Treasury and Risk Management. Mr. Sauer joined Fluoroware, Inc., a predecessor to Entegris Minnesota in 1988 and held a variety of finance and accounting positions until 2001 when he became the Director of Business Development for Entegris Minnesota, the successor to Fluoroware, serving in that position until the merger with Mykrolis.

Item 11. Executive Compensation.

The information required by this Item 11 has been omitted from this report, and is incorporated by reference to our Definitive Proxy Statement for the Entegris, Inc. Annual Meeting of Stockholders to be held on April 27, 2022, and to be filed with the Securities and Exchange Commission pursuant to Regulation 14A within 120 days after the end of our 2021 fiscal year.

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

Securities Authorized for Issuance Under Equity Compensation Plans:

As of December 31, 2021, our equity compensation plan information is as follows:

Equity Compensation Plan Information

Plan category	Number of securities to be issued upon exercise of outstanding options, warrants and rights (a)	Weighted-average exercise price of outstanding options, warrants and rights[1] (b)	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a))[2] [3] (c)
Equity compensation plans approved by security holders	1,893,199	$ 55.32	10,112,129
Equity compensation plans not approved by security holders	—	—	—
Total	1,893,199	$ 55.32	10,112,129

(1) The weighted average exercise price does not take into account the shares issuable upon vesting of outstanding restricted stock units, which have no exercise price.

(2) These shares are available for future issuance under the 2020 Stock Plan in the form of stock options, restricted stock units, performance shares and other stock awards in accordance with the terms of the 2020 Stock Plan.

(3) Includes 1,450,664 shares remaining available for future issuance under the Company's Employee Stock Purchase Plan as of December 31, 2021.

The other information required by this Item 12 has been omitted from this report, and is incorporated by reference to our Definitive Proxy Statement for the Entegris, Inc. Annual Meeting of Stockholders to be held on April 27, 2022, and to be filed with the Securities and Exchange Commission pursuant to Regulation 14A within 120 days after the end of our 2021 fiscal year.

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

The information required by this Item 13 has been omitted from this report, and is incorporated by reference to our Definitive Proxy Statement for the Entegris, Inc. Annual Meeting of Stockholders to be held on April 27, 2022, and to be filed with the Securities and Exchange Commission pursuant to Regulation 14A within 120 days after the end of our 2021 fiscal year.

Item 14. Principal Accountant Fees and Services.

The information required by this Item 14 has been omitted from this report, and is incorporated by reference to our Definitive Proxy Statement for the Entegris, Inc. Annual Meeting of Stockholders to be held on April 27, 2022, and to be filed with the Securities and Exchange Commission pursuant to Regulation 14A within 120 days after the end of our 2021 fiscal year.

PART IV

Item 15. Exhibits and Financial Statement Schedules.

(a) The following Financial Statements are included in Item 8 herein:

1. Financial Statements:
   - Report of Independent Registered Public Accounting Firm
   - Consolidated Balance Sheets at December 31, 2021 and 2020
   - Consolidated Statements of Operations for the Years Ended December 31, 2021, 2020 and 2019
   - Consolidated Statements of Comprehensive Income for the Years Ended December 31, 2021, 2020 and 2019
   - Consolidated Statements of Equity for the Years Ended December 31, 2021, 2020 and 2019
   - Consolidated Statements of Cash Flows for the Years Ended December 31, 2021, 2020 and 2019
   - Notes to Consolidated Financial Statements

2. Financial Statement Schedule - All financial statement schedules have been omitted since the information is either not applicable or is included in the consolidated financial statements notes thereof.

3. Exhibits - The following exhibits are incorporated by reference into this Annual Report on Form 10-K:

Reg. S-K Item 601(b) Reference	Document Incorporated	Referenced Document on file with the Commission
(2)	Agreement and Plan of Merger, dated as of December 14, 2021, by and among Entegris, Inc., CMC Materials, Inc. and Yosemite Merger Sub, Inc.	Exhibit 2.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on December 16, 2021
(3)	Amended and Restated Certificate of Incorporation of Entegris, Inc., as amended	Exhibit 3.1 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2011
(3)	By-Laws of Entegris, Inc., as amended December 17, 2008	Exhibit 3 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2008
(4)	Form of certificate representing shares of Common Stock, $.01 par value per share	Exhibit 4.1 to Form S-4 Registration Statement of Entegris, Inc. and Eagle DE, Inc. (No. 333-124719)
(4)	Indenture, dated as of April 30, 2020, by and among the Company, certain subsidiaries of the Company and Wells Fargo Bank, National Association, as trustee, including the form of note representing the 2028 Notes	Exhibit 4.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on April 30, 2020
(4)	Indenture, dated as of April 30, 2021, by and among the Company, certain subsidiaries of the Company and Wells Fargo Bank, National Association, as trustee, including the form of note representing the 2029 Notes	Exhibit 4.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on April 30, 2021
(4)	Description of Capital Stock	Exhibit 4.1 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Credit and Guaranty Agreement dated as of November 6, 2018, among Entegris, Inc., as borrower, certain subsidiaries of Entegris, Inc., as guarantors, the lenders party thereto and Goldman Sachs Bank USA, as administrative agent and collateral agent	Exhibit 10.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on November 6, 2018
(10)	Amendment No. 1 to Credit and Guaranty Agreement, dated as of February 8, 2019, among Entegris, Inc., as borrower, each lender party thereto, and Goldman Sachs Bank USA, as administrative agent and collateral agent	Exhibit 10.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on February 8, 2019

(10)	Amendment No. 2 to Credit and Guaranty Agreement, dated as of October 31, 2019, among Entegris, Inc., as borrower, the other credit parties party thereto, the lenders party thereto, the issuing banks party thereto, Goldman Sachs Bank USA, as the predecessor agent, and Morgan Stanley Senior Funding, Inc., as the successor agent.	Exhibit 10.5 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Amendment No. 3 to Credit and Guaranty Agreement, dated as of May 20, 2020, among Entegris, Inc., as borrower, the lenders party thereto and Morgan Stanley Senior Funding, Inc., as administrative agent	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended June 27, 2020
(10)	Amendment No. 4 to Credit and Guaranty Agreement, dated as of April 30, 2021, among Entegris, Inc., as borrower, the other credit parties thereto, the lenders party thereto, the issuing banks party thereto and Morgan Stanley Senior Funding, Inc., as administrative agent	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended July 3, 2021
(10)	Pledge and Security Agreement dated as of November 6, 2018, among Entegris, Inc., as borrower, the guarantors party thereto and Goldman Sachs Bank USA, as collateral agent	Exhibit 10.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on November 6, 2018
(10)	Amendment No. 1 to Pledge and Security Agreement, dated as of October 31, 2019, among Entegris, Inc., as borrower, the other credit parties party thereto, Goldman Sachs Bank USA, as the predecessor agent, and Morgan Stanley Senior Funding, Inc., as the successor agent	Exhibit 10.6 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Entegris, Inc. – 2010 Stock Plan, as amended*	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended July 3, 2010
(10)	Entegris, Inc. 2020 Stock Plan*	Annex 1 to the Entegris, Inc. Schedule 14A proxy statement for its 2020 Annual Meeting of Stockholders (No. 001-32598), as filed with the Securities and Exchange Commission on March 18, 2020
(10)	Entegris, Inc. Outside Directors’ Stock Option Plan*	Exhibit 10.2 to Entegris, Inc. Registration Statement on Form S-1 (No. 333-33668)
(10)	Entegris, Inc. Amended and Restated Employee Stock Purchase Plan*	Exhibit 4.1 to Entegris, Inc. Registration Statement on Form S-8 (No. 333-211444)
(10)	Second Amended and Restated Entegris Incentive Plan*	Exhibit 10.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on May 24, 2017
(10)	Entegris, Inc. 2007 Deferred Compensation Plan*	Exhibit 10.2 to Entegris, Inc. Quarterly Report on Form10-Q for the fiscal period ended June 30, 2007
(10)	Amended and Restated Supplemental Executive Retirement Plan for Key Salaried Employees*	Exhibit 10.2 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2008
(10)	Amendment to Amended and Restated SERP*	Exhibit 10.15 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2009
(10)	Lease Agreement, dated April 1, 2002 between Nortel Networks HPOCS Inc. and Mykrolis Corporation, relating to Executive office, R&D and manufacturing facility located at 129 Concord Road Billerica, MA	Exhibit 10.1.3 to Mykrolis Corporation’s Quarterly Report on Form 10-Q for the quarter ended March 31, 2002
(10)	Amendment of Lease between Entegris, Inc. and KBS Rivertech, LLC dated April 1, 2012	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended June 30, 2012
(10)	Second Amendment of Lease, dated March 8, 2016, between Entegris, Inc. and KBS Rivertech, LLC	Exhibit 10.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on March 11, 2016
(10)	Fluoropolymer Purchase and Sale Agreement, by and between E.I. Du Pont De Nemours and Company and the Registrant, dated January 1, 2011, as amended	Exhibit 10.2 to Entegris, Inc. Quarterly Report on Form 10-Q for the quarter ended April 2, 2011

(10)	Form of Indemnification Agreement between Entegris, Inc. and each of its executive officers and Directors	Exhibit 10.30 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended August 27, 2005
(10)	Form of Executive Change of Control Termination Agreement between Entegris, Inc. and certain of its executive officers*	Exhibit 10.31 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended August 27, 2005
(10)	Form of Revised Executive Change of Control Termination Agreement between Entegris, Inc. and certain of its executive officers executed in 2015 (other than those executive officers who executed the form previously filed)*	Exhibit 10.1 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 29, 2016
(10)	Entegris, Inc. 2015 Stock Option Grant Agreement*	Exhibit 10.4 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 29, 2016
(10)	Entegris, Inc. 2016 Stock Option Grant Agreement*	Exhibit 10.4 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 17, 2017
(10)	Entegris, Inc. 2017 Stock Option Grant Agreement*	Exhibit 10.3 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 15, 2018
(10)	Entegris, Inc. 2018 Performance Share Award Agreement*	Exhibit 10.1 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 11, 2019
(10)	Entegris, Inc. 2018 RSU Award Agreement*	Exhibit 10.2 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 11, 2019
(10)	Entegris, Inc. 2018 Stock Option Grant Agreement*	Exhibit 10.3 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 11, 2019
(10)	Entegris, Inc. 2019 Performance Share Award Agreement*	Exhibit 10.1 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Entegris, Inc. 2019 RSU Award Agreement*	Exhibit 10.2 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Entegris, Inc. 2019 Stock Option Grant Agreement*	Exhibit 10.3 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Entegris, Inc. 2020 Performance Share Award Agreement (under 2010 Stock Plan)*	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended March 28, 2020
(10)	Entegris, Inc. 2020 RSU Award Agreement (under 2010 Stock Plan)*	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended March 28, 2020
(10)	Entegris, Inc. 2020 Stock Option Grant Agreement (under 2010 Stock Plan)*	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended March 28, 2020
(10)	Entegris, Inc. 2020 RSU Award Agreement (under 2020 Stock Plan)*	Exhibit 10.1 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2020
(10)	Entegris, Inc. 2021 Performance Share Award Agreement*	Exhibit 10.2 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2020
(10)	Entegris, Inc. 2021 RSU Award Agreement*	Exhibit 10.3 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2020
(10)	Entegris, Inc. 2021 Stock Option Grant Agreement*	Exhibit 10.4 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2020

(10)	Executive Employment Agreement, effective November 28, 2012, between the Registrant and Bertrand Loy*	Exhibit 10.1 to Entegris, Inc. Annual Report on Form 10-K for the fiscal year ended December 31, 2012
(10)	Amendment No. 1, dated April 26, 2013, to Executive Change in Control Termination Agreement, between Entegris, Inc. and Bertrand Loy*	Exhibit 99.1 to Entegris, Inc. Current Report on Form 8-K filed with the Securities and Exchange Commission on April 26, 2013
(10)	Amendment No. 2, dated February 5, 2020, to Executive Change in Control Termination Agreement, between Entegris, Inc. and Bertrand Loy*	Exhibit 10.4 to Entegris, Inc. Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 7, 2020
(10)	Severance Protection Agreement, dated May 13, 2011 between Entegris, Inc. and Gregory B. Graves*	Exhibit 10.2 to Entegris, Inc. Quarterly Report on Form 10-Q for the period ended July 2, 2011
(10)	Amendment No. 1, dated as of February 23, 2016, to the Severance Protection Agreement by and between Entegris, Inc, and Gregory B. Graves*	Exhibit 10.2 to Entegris, Inc. Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on April 28, 2016
(10)	Separation Agreement and Release, dated as of August 27, 2019, by and between the Company and Gregory Marshall*	Exhibit 10.1 to Entegris, Inc. Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on October 24, 2019

* A “management contract or compensatory plan”

The Company hereby files as exhibits to this Annual Report on Form 10-K the following documents:

Reg. S-K

Item 601(b)

Reference	Exhibit No.	Documents Filed Herewith
(10)	10.1	Entegris, Inc. 2022 Performance Share Award Agreement*
(10)	10.2	Entegris, Inc. 2022 RSU Award Agreement*
(10)	10.3	Entegris, Inc. 2022 Stock Option Grant Agreement*
(10)	10.4	Third Amendment to Lease Agreement, dated as of October 21, 2021, between Entegris, Inc. and Rivertech Owner LLC
(21)	21	Subsidiaries of Entegris, Inc.
(23)	23	Consent of Independent Registered Public Accounting Firm
(24)	24	Power of Attorney by the Directors of Entegris, Inc.
(31)	31.1	Certification required by Rule 13a-14(a) in accordance with Section 302 of the Sarbanes—Oxley Act of 2002.
(31)	31.2	Certification required by Rule 13a-14(a) in accordance with Section 302 of the Sarbanes—Oxley Act of 2002.
(32)	32.1	Certification required by Rule 13a-14(b) and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
(32)	32.2	Certification required by Rule 13a-14(b) and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
(101)	101.INS	XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document
(101)	101.SCH	XBRL Taxonomy Extension Schema Document
(101)	101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document
(101)	101.DEF	XBRL Taxonomy Extension Definition Linkbase Document
(101)	101.LAB	XBRL Taxonomy Extension Label Linkbase Document
(101)	101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document
(104)	104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101)

* A “management contract or compensatory plan”

Item 16. Form 10-K Summary.

None.

SIGNATURES

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

ENTEGRIS, INC.

Date: February 4, 2022	By /s/ BERTRAND LOY
	Bertrand Loy
	President & Chief Executive Officer

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

SIGNATURE	**TITLE**	**DATE**
/s/ BERTRAND LOY Bertrand Loy	President, Chief Executive Officer and Director (Principal executive officer)	February 4, 2022
/s/ GREGORY B. GRAVES Gregory B. Graves	Executive Vice President, Chief Financial Officer & Treasurer (Principal financial officer)	February 4, 2022
/s/ MICHAEL D. SAUER Michael D. Sauer	Vice President, Controller & Chief Accounting Officer (Principal accounting officer)	February 4, 2022
PAUL L.H. OLSON* Paul L.H. Olson	Director, Chairman of the Board	February 4, 2022
MICHAEL A. BRADLEY* Michael A. Bradley	Director	February 4, 2022
RODNEY CLARK* Rodney Clark	Director	February 4, 2022
JAMES F. GENTILCORE* James F. Gentilcore	Director	February 4, 2022
YVETTE KANOUFF* Yvette Kanouff	Director	February 4, 2022
JAMES P. LEDERER* James P. Lederer	Director	February 4, 2022
AZITA SALEKI-GERHARDT* Azita Saleki-Gerhardt	Director	February 4, 2022

*By /s/ Gregory B. Graves
Gregory B. Graves, Attorney-in-fact

ENTEGRIS, INC.
INDEX TO FINANCIAL STATEMENTS

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

Entegris, Inc.:

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Entegris Inc. and subsidiaries (the Company) as of December 31, 2021 and 2020, the related consolidated statements of operations, comprehensive income, equity, and cash flows for each of the years in the three-year period ended December 31, 2021, and the related notes (collectively, the consolidated financial statements). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2021, in conformity with U.S. generally accepted accounting principles.

Basis for Opinion

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

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

Critical Audit Matter

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

Fair value of acquired customer relationships

As discussed in Note 3 to the consolidated financial statements, the Company accounts for acquired businesses using the acquisition method of accounting by recording assets and liabilities acquired at their respective fair values. During 2021, the Company acquired BASF's Precision Microchemical business for a total purchase price of $89.7 million, net of cash acquired, and the Company recorded intangible assets for customer relationships of $31.8 million.

We identified the assessment of the fair value of certain acquired customer relationships as a critical audit matter. The key assumptions in the discounted cash flow model used to estimate the acquisition-date fair value of the customer relationships included future revenue growth rates and the discount rate. Evaluating the key assumptions underlying the estimate of the fair value of the customer relationships acquired involved a high degree of auditor judgment, as changes in these key assumptions could have a significant impact on the fair value of the customer relationships.

The following are the primary procedures we performed to address this critical audit matter. We evaluated the design and tested the operating effectiveness of certain internal controls related to the Company's acquisition process. This included controls related to the development and review of the key assumptions. We evaluated the reasonableness of the Company's selected future revenue growth rates by comparing those assumptions to the historical results of BASF's Precision Microchemical business and industry outlooks for the end user markets of the acquired business's products. In addition, we involved valuation professionals with specialized skills and knowledge, who assisted in evaluating the Company's discount rate by comparing it against a discount rate range that was independently developed using publicly available market data for comparable entities.

/s/ KPMG LLP

We or our predecessor firms have served as the Company’s auditor since 1966.

Minneapolis, Minnesota
February 4, 2022

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED BALANCE SHEETS

(In thousands, except share and per share data)	December 31, 2021	December 31, 2020
ASSETS		
Current assets:		
Cash and cash equivalents	$ 402,565	$ 580,893
Trade accounts and notes receivable, net	347,413	264,392
Inventories, net	475,213	323,944
Deferred tax charges and refundable income taxes	35,312	21,136
Other current assets	52,867	43,892
Total current assets	1,313,370	1,234,257
Property, plant and equipment, net	654,098	525,367
Other assets:		
Right-of-use assets	66,563	45,924
Goodwill	793,702	748,037
Intangible assets, net	335,113	337,632
Deferred tax assets and other noncurrent tax assets	17,671	14,519
Other noncurrent assets	11,379	11,960
Total assets	$ 3,191,896	$ 2,917,696
LIABILITIES AND EQUITY		
Current liabilities:		
Accounts payable	$ 130,734	$ 81,618
Accrued payroll and related benefits	108,818	94,364
Other accrued liabilities	90,313	82,648
Income taxes payable	49,136	43,996
Total current liabilities	379,001	302,626
Long-term debt, excluding current maturities	937,027	1,085,783
Pension benefit obligations and other liabilities	37,816	36,457
Deferred tax liabilities and other noncurrent tax liabilities	64,170	73,606
Long-term lease liabilities	60,101	39,730
Commitments and contingent liabilities	—	—
Equity:		
Preferred stock, par value $.01; 5,000,000 shares authorized; none issued and outstanding as of December 31, 2021 and December 31, 2020	—	—
Common stock, par value $.01; 400,000,000 shares authorized; issued and outstanding shares as of December 31, 2021: 135,719,366 and 135,516,966, respectively; issued and outstanding shares as of December 31, 2020: 135,148,774 and 134,946,374, respectively	1,357	1,351
Treasury stock, common, at cost: 202,400 shares held as of December 31, 2021 and December 31, 2020	(7,112)	(7,112)
Additional paid-in capital	879,845	844,850
Retained earnings	879,776	577,833
Accumulated other comprehensive loss	(40,085)	(37,428)
Total equity	1,713,781	1,379,494
Total liabilities and equity	$ 3,191,896	$ 2,917,696

See the accompanying notes to consolidated financial statements.

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF OPERATIONS

(In thousands, except per share data)	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Net sales	$ 2,298,893	$ 1,859,313	$ 1,591,066
Cost of sales	1,239,229	1,009,591	879,413
Gross profit	1,059,664	849,722	711,653
Selling, general and administrative expenses	292,408	265,128	284,807
Engineering, research and development expenses	167,632	136,057	121,140
Amortization of intangible assets	47,856	53,092	66,428
Operating income	551,768	395,445	239,278
Interest expense	41,240	48,600	46,962
Interest income	(243)	(786)	(4,652)
Other expense (income), net	31,695	(6,656)	(121,081)
Income before income tax expense	479,076	354,287	318,049
Income tax expense	69,950	59,318	63,189
Net income	$ 409,126	$ 294,969	$ 254,860
Basic net income per common share	$ 3.02	$ 2.19	$ 1.89
Diluted net income per common share	$ 3.00	$ 2.16	$ 1.87
Weighted average shares outstanding			
Basic	135,411	134,837	135,137
Diluted	136,574	136,266	136,568

See the accompanying notes to consolidated financial statements.

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

(In thousands)	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Net income	$ 409,126	$ 294,969	$ 254,860
Other comprehensive loss, net of tax			
Foreign currency translation adjustments	(2,275)	(120)	(3,692)
Pension liability adjustments, net	(382)	(49)	69
Other comprehensive loss	(2,657)	(169)	(3,623)
Comprehensive income	$ 406,469	$ 294,800	$ 251,237

See the accompanying notes to consolidated financial statements.

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF EQUITY

(In thousands)	Common shares outstanding	Common stock	Treasury shares	Treasury stock	Additional paid-in capital	Retained earnings	Foreign currency translation adjustments	Defined benefit pension adjustments	Total
Balance at December 31, 2018	136,179	$ 1,362	202	$ (7,112)	$ 837,658	$ 213,753	$ (32,776)	$ (860)	$ 1,012,025
Shares issued under stock plans	877	9	—	—	(1,440)	—	—	—	(1,431)
Share-based compensation expense	—	—	—	—	19,629	—	—	—	19,629
Repurchase and retirement of common stock	(2,126)	(22)	—	—	(13,084)	(61,681)			(74,787)
Dividends declared ($0.30 per share)	—	—	—	—	21	(40,805)	—	—	(40,784)
Pension liability adjustment	—	—	—	—	—	—	—	69	69
Foreign currency translation	—	—	—	—	—	—	(3,692)	—	(3,692)
Net income	—	—	—	—	—	254,860	—	—	254,860
Balance at December 31, 2019	134,930	1,349	202	(7,112)	842,784	366,127	(36,468)	(791)	1,165,889
Shares issued under stock plans	997	10	—	—	(16,072)	—	—	—	(16,062)
Share-based compensation expense	—	—	—	—	22,920	—	—	—	22,920
Repurchase and retirement of common stock	(778)	(8)	—	—	(4,820)	(39,735)	—		(44,563)
Dividends declared ($0.32 per share)	—	—	—	—	38	(43,528)	—	—	(43,490)
Pension liability adjustment	—	—	—	—	—	—	—	(49)	(49)
Foreign currency translation	—	—	—	—	—	—	(120)	—	(120)
Net income	—	—	—	—	—	294,969	—	—	294,969
Balance at December 31, 2020	135,149	1,351	202	(7,112)	844,850	577,833	(36,588)	(840)	1,379,494
Shares issued under stock plans	1,133	11	—	—	8,643	—	—	—	8,654
Share-based compensation expense	—	—	—	—	29,884	—	—	—	29,884
Repurchase and retirement of common stock	(563)	(5)	—	—	(3,547)	(63,557)	—		(67,109)
Dividends declared ($0.32 per share)	—	—	—	—	15	(43,626)	—	—	(43,611)
Pension liability adjustment	—	—	—	—	—	—	—	(382)	(382)
Foreign currency translation	—	—	—	—	—	—	(2,275)	—	(2,275)
Net income	—	—	—	—	—	409,126	—	—	409,126
Balance at December 31, 2021	135,719	$ 1,357	202	$ (7,112)	$ 879,845	$ 879,776	$ (38,863)	$ (1,222)	$ 1,713,781

See the accompanying notes to consolidated financial statements.

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF CASH FLOWS

(In thousands)	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Operating activities:			
Net income	$ 409,126	$ 294,969	$ 254,860
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation	90,311	83,430	74,975
Amortization	47,856	53,092	66,428
Share-based compensation expense	29,884	22,920	19,629
Provision for deferred income taxes	(18,433)	(7,250)	(14,008)
Charge for excess and obsolete inventory	17,103	15,387	11,433
Loss on extinguishment of debt	23,338	2,378	—
Other	(2,000)	1,090	12,118
Changes in operating assets and liabilities, net of effects of acquisitions:			
Trade accounts receivable and notes receivable	(86,766)	(27,461)	(3,164)
Inventories	(168,372)	(50,772)	(21,354)
Accounts payable and other accrued liabilities	53,577	40,162	(22,647)
Other current assets	2,870	(11,952)	7,784
Income taxes payable, refundable income taxes and noncurrent taxes payable	(3,292)	28,490	(3,494)
Other	5,252	2,191	(262)
Net cash provided by operating activities	400,454	446,674	382,298
Investing activities:			
Acquisition of property and equipment	(210,626)	(131,752)	(112,355)
Acquisition of business, net of cash acquired	(91,942)	(111,912)	(277,369)
Other	4,450	338	3,884
Net cash used in investing activities	(298,118)	(243,326)	(385,840)
Financing activities:			
Proceeds from short-term borrowings	101,000	217,000	—
Payments of short-term borrowings	(101,000)	(217,000)	—
Proceeds from long-term debt	400,000	400,000	—
Payments of long-term debt	(550,000)	(251,000)	(4,000)
Payments for debt issuance costs	(5,069)	(3,964)	—
Payments for debt extinguishment costs	(19,080)	—	—
Payments for dividends	(43,545)	(43,245)	(40,566)
Issuance of common stock from employee stock plans	24,744	8,738	7,291
Taxes paid related to net share settlement of equity awards	(16,090)	(24,800)	(8,722)
Repurchase and retirement of common stock	(67,109)	(44,563)	(80,321)
Deferred acquisition payment	—	(16,125)	—
Other	(348)	(2,892)	(502)
Net cash (used in) provided by financing activities	(276,497)	22,149	(126,820)
Effect of exchange rate changes on cash and cash equivalents	(4,167)	3,485	211
(Decrease) increase in cash and cash equivalents	(178,328)	228,982	(130,151)
Cash and cash equivalents at beginning of year	580,893	351,911	482,062
Cash and cash equivalents at end of year	$ 402,565	$ 580,893	$ 351,911

See the accompanying notes to consolidated financial statements

ENTEGRIS, INC. AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF CASH FLOWS (CONTINUED)

Supplemental Cash Flow Information

(In thousands)	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Non-cash transactions:			
Contingent consideration obligation	$ —	$ —	$ 686
Deferred acquisition payments, net	250	1,482	19,848
Equipment purchases in accounts payable	29,042	11,921	11,285
Increase in dividends payable	66	245	349
Schedule of interest and income taxes paid:			
Interest paid	$ 46,791	$ 42,575	$ 41,711
Income taxes, net of refunds received	88,059	37,228	77,970

See the accompanying notes to consolidated financial statements

ENTEGRIS, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

DECEMBER 31, 2021

(1) SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Nature of Operations Entegris, Inc. (Entegris or the Company) is a leading supplier of advanced materials and process solutions for the semiconductor and other high-technology industries.

Principles of Consolidation The consolidated financial statements include the accounts of the Company and its majority-owned subsidiaries. Intercompany profits, transactions and balances have been eliminated in consolidation.

Use of Estimates and Basis of Presentation The preparation of consolidated financial statements in conformity with accounting principles generally accepted in the United States requires management to make judgments, estimates and assumptions that affect the amounts reported in the consolidated financial statements and accompanying notes. On an ongoing basis, Entegris evaluates its estimates, including those related to receivables, inventories, property, plant and equipment, goodwill, intangible assets, accrued liabilities, income taxes and share-based compensation, among others. Actual results could differ from those estimates.

Cash and Cash Equivalents Cash and cash equivalents include cash on hand and highly liquid debt securities with original maturities of three months or less, which are valued at cost and approximate fair value.

Allowance for Credit Allowances An allowance for uncollectible trade receivables is estimated based on a combination of write-off history, aging analysis and any specific, known troubled accounts. The Company maintains an allowance for credit allowances that management believes is adequate to cover expected losses on trade receivables.

Inventories Inventories are stated at the lower of cost and net realizable value. Cost is determined by the first-in, first-out (FIFO) method.

Leases The Company determines if an arrangement is a lease at inception. Right-of-use (ROU) assets include operating leases. Lease liabilities for operating leases are classified in “Other accrued liabilities” and “Long-term lease liabilities” in our consolidated balance sheet. We do not have material financing leases.

Operating assets and liabilities are recognized at commencement date based on the present value of the lease payments over the lease term. As most of our leases do not provide an implicit rate, we use our incremental borrowing rate based on the information available at commencement date in determining the present value of lease payments. We use the implicit rate when readily determinable. The ROU assets include prepaid lease payments and excludes lease incentives. Lease terms may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise that option. Lease expense for lease payments is recognized on a straight-line basis over the lease term.

Lease and non-lease components are generally accounted for separately for real estate leases. For non-real estate leases, we account for the lease and non-lease components as a single lease component.

Property, Plant and Equipment Property, plant and equipment are carried at cost and are depreciated using the straight-line method over the estimated useful lives of the assets. When assets are retired or disposed of, the cost and related accumulated depreciation are removed from the accounts, and gains or losses are recognized in the same period. Maintenance and repairs are expensed as incurred, while significant additions and improvements are capitalized. Long-lived assets, including property, plant and equipment, are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset or group of assets may not be recoverable based on estimated future undiscounted cash flows. The amount of impairment, if any, is measured as the difference between the net book value and the estimated fair value of the asset(s).

Fair Value of Financial Instruments The carrying value of cash equivalents, accounts receivable, accounts payable, accrued payroll and related benefits, and other accrued liabilities approximates fair value due to the short maturity of those instruments.

The fair value of long-term debt, including current maturities, based upon models utilizing market observable (Level 2) inputs and credit risk, was $952.5 million at December 31, 2021 compared to the carrying amount of long-term debt, including current maturities, of $937.0 million at December 31, 2021.

Goodwill and Intangible Assets Goodwill represents the excess of acquisition costs over the fair value of the net assets of businesses acquired. Goodwill is not subject to amortization, but is tested for impairment annually at August 31, the Company’s annual testing date, and whenever events or changes in circumstances indicate that impairment may have occurred. The Company compares the carrying value of its reporting units, including goodwill, to their fair value. For reporting units in which the assessment indicates that it is more likely than not that the fair value is more than its carrying value, goodwill is not considered impaired. If the carrying value of the reporting unit exceeds fair value, goodwill is considered impaired.

Based on its annual analysis, the Company determined there was no indication of impairment of goodwill and the estimated fair value of each reporting unit exceeded its carrying value.

Amortizable intangible assets include, among other items, patented, unpatented and other developed technology and customer-based intangibles, and are amortized using the straight-line method over their respective estimated useful lives. The Company reviews intangible assets and other long-lived assets for impairment if changes in circumstances or the occurrence of events suggest the remaining value may not be recoverable.

Derivative Financial Instruments The Company records derivatives as assets or liabilities on the balance sheet and measures such instruments at fair value. Changes in fair value of derivatives are recorded each period in the Company’s consolidated statements of operations.

The Company periodically enters into forward foreign currency contracts to reduce exposures relating to rate changes in certain foreign currencies. Certain exposures to credit losses related to counterparty nonperformance exist. However, the Company does not anticipate nonperformance by the counterparties since they are large, well-established financial institutions. None of these derivatives is accounted for as a hedge transaction. Accordingly, changes in the fair value of forward foreign currency contracts are recorded as other expense (income), net, in the Company’s consolidated statements of operations. The fair values of the Company’s derivative financial instruments are based on prices quoted by financial institutions for these instruments.

Foreign Currency Translation Assets and liabilities of certain foreign subsidiaries are translated from foreign currencies into U.S. dollars at period-end exchange rates, and the resulting gains and losses arising from translation of net assets located outside the U.S. are recorded as a cumulative translation adjustment, a component of accumulated other comprehensive loss in the consolidated balance sheets. Income statement amounts are translated at the weighted average exchange rates for the year. Translation adjustments are not adjusted for income taxes, as substantially all translation adjustments relate to permanent investments in non-U.S. subsidiaries. Gains and losses resulting from foreign currency transactions are included in other expense (income), net, in the Company’s consolidated statements of operations.

Revenue Recognition Revenue is measured based on consideration specified in a contract with a customer, and excludes any sales incentives and amounts collected on behalf of third parties. The Company recognizes revenue when it satisfies a performance obligation by transferring control over a product or service to a customer.

Taxes assessed by a governmental authority that are both imposed on and concurrent with a specific revenue-producing transaction, that are collected by the Company from a customer, are excluded from revenue.

Shipping and handling costs associated with outbound freight after control over a product has transferred to a customer are accounted for as a fulfillment cost and are included in cost of sales.

The Company recognizes the incremental costs of obtaining contracts as an expense when incurred if the amortization period of the assets that the Company otherwise would have recognized is one year or less.

When the Company receives consideration, or such consideration is unconditionally due, from a customer prior to transferring goods or services to the customer under the terms of a sales contract, the Company records deferred revenue, which represents a contract liability. Such deferred revenue typically results from advance payments received on sales of the Company’s products. The Company makes the required disclosures with respect to deferred revenue below.

The Company does not disclose information about remaining performance obligations that have original expected durations of one year or less.

The following is a description of principal activities from which the Company generates its revenues. The Company has three reportable segments. For more detailed information about reportable segments, see note 16 to the consolidated financial statements. For each of the three reportable segments, the recognition of revenue regarding the nature of goods and services provided by the segments are similar and described below. The Company recognizes revenue for product sales at a point in time following the transfer of control of such products to the customer, which generally occurs upon shipment or delivery, depending on the terms of the underlying contracts. For product sales contracts that contain multiple performance obligations, the Company allocates the transaction price to each performance obligation identified in the contract based on relative standalone selling prices, or estimates of such prices, and recognizes the related revenue as control of each individual product is transferred to the customer in satisfaction of the corresponding performance obligations. All material revenue is being recognized at a point in time.

The Company generally recognizes revenue for sales of services when the Company has satisfied the performance obligation. The payment terms and revenue recognized are based on time and materials.

The Company also enters into arrangements to license its intellectual property. These arrangements typically permit the customer to use a specialized manufacturing process and in return the Company receives a royalty fee. The Company recognizes revenue for a sales-based or usage-based royalty promised in exchange for a license of intellectual property when the subsequent sale or usage occurs.

The Company offers certain customers cash discounts and volume rebates as sales incentives. The discounts and volume rebates are recorded as a reduction in sales at the time revenue is recognized in an amount estimated based on historical experience and contractual obligations. The Company periodically reviews the assumptions underlying its estimates of discounts and volume rebates and adjusts its revenues accordingly.

In addition, the Company offers free product rebates to certain customers. The Company utilizes an adjusted market approach to estimate the stand-alone selling price of the loyalty program and allocates a portion of the consideration received to the free product offering. The free product offering is redeemable upon future purchases of the Company's products. The amount associated with free product rebates is recorded as deferred revenue on the balance sheet and is recognized as revenue when the free product is redeemed or when the likelihood of redemption is remote. The Company has deemed that the amount is immaterial for disclosure.

The Company provides for the estimated costs of fulfilling its obligations under product warranties at the time the related revenue is recognized. The Company estimates the costs based on historical failure rates, projected repair costs, and knowledge of specific product failures (if any). The specific warranty terms and conditions vary depending upon the product sold and the country in which we do business, but generally include parts and labor over a period generally ranging from 90 days to one year. The Company regularly reevaluates its estimates to assess the adequacy of the recorded warranty liabilities and adjusts the amounts as necessary.

The Company's contracts are generally short-term in nature. Most contracts do not exceed twelve months. Payment terms vary by the type and location of the Company's customers and the products or services offered. The term between invoicing and when payment is due is not significant. For certain products or services and customer types, the Company requires payment before the products or services are delivered to the customer. Those customers that prepay are represented by the contract liabilities below until the performance obligations are satisfied.

Engineering, Research and Development Expenses Engineering, research and development expenses are expensed as incurred.

Share-based Compensation The Company measures the cost of employee services received in exchange for the award of equity instruments based on the fair value of the award at the date of grant. Share-based compensation expense is recognized using the straight-line attribution method to recognize share-based compensation over the service period of the award, with adjustments recorded for forfeitures as they occur.

Income Taxes The Company accounts for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined on the basis of the differences between the financial statements and tax basis of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income tax expense in the period that includes the enactment date.

The Company recognizes deferred tax assets to the extent that it believes these assets are more likely than not to be realized. A valuation allowance is recorded to reduce deferred tax assets when it is more likely than not that the Company would not be able to realize all or part of its deferred tax assets. In making such a determination, the Company considers all available positive and negative evidence, including future reversals of existing temporary differences, projected future taxable income, tax-planning strategies, and results of recent operations. If the Company determines that it would be able to realize its deferred tax assets in the future in excess of their net recorded amount, the Company would make an adjustment to the deferred tax asset valuation allowance, which would reduce the provision for income taxes.

The Company's policy for recording interest and penalties associated with audits and unrecognized tax benefits is to record such items as a component of income before taxes. Penalties and interest to be paid or received are recorded in other expense (income), net, in the statement of operations.

Comprehensive Income (Loss) Comprehensive income (loss) represents the change in equity resulting from items other than shareholder investments and distributions. The Company's foreign currency translation adjustments, unrealized gains and losses on available-for-sale investments, and minimum pension liability adjustments are included in accumulated other comprehensive loss. Comprehensive income (loss) and the components of accumulated other comprehensive loss are presented in the accompanying consolidated statements of comprehensive income (loss) and consolidated statements of equity.

Recent Accounting Pronouncements Adopted in 2021 In December 2019, the FASB issued ASU No. 2019-12, "Simplifying the Accounting for Income Taxes" under ASC 740, which simplifies the accounting for income taxes by removing certain exceptions to the general principles in Topic 740 and amends existing guidance to improve consistent application. This guidance is effective for fiscal years beginning after December 15, 2020, including interim periods within that fiscal year. The Company adopted this new guidance in the first quarter of fiscal 2021. The adoption of ASU 2019-12 did not have a material impact on the consolidated financial statements.

Recent Accounting Pronouncements Yet to be Adopted

The Company currently has no material recent accounting pronouncements yet to be adopted.

(2) REVENUES

The following table provides information about current contract liabilities from contracts with customers. The contract liabilities are included in other accrued liabilities balance in the consolidated balance sheet.

(In thousands)	2021	2020
Balance at beginning of year	$ 13,852	$ 13,022
Revenue recognized that was included in the contract liability balance at the beginning of the period	(13,819)	(11,018)
Increases due to cash received, excluding amounts recognized as revenue during the period	23,017	11,848
Balance at end of year	$ 23,050	$ 13,852

(3) ACQUISITIONS

Pending Acquisition - CMC Materials

On December 14, 2021, Entegris and CMC Materials, Inc. entered into a definitive Agreement and Plan of Merger pursuant to which Entegris will acquire CMC Materials in a cash and stock transaction with an enterprise value of approximately $6.5 billion. The transaction is to be financed with a combination of equity issued to CMC Materials, new debt and cash on hand. Entegris has obtained fully committed debt financing from Morgan Stanley Senior Funding, Inc. The transaction is expected to close in the second half of 2022, subject to the satisfaction of customary closing conditions, including regulatory approval and approval by CMC Materials shareholders.

Precision Microchemicals

On November 30, 2021, the Company completed its acquisition of the Precision Microchemicals business from BASF SE. The Precision Microchemicals business reports into the Specialty Chemicals and Engineered Materials segment of the Company. The acquisition was accounted for under the acquisition method of accounting, and the Precision Microchemicals business results of operations are included in the Company's consolidated financial statements as of and since November 30, 2021. Costs associated with the acquisition of the Precision Microchemicals business were $0.2 million for the year ended December 31, 2021 and were expensed as incurred. These costs are included in the selling, general and administrative expenses in the Company's consolidated statement of operations. The acquisition does not constitute a material business combination.

The purchase price for the Precision Microchemical business includes cash consideration of $89.7 million (net of cash acquired), which was funded from the Company's existing cash on hand.

The purchase price of the Precision Microchemical business exceeds the net of the acquisition-date amounts of the identifiable assets acquired and the liabilities assumed by $42.8 million. Cash flows used to determine the purchase price included strategic and synergistic benefits (investment value) specific to the Company, which resulted in a purchase price in excess of the fair value of identifiable net assets. This additional investment value resulted in goodwill, which is expected to be deductible for income tax purposes.

The fair value of acquired identifiable intangible assets was determined using Level 3 inputs for the "income approach" on an individual asset basis. The key assumptions used in the calculation of the discounted cash flows include future revenue growth rates, future gross margin, future selling, general and administrative expense, royalty rates, and discount rates. The valuations and the underlying assumptions have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations.

The following table summarizes the preliminary allocation of the purchase price to the fair values assigned to the assets acquired and liabilities assumed at the date of the acquisition:

(In thousands):	November 30, 2021
Inventories, net	$ 967
Other current assets	19
Identifiable intangible assets	44,910
Right-of-use assets	1,912
Property, plant and equipment	1,002
Other noncurrent assets	18
Accounts payable and accrued liabilities	(43)
Short-term lease liability	(170)
Long-term lease liability	(1,742)
Net assets acquired	46,873
Goodwill	42,819
Total purchase price, net of cash acquired	$ 89,692

The Company recognized the following provisional finite-lived intangible assets as part of the acquisition of the Precision Microchemical business:

(In thousands)	Amount	Weighted average life in years
Developed technology	$ 9,600	9.0
Trademarks and trade names	3,400	15.0
Customer relationships	31,800	15.5
Other	110	
	$ 44,910	14.1

The final valuation of assets acquired and liabilities assumed is expected to be completed as soon as possible, but no later than one year from the acquisition date. The determination of the fair value of property, plant and equipment is completed, with the remaining assets acquired, liabilities assumed and working capital expected to be finalized in the first quarter of 2022. To the extent that the Company's estimates require adjustment, the Company will modify the fair values.

Other Acquisitions

During the year ended December 31, 2021, the Company completed an acquisition for $2.5 million, substantially all of which was paid in cash and qualified as a business combination. This acquisition has been included in the Company’s condensed consolidated results of operations since its acquisition date. The effect of this business combination was not material to the Company’s condensed consolidated results of operations.

Global Measurement Technologies, Inc.

On July 10, 2020, the Company acquired Global Measurement Technologies, Inc., an analytical instrument provider for critical processes in semiconductor production, and its manufacturing partner Clean Room Plastics, Inc. (collectively, “GMTI”). GMTI reports into the Advanced Materials Handling segment of the Company. The acquisition was accounted for under the acquisition method of accounting, and GMTI’s results of operations are included in the Company’s consolidated financial statements as of and since July 10, 2020. Costs associated with the acquisition of GMTI were $1.0 million for the year ended December 31, 2020 and were expensed as incurred. These costs are included in the selling, general and administrative expenses in the Company’s consolidated statement of operations. The acquisition does not constitute a material business combination.

The purchase price for GMTI included cash consideration of $36.3 million, net of cash acquired, which was funded from the Company’s existing cash on hand.

The purchase price of GMTI exceeded the net of the acquisition-date amounts of the identifiable assets acquired and the liabilities assumed by $16.1 million. Cash flows used to determine the purchase price included strategic and synergistic benefits (investment value) specific to the Company, which resulted in a purchase price in excess of the fair value of identifiable net assets. This additional investment value resulted in goodwill, which is expected to be deductible for income tax purposes.

The fair value of acquired identifiable intangible assets was determined using Level 3 inputs for the "income approach" on an individual asset basis. The key assumptions used in the calculation of the discounted cash flows include future revenue growth rates, future gross margin, future selling, general and administrative expense, royalty rates, and discount rates. The valuations and the underlying assumptions have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations.

During the quarter ended September 26, 2020, the Company finalized its fair value determination of the assets acquired and the liabilities assumed. The following table summarizes the final allocation of the purchase price to the fair values assigned to the assets acquired and liabilities assumed at the date of the acquisition:

(In thousands):	July 10, 2020	
Trade accounts and note receivable, net	$	937
Inventories, net		1,079
Identifiable intangible assets		18,180
Right-of-use assets		337
Accounts payable and accrued liabilities		(28)
Short-term lease liability		(150)
Long-term lease liability		(187)
Net assets acquired		20,168
Goodwill		16,099
Total purchase price, net of cash acquired	$	36,267

The Company recognized the following finite-lived intangible assets as part of the acquisition of GMTI:

(In thousands)		Amount	Weighted average life in years
Developed technology	$	3,570	6.5
Trademarks and trade names		1,010	11.5
Customer relationships		13,600	15.5
	$	18,180	13.5

Sinmat

On January 10, 2020, the Company acquired Sinmat, Inc. ("Sinmat"), a chemical mechanical polishing slurry manufacturer. Sinmat reports into the Specialty Chemicals and Engineered Materials segment of the Company. The acquisition was accounted for under the acquisition method of accounting and Sinmat's results of operations are included in the Company's consolidated financial statements as of and since January 10, 2020. Costs associated with the acquisition of Sinmat were $0.7 million for year ended December 31, 2020 and were expensed as incurred. These costs are included in the selling, general and administrative expenses in the Company's consolidated statement of operations. The acquisition does not constitute a material business combination.

The purchase price for Sinmat included cash consideration of $76.2 million, or $75.6 million net of cash acquired, which was funded from the Company's existing cash on hand.

The purchase price of Sinmat exceeded the net of the acquisition-date amounts of the identifiable assets acquired and the liabilities assumed by $31.7 million. Cash flows used to determine the purchase price included strategic and synergistic benefits (investment value) specific to the Company, which resulted in a purchase price in excess of the fair value of identifiable net assets. This additional investment value resulted in goodwill, which is expected to be deductible for income tax purposes.

The fair value of acquired identifiable intangible assets was determined using Level 3 inputs for the "income approach" on an individual asset basis. The key assumptions used in the calculation of the discounted cash flows include future revenue growth rates, future gross margin, future selling, general and administrative expense, royalty rates, and discount rates. The valuations and the underlying assumptions have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations.

During the quarter ended June 27, 2020, the Company finalized its fair value determination of the assets acquired and the liabilities assumed. The following table summarizes the provisional and final allocations of the purchase price to the fair values assigned to the assets acquired and liabilities assumed at the date of the acquisition date and as adjusted as of June 27, 2020, respectively:

(In thousands):	As of January 10, 2020	As of June 27, 2020
Trade accounts and note receivable, net	$ 1,189	$ 1,189
Inventories, net	1,010	1,010
Other current assets	8	8
Property, plant and equipment	63	63
Identifiable intangible assets	41,680	41,680
Right-of-use assets	1,712	1,712
Deferred tax asset	—	102
Accounts payable and accrued liabilities	(58)	(58)
Short-term lease liability	(150)	(150)
Long-term lease liability	(1,562)	(1,562)
Net assets acquired	43,892	43,994
Goodwill	31,751	31,651
Total purchase price, net of cash acquired	$ 75,643	$ 75,645

The Company recognized the following finite-lived intangible assets as part of the acquisition of Sinmat:

(In thousands)	Amount	Weighted average life in years
Developed technology	$ 7,650	7.0
Trademarks and trade names	130	1.3
Customer relationships	33,900	15.0
	$ 41,680	13.5

(4) TRADE ACCOUNTS AND NOTES RECEIVABLE

Trade accounts and notes receivable from customers at December 31, 2021 and 2020 consist of the following:

(In thousands)	2021	2020
Accounts receivable	$ 347,111	$ 264,771
Notes receivable	2,651	2,005
Total trade accounts and notes receivable	349,762	266,776
Less allowance for credit allowances	2,349	2,384
Trade accounts and notes receivable, net	$ 347,413	$ 264,392

(5) INVENTORIES

Inventories at December 31, 2021 and 2020 consist of the following:

(In thousands)	2021	2020
Raw materials	$ 191,986	$ 97,319
Work-in-process	40,257	32,316
Finished goods [a]	242,970	194,309
Inventories, net	$ 475,213	$ 323,944

[a] Includes consignment inventories held by customers of $16.0 million and $13.0 million at December 31, 2021 and 2020, respectively.

(6) PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment at December 31, 2021 and 2020 consists of the following:

(In thousands)	2021	2020	Estimated useful lives in years
Land	$ 24,000	$ 23,901	
Buildings and improvements	281,019	238,586	5-35
Manufacturing equipment	415,985	365,511	5-10
Canisters and cylinders	142,071	120,113	3-12
Molds	77,708	76,283	3-5
Office furniture and lab equipment	189,258	165,950	3-8
Construction in progress	177,161	109,280	
Total property, plant and equipment	1,307,202	1,099,624	
Less accumulated depreciation	653,104	574,257	
Property, plant and equipment, net	$ 654,098	$ 525,367	

The table below sets forth the depreciation expense for the years ended December 31, 2021, 2020 and 2019:

(In thousands)	2021	2020	2019
Depreciation expense	$ 90,311	$ 83,430	$ 74,975

(7) GOODWILL AND INTANGIBLE ASSETS

Goodwill activity for each of the Company's reportable segments that carry goodwill, Specialty Chemicals and Engineered Materials ("SCEM"), Microcontamination Control ("MC") and Advanced Materials Handling ("AMH"), for the years ended December 31, 2021 and 2020 is shown below:

(In thousands)	SCEM	MC	AMH	Total
December 31, 2019	$ 397,952	$ 240,021	$ 57,071	$ 695,044
Addition due to acquisitions	31,751	—	16,099	47,850
Purchase accounting adjustments	1,276	1,769	—	3,045
Foreign currency translation	(3,266)	5,364	—	2,098
December 31, 2020	427,713	247,154	73,170	748,037
Addition due to acquisitions	42,819	—	932	43,751
Foreign currency translation	343	1,571	—	1,914
December 31, 2021	$ 470,875	$ 248,725	$ 74,102	$ 793,702

As of December 31, 2021, goodwill amounted to approximately $793.7 million, an increase of $45.7 million from the balance at December 31, 2020. The increase in goodwill in 2021 reflects the acquisitions of the Precision Microchemicals business and the other transaction described in note 3 and foreign currency translation. The increase in goodwill in 2020 reflects the acquisition of GMTI and Sinmat described in note 3 with additional increases as a result of purchase accounting adjustments related to Anow and MPD and foreign currency translation.

Identifiable intangible assets at December 31, 2021 and 2020 consist of the following:

	2021			
(In thousands)	Gross carrying amount	Accumulated amortization	Net carrying value	Weighted average life in years
Developed technology	$ 293,982	$ 232,722	$ 61,260	7.2
Trademarks and trade names	33,553	20,340	13,213	10.6
Customer relationships	481,674	227,350	254,324	12.4
Other	20,505	14,189	6,316	6.6
	$ 829,714	$ 494,601	$ 335,113	10.3

(In thousands)	2020 Gross carrying amount	Accumulated amortization	Net carrying value	Weighted average life in years
Developed technology	$ 283,272	$ 221,651	$ 61,621	7.1
Trademarks and trade names	30,100	18,374	11,726	10.1
Customer relationships	449,659	193,313	256,346	12.2
Other	20,396	12,457	7,939	6.6
	$ 783,427	$ 445,795	$ 337,632	10.1

The table below sets forth the amortization expense for the years ended December 31, 2021, 2020, and 2019:

(In thousands)	2021	2020	2019
Amortization expense	$ 47,856	$ 53,092	$ 66,428

The amortization expense for each of the five succeeding years and thereafter relating to intangible assets currently recorded in the Company's consolidated balance sheets is estimated to be the following at December 31, 2021:

(In thousands)	2022	2023	2024	2025	2026	Thereafter	Total
Future amortization expense	$ 51,041	50,352	37,738	31,293	29,060	135,629	$ 335,113

(8) DEBT

Long-term debt at December 31, 2021 and 2020 consists of the following:

(In thousands)	2021	2020
Senior unsecured notes due 2029	$ 400,000	$ —
Senior unsecured notes due 2028	400,000	400,000
Senior secured term loan facility due 2025	145,000	145,000
Senior unsecured notes due 2026	—	550,000
	945,000	1,095,000
Unamortized discount and debt issuance costs	7,973	9,217
Total long-term debt	937,027	1,085,783
Less current maturities of long-term debt	—	—
Long-term debt less current maturities	$ 937,027	$ 1,085,783

Annual maturities of long-term debt, excluding unamortized discount and issuance costs, due as of December 31, 2021 are as follows:

(In thousands)	2022	2023	2024	2025	2026	Thereafter	Total
Contractual debt obligation maturities*	$ —	—	—	145,000	—	800,000	$ 945,000

*Subject to Excess Cash Flow payments to the lenders, see discussion below.

Pending Merger

In connection with the proposed merger with CMC Materials, on December 31, 2021, the Company entered into an amended and restated commitment letter, which amended and restated the commitment letter with Morgan Stanley Senior Funding, Inc. and certain other financial institutions (collectively, the "Financing Sources"), dated as of December 14, 2021, among Entegris and the Financing Sources (as amended and restated, the "Commitment Letter"). Pursuant to the Commitment Letter, the Financing Sources (a) committed to provide Entegris (i) a senior secured first lien term loan B facility in an aggregate principal amount of up to $4 billion (the "Term Loan B Facility"), and (ii) a senior unsecured bridge term loan facility in an aggregate principal amount of up to $895.0 million (the "Bridge Facility" and together with the Term Loan B Facility, the "Facilities") and (b) to the extent that such Financing Sources are revolving lenders under Entegris' existing credit agreement, (i) consented to the merger and certain amendments to the terms of the Company's senior secured revolving credit facility (the "Revolving Facility") and (ii) committed to provide to Entegris additional revolving credit commitments in an aggregate principal amount of $175.0 million. Commitments under the Bridge Facility will be reduced by, among other things, the aggregate gross cash proceeds in excess of $300.0 million resulting from any issuance or sale by Entegris of (x) senior unsecured notes pursuant to a public offering or a Rule 144A offering or other private placement or certain other debt securities or indebtedness for borrowed money, which are collectively referred to as the notes, and (y) equity securities (including common stock and any securities convertible or exchangeable into or exercisable for equity securities or other equity-linked securities) of Entegris.

2029 Senior Unsecured Notes

On April 30, 2021, the Company issued $400 million aggregate principal amount of 3.625% senior unsecured notes due May 1, 2029 (the "2029 Notes"). The 2029 Notes were issued under an indenture dated as of April 30, 2021 (the "2029 Notes Indenture") by and among the Company, certain subsidiaries of the Company and Wells Fargo Bank, National Association, as trustee (the "Trustee"). Interest on the 2029 Notes is payable semi-annually in arrears on May 1 and November 1 of each year, commencing on November 1, 2021. The Company incurred debt issuance costs of $4.1 million in connection with the 2029 Notes. These costs are reported in the consolidated balance sheet as a direct deduction from the face amount of the 2029 Notes.

The Company used the net proceeds of the offering, together with cash on hand and $51 million borrowed under the Revolving Facility, to pay the redemption price for the redemption in full of the $550 million aggregate principal amount of senior unsecured notes due 2026 (the "2026 Notes") and to pay certain fees and expenses related to the offering. In connection with the redemption of the 2026 Notes, the Company incurred a loss on extinguishment of debt of $23.1 million, which is included in Other expense (income), net on the condensed consolidated statement of operations.

The 2029 Notes are guaranteed, jointly and severally, fully and unconditionally, on a senior unsecured basis, by the Company's existing and future domestic subsidiaries, other than certain excluded subsidiaries, to the extent that such subsidiaries guarantee indebtedness under the Company's senior secured term loan facility and Revolving Facility (together, the "Senior Secured Credit Facilities") or the Company's 4.375% senior unsecured notes due 2028 (the "2028 Notes"), and any other subsidiary of the Company, to the extent it incurs certain additional indebtedness (collectively, the "Guarantors").

The 2029 Notes and the guarantees thereof are the Company's and the Guarantors' senior unsecured obligations, respectively, and will (i) rank equally in right of payment with all of the Company's and the Guarantors' existing and future senior indebtedness (including the 2028 Notes); (ii) rank senior to any subordinated indebtedness that the Company or the Guarantors may incur; (iii) be effectively subordinated to all of the Company's or the Guarantors' existing and future secured indebtedness (including the Senior Secured Credit Facilities), in each case, to the extent of the value of the assets securing such indebtedness; and (iv) be structurally subordinated in right of payment to all existing and future obligations of the Company's subsidiaries that do not guarantee the 2029 Notes.

At any time prior to May 1, 2024, the Company may, at its option, on any one or more occasions, redeem up to 40% of the aggregate principal amount of the 2029 Notes, at a redemption price equal to 103.625% of the principal amount of the 2029 Notes redeemed, plus accrued and unpaid interest, if any, to, but not including, the date of redemption, with an amount of cash equal to the net cash proceeds of an equity offering, as defined in the 2029 Notes Indenture, by the Company; provided that (1) at least 60% of the aggregate principal amount of 2029 Notes issued under the 2029 Notes Indenture remains outstanding immediately after the occurrence of each such redemption; and (2) the redemption occurs within 120 days of the date of the closing of such equity offering.

Additionally, at any time prior to May 1, 2024, the 2029 Notes may be redeemed, in whole or in part, at the option of the Company, at a redemption price equal to 100% of the principal amount of the 2029 Notes redeemed, plus a "make whole" premium, plus accrued and unpaid interest, if any, to, but not including, the applicable redemption date.

On or after May 1, 2024, the Company may, on any one or more occasions, redeem all or a part of the 2029 Notes, at its option, at the redemption prices (expressed as percentages of principal amount) set forth below, plus accrued and unpaid interest, if any, on the 2029 Notes redeemed, to, but not including, the applicable date of redemption, if redeemed during the 12-month period beginning on May 1 of the years indicated below:

Year	Percentage
2024	102.719 %
2025	101.813 %
2026	100.906 %
2027 and thereafter	100.000 %

Upon the occurrence of certain change of control events accompanied by certain ratings events, the Company will be required to offer to repurchase all of the outstanding 2029 Notes at a purchase price of 101% of the principal amount thereof, plus accrued and unpaid interest, if any, to, but not including, the date of repurchase.

The 2029 Notes Indenture contains covenants that, among other things, limit the Company's ability and/or the ability of the Company's subsidiaries to:

- incur liens;

- engage in sales-and-leaseback transactions; and
- consolidate, merge with or convey, transfer or lease all or substantially all of the Company’s and its subsidiaries’ assets to another person.

The 2029 Notes Indenture also, subject to certain exceptions, limits the ability of any non-Guarantor subsidiary of the Company to incur indebtedness. These covenants are subject to a number of other limitations and exceptions as set forth in the 2029 Notes Indenture. The Company was in compliance with all of the above covenants at December 31, 2021.

The 2029 Notes Indenture provides for events of default which, if certain of them occur, would permit the Trustee or the holders of at least 25% in aggregate principal amount of the then-outstanding 2029 Notes to declare the principal of, and interest or premium, if any, and any other monetary obligations on, all the then-outstanding 2029 Notes to be due and payable immediately.

2028 Senior Unsecured Notes

On April 30, 2020, the Company issued $400.0 million aggregate principal amount of 4.375% senior unsecured notes due April 15, 2028 (the “2028 Notes”). The 2028 Notes were issued under an indenture dated as of April 30, 2020 (the “2028 Notes Indenture”) by and among the Company, certain subsidiaries of the Company and Wells Fargo Bank, National Association, as trustee (the “2028 Notes Trustee”). Interest on the 2028 Notes is payable semi-annually in arrears on April 15 and October 15 of each year, commencing on October 15, 2020. The Company incurred debt issuance costs of $4.0 million in connection with the 2028 Notes. These costs are reported in the consolidated balance sheet as a direct deduction from the face amount of the 2028 Notes.

The 2028 Notes are guaranteed, jointly and severally, fully and unconditionally, on a senior unsecured basis, by the Company’s existing and future domestic subsidiaries, other than certain excluded subsidiaries, to the extent that such entities guarantee indebtedness under the Senior Secured Credit Facilities or the Company’s 3.625% senior unsecured notes due 2029 (the “2029 Notes”) and any other subsidiary of the Company to the extent it incurs certain additional indebtedness (collectively, the “Guarantors”).

The 2028 Notes and the guarantees thereof are the Company’s and the Guarantors’ senior unsecured obligations, respectively, and will (i) rank equally in right of payment with all of the Company’s and the Guarantors’ existing and future senior indebtedness; (ii) rank senior to any subordinated indebtedness that the Company or the Guarantors may incur; (iii) be effectively subordinated to all of the Company’s or the Guarantors’ existing and future secured indebtedness (including the Senior Secured Credit Facilities), in each case, to the extent of the value of the assets securing such indebtedness; and (iv) be structurally subordinated in right of payment to all existing and future obligations of the Company’s subsidiaries that do not guarantee the 2028 Notes.

At any time prior to April 15, 2023, the Company may, at its option, on any one or more occasions, redeem up to 40% of the aggregate principal amount of the 2028 Notes, at a redemption price equal to 104.375% of the principal amount of the 2028 Notes redeemed, plus accrued and unpaid interest, if any, to, but not including, the date of redemption, with an amount of cash equal to the net cash proceeds of an equity offering, as defined in the 2028 Notes Indenture, by the Company; provided that (1) at least 60% of the aggregate principal amount of 2028 Notes issued under the 2028 Notes Indenture remains outstanding immediately after the occurrence of each such redemption; and (2) the redemption occurs within 120 days of the date of the closing of such equity offering.

Additionally, at any time prior to April 15, 2023, the 2028 Notes may be redeemed, in whole or in part, at the option of the Company, at a redemption price equal to 100% of the principal amount of the 2028 Notes redeemed, plus a “make whole” premium, plus accrued and unpaid interest to, but not including, the applicable redemption date.

On or after April 15, 2023, the Company may on any one or more occasions redeem all or a part of the 2028 Notes, at its option, at the redemption prices (expressed as percentages of principal amount) set forth below, plus accrued and unpaid interest, if any, on the 2028 Notes redeemed, to, but not including, the applicable date of redemption, if redeemed during the 12-month period beginning on April 15 of the years indicated below:

Year	**Percentage**
2023	102.188 %
2024	101.094 %
2025 and thereafter	100.000 %

Upon the occurrence of certain change of control events accompanied by certain ratings events, the Company will be required to offer to repurchase all of the outstanding 2028 Notes at a purchase price of 101% of the principal amount thereof, plus accrued and unpaid interest, if any, to, but not including, the date of repurchase.

The 2028 Notes Indenture that governs the 2028 Notes contains covenants that, among other things, limit the Company's ability and/or the ability of the Company's subsidiaries to incur liens, engage in sale and leaseback transactions and consolidate, merge with or convey, transfer or lease all or substantially all of the Company's and its subsidiaries' assets to another person. The 2028 Notes Indenture also, subject to certain exceptions, limits the ability of any non-Guarantor subsidiary of the Company to incur indebtedness. These covenants are subject to a number of other limitations and exceptions as set forth in the 2028 Notes Indenture. The Company is in compliance with all of the above covenants at December 31, 2021.

The 2028 Notes Indenture provides for events of default which, if certain of them occur, would permit the 2028 Notes Trustee or the holders of at least 25% in aggregate principal amount of the then outstanding 2028 Notes to declare the principal of, and interest or premium, if any, and any other monetary obligations on, all the then-outstanding 2028 Notes to be due and payable immediately.

Senior Secured Credit Facilities

On November 6, 2018, the Company entered into a credit and guaranty agreement with Goldman Sachs Bank USA, as administrative agent and collateral agent, and added two additional lenders to the lenders party thereto. The credit agreement was amended in October 2019 (as so amended, the "Credit Agreement") to change the administrative agent and collateral agent to Morgan Stanley and add two lenders. The Credit Agreement provides senior secured financing in an aggregate principal amount of $700 million, consisting initially of (a) term loans in an aggregate principal amount of $400 million (the "New Term Loan Facility") and (b) revolving commitments in an aggregate amount of $300 million (the "New Revolving Facility", amended with the issuance of the 2029 Notes to $400 million and together with the New Term Loan Facility, the "New Credit Facilities"). Borrowings under the New Credit Facilities bear interest at a rate per annum equal to, at the Company's option, a base rate (such as prime rate or LIBOR) plus an applicable margin. The Company's interest rate on the term loans under the New Term Loan Facility is 2.10% at December 31, 2021. In addition to paying interest on the outstanding principal under the New Credit Facilities, the Company will pay (i) with respect to the New Term Loan Facility, customary agency fees, and (ii) with respect to the New Revolving Facility, a commitment fee in respect of the unutilized commitments thereunder and customary letter of credit fees and agency fees. The initial commitment fee is 0.20% per annum.

Debt issuance costs of $5.1 million for the year ended December 31, 2018 were paid to third parties and are capitalized as debt issuance costs in connection with the New Credit Facilities. These debt issuance costs are being amortized as interest expense in the Company's consolidated statements of operations over the term of the debt instrument using the straight-line method.

The Company may voluntarily prepay outstanding term loans and revolving loans under the New Credit Facilities and may reduce the unutilized portion of the New Revolving Facility at any time without premium or penalty other than customary "breakage" costs with respect to LIBOR loans.

At present, LIBOR is expected to be published only on a limited basis after 2021. The Credit Agreement includes customary "hard-wired" LIBOR replacement provisions for when LIBOR becomes unavailable, which would replace LIBOR with Term SOFR or any prevailing market convention for determining rates of interest for syndicated loans denominated in U.S. dollars in the United States.

The Credit Agreement also requires the Company to prepay outstanding term loans, subject to certain exceptions, with (a) up to 50% of the Company's annual Excess Cash Flow (as defined in the Credit Agreement) and (b) 100% of the net cash proceeds of (i) certain asset sales and casualty and condemnation events, subject to reinvestment rights and certain other exceptions; and (ii) any incurrence or issuance of certain debt, other than debt permitted under the New Credit Facilities.

The New Term Loan Facility matures on November 6, 2025 and the New Revolving Facility matures on April 30, 2026, which was amended from November 6, 2023 in connection with the issuance of the 2029 Notes. At December 31, 2021, the only outstanding amounts under the New Revolving Facility were undrawn outstanding letters of credit of $0.2 million.

All obligations under the New Credit Facilities are unconditionally guaranteed by certain of the Company's wholly-owned domestic subsidiaries and are secured, subject to certain exceptions, by substantially all of the Company's assets and the assets of the Company's subsidiaries that have guaranteed the New Credit Facilities.

The New Credit Facilities contain a number of negative covenants that, subject to certain exceptions, restrict the Company's ability and each of the Company's subsidiaries' ability to incur additional indebtedness; pay dividends on its capital stock or redeem, repurchase or retire its capital stock or its other indebtedness; make investments, loans and acquisitions, create restrictions on the payment of dividends or other amounts to the Company from the Company's restricted subsidiaries; engage in transactions with its affiliates; sell assets, including capital stock of its subsidiaries; materially alter the business it conducts; consolidate or merge; incur liens; and engage in sale-leaseback transactions. If at any time, commencing with the fiscal quarter ending March 31, 2019, the Company has revolving borrowings, unreimbursed letter of credit drawings and undrawn letters of credit outstanding in an amount in excess of 35.0% of the commitment amount under the New Revolving Facility, the Credit Agreement requires the Company to maintain a secured net leverage ratio of at least 3.25 to 1.0. The Company is in compliance with all of the above covenants at December 31, 2021.

(9) OTHER EXPENSE (INCOME), NET

The table below sets forth the Other (income) expense, net for the years ended December 31, 2021, 2020 and 2019:

(In thousands)	2021	2020	2019
Versum termination fee, net	$ —	$ —	$ (122,000)
Loss (gain) on foreign currency remeasurement	7,857	(9,751)	(237)
Loss on extinguishment of debt and modification	23,338	2,378	—
Other, net	500	717	1,156
Other expense (income), net	$ 31,695	$ (6,656)	$ (121,081)

Versum termination fee, net

On January 28, 2019, the Company and Versum announced that they had entered into an Agreement and Plan of Merger, dated as of January 27, 2019 (the "Versum Merger Agreement"), pursuant to which they agreed to combine in a merger of equals. On April 8, 2019, Versum announced that its board of directors had received a proposal from Merck KGaA to acquire Versum and that its board of directors had deemed such proposal as a "Superior Proposal" as defined in the Versum Merger Agreement. On April 12, 2019, the Company received a termination notice from Versum terminating the Versum Merger Agreement. In accordance with the terms of the Merger Agreement, Entegris received a $140.0 million termination fee from Versum in the second quarter of 2019. Also in the second quarter of 2019, the Company paid a fee of $18.0 million to the third-party financial adviser it had engaged to assist with the transaction.

(10) LEASES

Leases As of December 31, 2021, the Company was obligated under operating lease agreements for certain office space and manufacturing facilities, manufacturing equipment, vehicles, information technology equipment and warehouse space. Our leases have remaining lease terms of 1 year to 19 years, some of which may include options to extend the lease for up to 6 years, and some of which may include options to terminate the leases within 1 year.

As of December 31, 2021 and 2020, the Company's operating lease components with initial or remaining terms in excess of one year were classified on the consolidated balance sheet as follows, together with certain supplemental balance sheet information:

(In thousands)	Classification	2021	2020
Assets			
Right-of-use assets	Right-of-use assets	$ 66,563	$ 45,924
Liabilities			
Short-term lease liability	Other accrued liabilities	10,638	9,960
Long-term lease liability	Long-term lease liability	60,101	39,730
Total lease liabilities		$ 70,739	$ 49,690
Lease Term and Discount Rate			
Weighted average remaining lease term (years)		9.2	7.9
Weighted average discount rate		4.2 %	5.0 %

Expense for leases less than 12 months for the year ended December 31, 2021, 2020 and 2019 were not material. The components of lease expense for the year ended December 31, 2021, 2020 and 2019 are as follows:

(In thousands)	2021	2020	2019
Operating lease cost	$ 13,127	$ 13,576	$ 12,538

The Company combines the amortization of the right-of-use assets and the change in the operating lease liability in the same line item in the Statement of Cash Flows. Other information related to the Company's operating leases for the year ended December 31, 2021, 2020 and 2019 are as follows:

(In thousands)	2021	2020	2019
Cash paid for amounts included in the measurement of lease liabilities:			
Operating cash flows from leases	$ 11,009	$ 10,806	$ 11,137
Right-of-use assets obtained in exchange for lease obligations:			
Operating leases	$ 31,492	$ 5,133	$ 9,077

Future minimum lease payments for noncancellable operating leases as of December 31, 2021, were as follows:

(In thousands)	2021
One Year	$ 13,340
Two Years	11,612
Three Years	8,690
Four Years	7,860
Five Years	7,473
Beyond Five Years	37,474
Total	$ 86,449
Less: Interest	15,710
Present value of lease liabilities	$ 70,739

(11) ASSET RETIREMENT OBLIGATIONS

The Company has asset retirement obligations ("AROs") related to environmental disposal obligations associated with cylinders used to supply customers with gas products, and certain restoration obligations associated with certain of its leased facilities.

Changes in the carrying amounts of the Company's AROs for the years ended December 31, 2021 and 2020 are shown below:

(In thousands)	2021	2020
Balance at beginning of year	$ 14,500	$ 13,940
Liabilities settled	(78)	—
Liabilities incurred	3,274	218
Accretion expense	166	216
Revision of estimate	(368)	126
Balance at end of year	$ 17,494	$ 14,500

ARO liabilities expected to be settled within twelve months are included in the consolidated balance sheets in other accrued liabilities, while all other ARO liabilities are included in pension benefit obligations and other liabilities in the consolidated balance sheets.

(12) INCOME TAXES

Income before income taxes for the years ended December 31, 2021, 2020 and 2019 was derived from the following sources:

(In thousands)	2021	2020	2019
Domestic	$ 137,145	$ 86,572	$ 145,215
Foreign	341,931	267,715	172,834
Income before income tax expense	$ 479,076	$ 354,287	$ 318,049

Income tax expense for the years ended December 31, 2021, 2020 and 2019 is summarized as follows:

(In thousands)	2021	2020	2019
Current:			
Federal	$ 9,187	$ 8,107	$ 35,497
State	2,939	1,151	2,625
Foreign	76,257	57,310	39,075
	88,383	66,568	77,197
Deferred (net of valuation allowance):			
Federal	(11,726)	(592)	(10,966)
State	(498)	(407)	(1,018)
Foreign	(6,209)	(6,251)	(2,024)
	(18,433)	(7,250)	(14,008)
Income tax expense	$ 69,950	$ 59,318	$ 63,189

Income tax expense differs from the expected amounts based upon the statutory federal tax rates for the years ended December 31, 2021, 2020 and 2019 as follows:

(In thousands)	2021	2020	2019
Expected federal income tax at statutory rate	$ 100,606	$ 74,400	$ 66,790
State income taxes before valuation allowance, net of federal tax effect	(1,333)	(1,539)	(1,563)
Effect of foreign source income	(15,862)	(7,877)	(1,362)
Tax contingencies	4,696	1,688	1,785
Valuation allowance	9,984	9,281	2,051
U.S. federal research credit	(8,469)	(7,204)	(6,514)
Equity compensation	(8,899)	(8,231)	(1,411)
Foreign derived intangible income	(6,496)	(1,153)	(7,851)
Legal entity restructuring capital loss	(5,079)	—	—
Legal entity restructuring dividends received deduction	—	—	9,398
Other items, net	802	(47)	1,866
Income tax expense	$ 69,950	$ 59,318	$ 63,189

The Company has made employment and spending commitments to Singapore. In return for those commitments, the Company has been granted a partial tax holiday for eight years starting in 2013. During 2017, this agreement was extended to 2027 in exchange for revised employment and spending commitments. The income tax benefits attributable to the tax status are $13.9 million ($0.10 per diluted share), $9.4 million ($0.07 per diluted share) and $5.8 million ($0.04 per diluted share) for the years ending December 31, 2021, 2020 and 2019, respectively. The 2021, 2020 and 2019 effective tax rates include additional benefits of $8.0 million, $5.4 million and $3.3 million because the corporate tax rate in Singapore is lower than the U.S. rate.

At December 31, 2021, there were approximately $101.3 million of accumulated undistributed earnings of subsidiaries outside of the United States, all of which are considered to be indefinitely reinvested. Management estimates that approximately $11.6 million of withholding taxes would be incurred if these undistributed earnings were distributed.

The significant components of the Company’s deferred tax assets and deferred tax liabilities at December 31, 2021 and 2020 are as follows:

(In thousands)	2021	2020
Deferred tax assets attributable to:		
Accounts receivable	$ 397	$ 436
Inventory	6,510	4,566
Accruals not currently deductible for tax purposes	19,636	12,828
Net operating loss and credit carryforwards	42,599	33,347
Capital loss carryforward	485	—
Equity compensation	2,630	3,001
Asset impairments	—	452
Other, net	7,786	6,212
Gross deferred tax assets	80,043	60,842
Valuation allowance	(39,383)	(29,399)
Total deferred tax assets	40,660	31,443
Deferred tax liabilities attributable to:		
Purchased intangible assets	(33,887)	(38,083)
Depreciation	(9,102)	(13,276)
Total deferred tax liabilities	(42,989)	(51,359)
Net deferred tax liabilities	$ (2,329)	$ (19,916)

Deferred tax assets are generally required to be reduced by a valuation allowance if it is more likely than not that some portion or all of the deferred tax assets will not be realized.

As of December 31, 2021 and 2020, the Company had net U.S. deferred tax assets of $3.0 million and deferred tax liabilities of $4.7 million, respectively, which are composed of temporary differences and various tax credit carryforwards. Management believes that it is more likely than not that the benefit from certain state net operating loss carryforwards, state credit carryforwards and certain federal foreign tax credit carryforwards will not be realized. In recognition of this risk, management has provided valuation allowances of $16.1 million and $18.6 million as of December 31, 2021 and 2020, respectively, on the related deferred tax assets. If the assumptions change and management determines the assets will be realized, the tax benefits relating to any reversal of the valuation allowance on deferred tax assets at December 31, 2021 will be recognized as a reduction of income tax expense.

At December 31, 2021, the Company had state operating loss and credit carryforwards of approximately $16.0 million, which begin to expire in 2022, and foreign operating loss carryforwards of $37.6 million, which begin to expire in 2023.

As of December 31, 2021 and 2020, the Company had net non-U.S. deferred tax assets of $34 million and $14.1 million, respectively, for which management determined based upon the available evidence a valuation allowance of $23.3 million and $10.8 million as of December 31, 2021 and 2020, respectively, was required against the non-U.S. gross deferred tax assets. For other non-U.S. jurisdictions, management relies upon projections of future taxable income to utilize deferred tax assets.

Benefits from tax positions should be recognized in the financial statements only when it is more likely than not that the tax positions will be sustained upon examination by the appropriate taxing authority that would have full knowledge of all relevant information. A tax position that meets the more-likely-than-not recognition threshold is measured at the largest amount of benefit that is greater than fifty percent likely of being realized upon ultimate settlement. Tax positions that fail to meet the more-likely-than-not recognition threshold should be recognized in the first subsequent financial reporting period in which that threshold is met. Previously recognized tax positions that no longer meet the more-likely-than-not recognition threshold should be derecognized in the first subsequent financial reporting period in which that threshold is no longer met. The provisions also provide guidance on the accounting for and disclosure of unrecognized tax benefits, interest and penalties.

Reconciliations of the beginning and ending balances of the total amounts of gross unrecognized tax benefits for the years ended December 31, 2021 and 2020 are as follows:

(In thousands)	2021	2020
Gross unrecognized tax benefits at beginning of year	$ 17,395	$ 16,194
Increase in tax positions from prior years	131	412
Decrease in tax positions from prior years	(69)	(453)
Increases in tax positions for current year	8,476	3,463
Settlement of tax positions for current year	(286)	(532)
Lapse in statute of limitations	(1,858)	(1,689)
Gross unrecognized tax benefits at end of year	$ 23,789	$ 17,395

The total amount of net unrecognized tax benefits that, if recognized, would affect the effective tax rate was $17.1 million at December 31, 2021.

Penalties and interest paid or received are recorded in other income, net in the consolidated statements of operations. As of December 31, 2021 and 2020, the Company had accrued interest and penalties related to unrecognized tax benefits of $5.9 million and $4.9 million, respectively. Expenses of $1.0 million, $0.9 million and $0.6 million were recognized as interest and penalties in the consolidated statements of operations for the years ended December 31, 2021, 2020 and 2019, respectively.

The Company files income tax returns in the U.S. and in various state, local and foreign jurisdictions. The statutes of limitations related to both the consolidated federal income tax return and state returns are closed for all years up to and including 2017 and 2017, respectively. With respect to foreign jurisdictions, the statute of limitations varies from country to country, with the earliest open year for the Company's major foreign subsidiaries being 2015.

Due to the expiration of various statutes of limitations and settlements of audits, it is reasonably possible that the Company's gross unrecognized tax benefit balance may decrease within the next twelve months by approximately $1.9 million.

(13) EQUITY

Dividend

Holders of the Company's common stock are entitled to receive dividends when and if they are declared by the Company's board of directors. The Company's board of directors declared cash dividends of $0.08 per share during each of the first, second, third and fourth quarters of 2021, payments for which totaled $43.6 million. The Company's board of directors declared cash dividends of $0.08 per share during each of the first, second, third and fourth quarters of 2020, payments for which totaled $43.5 million. During 2019, the Company's board of directors declared cash dividends of $0.07 per share during each of the first and second quarters and $0.08 per share during each of the third and fourth quarters of 2019, payments for which totaled $40.8 million.

On January 19, 2022, the Company's board of directors declared a quarterly cash dividend of $0.10 per share to be paid on February 23, 2022 to shareholders of record as of February 2, 2022.

Future dividend declarations, if any, as well as the record and payment dates for such dividends, are subject to the final determination of the Company's board of directors. Furthermore, the credit agreements governing the New Credit Facilities contain restrictions that may limit our ability to pay dividends.

Share Repurchase Program

On December 14, 2020, the Company's board of directors authorized a repurchase program, effective February 16, 2021, covering the repurchase of up to an aggregate of $125.0 million of the Company's common stock**,** during a period of twelve months, in open market transactions and in accordance with one or more pre-arranged stock trading plans to be established in accordance with Rule 10b5-1 under the Securities Exchange Act of 1934, as amended. This repurchase program will expire pursuant to its terms on February 15, 2022. In connection with its proposed acquisition of CMC, the Company suspended this share repurchase program and does not anticipate authorizing a new program in 2022.

The Company repurchased $67.1 million, $44.6 million and $74.8 million of shares for the years ended December 31, 2021, 2020 and 2019, respectively.

The credit agreement governing the New Credit Facilities contains restrictions that may limit the Company's ability to continue to repurchase shares.

2020 Stock Plan

In 2020, the Company's board of directors and stockholders approved the Entegris, Inc. 2020 Stock Plan (the "2020 Stock Plan"). The 2020 Stock Plan replaced the Entegris, Inc. 2010 Stock Plan for future stock awards and stock option grants. The 2020 Stock Plan has a term of ten years and provides for the issuance of stock options and other share-based awards to selected employees, directors, and other individuals or entities that provide services to the Company or its affiliates. Under the 2020 Stock Plan, the board of directors or a committee selected by the board of directors will determine for each award, the term, price, number of shares, rate at which each award is exercisable and whether restrictions are imposed on the shares subject to the awards. The exercise price for option awards generally may not be less than the fair market value per share of the underlying common stock on the date granted. The 2020 Stock Plan provides that after December 31, 2019, any shares subject to stock awards that were awarded from the Company's expired plans and that are forfeited, expired or otherwise terminated without issuance of shares will again be available for issuance under the 2020 Stock Plan.

For all plans, exclusive of the employee stock purchase plan, the Company had shares available for future grants of 8.7 million, 9.0 million, and 8.2 million shares at December 31, 2021, 2020 and 2019, respectively.

Stock Options

Stock option activity for the years ended December 31, 2021, 2020 and 2019 is summarized as follows:

	2021		2020		2019	
(Shares in thousands)	Number of shares	Weighted average exercise price	Number of shares	Weighted average exercise price	Number of shares	Weighted average exercise price
Options outstanding, beginning of year	1,082	$ 33.38	1,575	$ 21.39	1,410	$ 18.22
Granted	167	98.11	216	55.72	293	33.33
Exercised	(592)	27.32	(709)	13.60	(128)	13.89
Expired or forfeited	—	—	—	—	—	—
Options outstanding, end of year	657	$ 55.32	1,082	$ 33.38	1,575	$ 21.39
Options exercisable, end of year	111	$ 34.54	426	$ 24.99	788	$ 15.75

Options outstanding under the Company’s stock plans at December 31, 2021 are summarized as follows:

(Shares in thousands)	Options outstanding				Options exercisable		
Range of exercise prices	Number outstanding	Weighted average remaining life in years		Weighted-average exercise price	Number exercisable		Weighted average exercise price
$21.60 to $21.60	29	2.1 years	$	21.60	29	$	21.60
$31.10 to $31.10	101	3.1 years		31.10	31		31.10
$33.33 to $33.33	173	4.1 years		33.33	27		33.33
$55.72 to $55.72	187	5.1 years		55.72	24		55.72
$98.11 to $98.11	167	6.1 years		98.11	—		—
	657	4.7 years	$	55.32	111	$	34.54

The weighted average remaining contractual term for options outstanding and options exercisable for all plans at December 31, 2021 was 4.7 years and 3.6 years, respectively.

Under the stock plans, the total pre-tax intrinsic value of stock options exercised during the years ended December 31, 2021 and 2020 was $54.7 million and $36.4 million, respectively. The aggregate intrinsic value, which represents the total pre-tax intrinsic value based on the Company’s closing stock price of $138.58 at December 31, 2021, which theoretically could have been received by the option holders had all option holders exercised their options as of that date, was $54.7 million and $11.5 million for options outstanding and options exercisable, respectively.

Share-based payment awards in the form of stock option awards for 0.2 million, 0.2 million and 0.3 million shares were granted to employees during the years ended December 31, 2021, 2020 and 2019, respectively. Compensation expense is based on the grant date fair value. The awards vest annually over a period of four years and have a contractual term of 7 years. The Company estimates the fair value of stock options using the Black-Scholes valuation model. Key inputs and assumptions used to estimate the fair value of stock options include the grant price of the award, the expected option term, volatility of the Company’s stock, the risk-free rate and the Company’s dividend yield. Estimates of fair value are not intended to predict actual future events or the value ultimately realized by employees who receive equity awards, and subsequent events are not indicative of reasonableness of the original estimates of fair value made by the Company.

The fair value of each stock option grant was estimated at the date of grant using a Black-Scholes option pricing model. The following table presents the weighted-average assumptions used in the valuation and the resulting weighted-average fair value per option granted for the years ended December 31, 2021, 2020 and 2019:

Employee stock options:		2021		2020		2019
Volatility		38.0 %		31.9 %		31.6 %
Risk-free interest rate		0.4 %		1.4 %		2.5 %
Dividend yield		0.3 %		0.6 %		0.8 %
Expected life (years)		4.6		4.3		4.1
Weighted average fair value per option	$	30.69	$	14.83	$	8.89

A historical daily measurement of volatility is determined based on the expected life of the option granted. The risk-free interest rate is determined by reference to the yield on an outstanding U.S. Treasury note with a term equal to the expected life of the option granted. Expected life is determined by reference to the Company’s historical experience. The Company determines the dividend yield by dividing the expected annual dividend on the Company’s stock by the option exercise price.

Employee Stock Purchase Plan

The Company maintains the Entegris, Inc. Amended and Restated Employee Stock Purchase Plan (“ESPP”). The ESPP allows employees to elect, at six-month intervals, to contribute up to 10% of their compensation, subject to certain limitations, to purchase shares of the Company’s common stock at a discount of 15% from the fair market value on the first day or last day of each six-month period. The Company treats the ESPP as a compensatory plan. At December 31, 2021, 1.5 million shares remained available for issuance under the ESPP. Employees purchased 0.1 million, 0.2 million and 0.2 million shares, at a weighted-average price of $90.89, $46.58, and $28.67 during the years ended December 31, 2021, 2020 and 2019, respectively.

Restricted Stock Units

Restricted stock units are awards of common stock made under the Stock Plans that are subject to a risk of forfeiture if the awardee terminates employment with the Company prior to the lapse of the restrictions. The value of such restricted stock units is determined using the market price on the grant date. Compensation expense for restricted stock units is generally recognized using the straight-line single-option method. A summary of the Company's restricted stock unit activity for the years ended December 31, 2021, 2020 and 2019 is presented in the following table:

	2021		2020		2019	
(Shares in thousands)	Number of shares	Weighted average grant date fair value	Number of shares	Weighted average grant date fair value	Number of shares	Weighted average grant date fair value
Unvested, beginning of year	1,083	$ 41.31	1,254	$ 27.48	1,519	$ 21.24
Granted	293	101.04	437	57.46	514	34.05
Vested	(439)	35.58	(564)	23.48	(679)	18.89
Forfeited	(40)	57.39	(44)	35.86	(100)	24.82
Unvested, end of year	897	62.69	1,083	41.31	1,254	27.48

The weighted average remaining contractual term for unvested restricted shares at December 31, 2021 and 2020 was 1.1 years and 1.2 years, respectively.

During the years ended December 31, 2021, 2020 and 2019, the Company awarded performance-based restricted stock units for up to 0.1 million, 0.1 million and 0.1 million shares of common stock, respectively, to be issued upon the achievement of performance conditions under the Company's stock plans to certain officers and other key employees. Compensation expense is based on the grant date fair value. The awards vest on the third anniversary of the award date. The Company estimates the fair value of the performance shares using a Monte Carlo simulation process.

As of December 31, 2021, the total compensation cost related to unvested stock options, performance-based restricted stock units and restricted stock unit awards not yet recognized was $5.8 million, $4.9 million and $37.9 million, respectively, and is expected to be recognized over the next 3.4 years on a weighted-average basis.

Valuation and Expense Information

The Company recognizes compensation expense for all share-based payment awards made to employees and directors based on their estimated fair values on the date of grant. Compensation expense is recognized using the straight-line attribution method to recognize share-based compensation over the service period of the award, with adjustments recorded for forfeitures as they occur. The following table summarizes the allocation of share-based compensation expense related to employee stock options, restricted stock awards, performance-based restricted stock awards and grants under the employee stock purchase plan for the years ended December 31, 2021, 2020 and 2019:

(In thousands)	2021	2020	2019
Cost of sales	$ 3,844	$ 1,463	$ 1,180
Engineering, research and development expenses	3,504	2,359	1,901
Selling, general and administrative expenses	22,536	19,098	16,548
Share-based compensation expense	29,884	22,920	19,629
Tax benefit	5,488	4,129	3,626
Share-based compensation expense, net of tax	$ 24,396	$ 18,791	$ 16,003

(14) BENEFIT PLANS

401(k) Plan

The Company maintains the Entegris, Inc. 401(k) Savings and Profit Sharing Plan (the "401(k) Plan") that qualifies as a deferred salary arrangement under Section 401(k) of the Internal Revenue Code. Under the Plan, eligible employees may defer a portion of their pre-tax wages, up to the Internal Revenue Service annual contribution limit. Entegris matches employees' contributions to a maximum match of 4% of the employee's eligible wages. Beginning on January 1, 2022, the maximum match contribution increased to 5% of the employee's eligible wages. The employer matching contribution expense under the 401(k) Plan was $10.1 million, $8.2 million and $7.1 million in the fiscal years ended December 31, 2021, 2020 and 2019, respectively.

Defined Benefit Plans

The employees of the Company’s subsidiaries in Japan, Taiwan and Germany are covered in defined benefit pension plans. The Company uses a December 31 measurement date for its pension plans.

The tables below set forth the Company’s estimated funded status as of December 31, 2021 and 2020:

(In thousands)	2021	2020
Change in benefit obligation:		
Benefit obligation at beginning of year	$ 7,278	$ 6,946
Service cost	35	31
Interest cost	28	37
Actuarial (gain) loss	547	137
Benefits paid	(455)	(322)
Foreign exchange impact	(383)	449
Benefit obligation at end of year	7,050	7,278
Change in plan assets:		
Fair value of plan assets at beginning of year	1,042	910
Return on plan assets	16	31
Employer contributions	74	73
Benefits paid	(157)	(41)
Foreign exchange impact	(6)	69
Fair value of plan assets at end of year	969	1,042
Funded status:		
Plan assets less than benefit obligation - Net amount recognized	$ (6,081)	$ (6,236)

Amounts recognized in the consolidated balance sheets consist of:

(In thousands)	2021	2020
Noncurrent liability	$ (6,081)	$ (6,236)
Accumulated other comprehensive loss, net of taxes	1,222	840

Amounts recognized in accumulated other comprehensive loss, (pre-tax):

(In thousands)	2021	2020
Net actuarial loss	$ 1,195	$ 713
Prior service cost	422	454
Gross amount recognized	$ 1,617	$ 1,167

Information for pension plans with a projected benefit obligation and an accumulated benefit obligation in excess of plan assets:

(In thousands)	2021	2020
Projected benefit obligation	$ 7,050	$ 7,278
Accumulated benefit obligation	5,995	6,480
Fair value of plan assets	969	1,042

The components of the net periodic benefit cost for the years ended December 31, 2021, 2020 and 2019 were as follows:

(In thousands)	2021	2020	2019
Pension benefits:			
Service cost	$ 35	$ 31	$ 26
Interest cost	28	37	54
Expected return on plan assets	(12)	(15)	(16)
Curtailments	—	—	95
Settlements	—	21	—
Amortization of prior service cost	38	36	67
Amortization of plan loss	41	38	17
Net periodic pension benefit cost	$ 130	$ 148	$ 243

Assumptions used in determining the benefit obligation and net periodic benefit cost for the Company's pension plans for the years ended December 31, 2021, 2020 and 2019 are presented in the following table as weighted-averages:

	2021	2020	2019
Benefit obligations:			
Discount rate	0.47 %	0.39 %	0.53 %
Rate of compensation increase	3.94 %	2.33 %	2.91 %
Net periodic benefit cost:			
Discount rate	0.70 %	0.98 %	1.29 %
Rate of compensation increase	2.51 %	2.33 %	3.51 %
Expected return on plan assets	1.32 %	1.82 %	1.51 %

The pension plans' expected return on assets as shown above is based on management's expectations of long-term average rates of return to be achieved by the underlying investment portfolios. In establishing this assumption, management considers historical and expected returns for the asset classes in which the plans are invested, as well as current economic and capital market conditions. The discount rate primarily used by the Company is based on market yields at the valuation date on government bonds as well as the estimated maturity of benefit payments.

Plan Assets

At December 31, 2021, the majority of the Company's pension plan assets were deposited with the Bank of Taiwan in the form of money market funds, where the Bank of Taiwan is the assigned funding vehicle for the statutory retirement benefit. The remaining portion of the Company's plan assets is deposited in a German insurance company's investment fund.

The fair value measurements of the Company's pension plan assets at December 31, 2021, by asset category are as follows:

(In thousands) Asset category	Total	Quoted prices in active markets for identical assets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Taiwan plan assets (a)	$ 712	$ 712	—	—
Germany plan assets (b)	257	257	—	—
	$ 969	$ 969	—	—

(a) This category includes investments in the government of Taiwan's pension fund. The government of Taiwan is responsible for the strategy and allocation of the investment contributions.

(b) This category includes investments in an insurer's balanced asset fund. The insurer is responsible for the strategy and allocation of the investment contributions. The Company selects a pre-packaged portfolio pooled investment fund that is conservative. The majority of the funds are invested broadly in German mortgage bonds, construction loans and government bonds with good credit ratings.

The fair value measurements of the Company's pension plan assets at December 31, 2020, by asset category are as follows:

(In thousands) Asset category	Total	Quoted prices in active markets for identical assets (Level 1)	Significant observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Taiwan plan assets (a)	$ 827	$ 827	—	—
Germany plan assets (b)	215	215	—	—
	$ 1,042	$ 1,042	—	—

(a) This category includes investments in the government of Taiwan's pension fund. The government of Taiwan is responsible for the strategy and allocation of the investment contributions.

(b) This category includes investments in an insurer's balanced asset fund. The insurer is responsible for the strategy and allocation of the investment contributions. The Company selects a pre-packaged portfolio pooled investment fund that is conservative. The majority of the funds are invested broadly in German mortgage bonds, construction loans and government bonds with good credit ratings.

Cash Flows

The Company expects to make the following contributions and benefit payments:

(In thousands)	Contributions	Payments
2022	$ 70	$ 42
2023	—	200
2024	—	317
2025	—	251
2026	—	467
Years 2027-2031	—	935

(15) EARNINGS PER SHARE (EPS)

Basic EPS is computed by dividing net income by the weighted average number of shares of common stock outstanding during each period. The following table presents a reconciliation of the share amounts used in the computation of basic and diluted earnings per share:

(In thousands)	2021	2020	2019
Basic earnings per share—Weighted common shares outstanding	135,411	134,837	135,137
Weighted common shares assumed upon exercise of options and vesting of restricted stock units	1,163	1,429	1,431
Diluted earnings per share—Weighted common shares outstanding	136,574	136,266	136,568

The Company excluded the following shares underlying stock-based awards from the calculations of diluted EPS because their inclusion would have been anti-dilutive for the years ended December 31, 2021, 2020 and 2019:

(In thousands)	2021	2020	2019
Shares excluded from calculations of diluted EPS	136	195	273

(16) SEGMENT INFORMATION

The Company’s financial segment reporting reflects an organizational alignment intended to leverage the Company’s unique breadth of capabilities to create mission-critical microcontamination control products, specialty chemicals and advanced materials handing solutions that maximize manufacturing yields, reduce manufacturing costs and enable higher device performance for its customers. While these segments have separate products and technical know-how, they share a common business systems and processes, technology centers, and strategic and technology roadmaps. The Company’s business is reported in the following three segments:

- **Specialty Chemicals and Engineered Materials:** SCEM provides high-performance and high-purity process chemistries, gases and materials and safe and efficient delivery systems to support semiconductor and other advanced manufacturing processes.
- **Microcontamination Control:** MC offers solutions to filter and purify critical liquid chemistries and gases used in semiconductor manufacturing processes and other high-technology industries.
- **Advanced Materials Handling:** AMH develops solutions to monitor, protect, transport, and deliver critical liquid chemistries and substrates for a broad set of applications in the semiconductor industry and other high-technology industries.

Segment profit is defined as net sales less direct and indirect segment operating expenses, including certain general and administrative costs for the Company’s human resources, finance and information technology functions. The Company accounts for inter-segment sales and transfers as if the sales or transfers were to third parties, that is, at approximate market prices. Inter-segment sales are presented as an elimination below. The remaining unallocated expenses consist mainly of the Company’s corporate functions as well as interest expense, amortization of intangible assets and income tax expense.

Corporate assets consist primarily of cash and cash equivalents, deferred tax assets and deferred tax charges.

Summarized financial information for the Company’s reportable segments is shown in the following tables.

(In thousands)	2021	2020	2019
Net sales:			
SCEM	$ 711,291	$ 609,532	$ 526,519
MC	919,363	742,186	633,664
AMH	704,946	538,682	458,290
Inter-segment elimination	(36,707)	(31,087)	(27,407)
Total net sales	$ 2,298,893	$ 1,859,313	$ 1,591,066

(In thousands)	2021	2020	2019
Segment profit:			
SCEM	$ 167,807	$ 127,969	$ 98,327
MC	321,300	248,910	194,398
AMH	159,995	111,028	75,173
Total segment profit	$ 649,102	$ 487,907	$ 367,898

(In thousands)	2021	2020	2019
Total assets:			
SCEM	$ 1,191,465	$ 1,022,357	$ 936,609
MC	946,336	819,602	786,131
AMH	598,547	437,322	372,849
Corporate	455,548	638,415	420,497
Total assets	$ 3,191,896	$ 2,917,696	$ 2,516,086

(In thousands)	2021	2020	2019
Depreciation and amortization:			
SCEM	$ 66,983	$ 71,417	$ 75,391
MC	41,536	39,775	41,917
AMH	29,648	25,231	23,911
Corporate	—	99	184
Total depreciation and amortization	$ 138,167	$ 136,522	$ 141,403

(In thousands)	2021	2020	2019
Capital expenditures:			
SCEM	$ 74,410	$ 54,989	$ 57,585
MC	69,120	40,656	28,549
AMH	67,096	36,107	25,212
Corporate	—	—	1,009
Total capital expenditures	$ 210,626	$ 131,752	$ 112,355

The following table reconciles total segment profit to income before income taxes and equity in net loss of affiliate:

(In thousands)	2021	2020	2019
Total segment profit	$ 649,102	$ 487,907	$ 367,898
Less:			
Amortization of intangibles	47,856	53,092	66,428
Unallocated general and administrative expenses	49,478	39,370	62,192
Operating income	551,768	395,445	239,278
Interest expense	41,240	48,600	46,962
Interest income	(243)	(786)	(4,652)
Other expense (income), net	31,695	(6,656)	(121,081)
Income before income tax expense	$ 479,076	$ 354,287	$ 318,049

In the following tables, revenue is disaggregated by country or region based on the ship to location of the customer for the years ended December 31, 2021, 2020 and 2019:

	2021				
(In thousands)	SCEM	MC	AMH	Inter-segment	Total
North America	$ 208,997	$ 133,653	$ 219,853	$ (36,707)	$ 525,796
Taiwan	117,056	225,086	111,968	—	454,110
South Korea	97,568	114,211	105,493	—	317,272
Japan	89,767	161,569	51,267	—	302,603
China	102,791	164,471	97,157	—	364,419
Europe	50,136	70,011	89,121	—	209,268
Southeast Asia	44,976	50,362	30,087		125,425
	$ 711,291	$ 919,363	$ 704,946	$ (36,707)	$ 2,298,893

	2020				
(In thousands)	SCEM	MC	AMH	Inter-segment	Total
North America	$ 189,009	$ 144,015	$ 164,576	$ (31,087)	$ 466,513
Taiwan	106,665	171,201	94,339	—	372,205
South Korea	88,580	91,997	92,623	—	273,200
Japan	73,366	124,321	45,209	—	242,896
China	77,817	108,588	61,458	—	247,863
Europe	35,027	67,090	52,321	—	154,438
Southeast Asia	39,068	34,974	28,156	—	102,198
	$ 609,532	$ 742,186	$ 538,682	$ (31,087)	$ 1,859,313

(In thousands)	2019				
	SCEM	MC	AMH	Inter-segment	Total
North America	$ 149,570	$ 113,551	$ 145,150	$ (27,407)	$ 380,864
Taiwan	94,561	144,404	70,864	—	309,829
South Korea	76,447	98,568	69,352	—	244,367
Japan	57,456	104,202	43,832	—	205,490
China	67,877	98,693	48,170	—	214,740
Europe	33,147	45,454	53,622	—	132,223
Southeast Asia	47,461	28,792	27,300	—	103,553
	$ 526,519	$ 633,664	$ 458,290	$ (27,407)	$ 1,591,066

The following table summarizes property, plant and equipment, net, attributed to significant countries for the years ended December 31, 2021, 2020 and 2019:

(In thousands)	2021	2020	2019
Property, plant and equipment:			
North America	$ 417,549	$ 348,363	$ 329,323
South Korea	58,725	55,404	43,540
Japan	56,357	41,044	37,851
Malaysia	29,443	32,727	34,339
China	32,133	29,528	16,473
Taiwan	58,444	17,050	16,264
Other	1,447	1,251	1,754
	$ 654,098	$ 525,367	$ 479,544

The Company reported net sales of 10 percent or more for one customer in the amount of $271.9 million, $208.3 million and $187.0 million for the years ended December 31, 2021, 2020 and 2019, respectively, all of which include sales from all the Company's segments.

(17) COMMITMENTS AND CONTINGENT LIABILITIES

We are involved in certain legal actions. The outcomes of these legal actions are not within our complete control and may not be known for prolonged periods of time. In some actions, the claimants seek damages, as well as other relief, that could require significant expenditures or result in lost revenues. We record a liability for these legal actions when a loss is known or considered probable and the amount can be reasonably estimated. If the reasonable estimate of a known or probable loss is a range, and no amount within the range is a better estimate than any other, the minimum amount of the range is accrued. If a loss is reasonably possible but not known or probable, and can be reasonably estimated, the estimated loss or range of loss is disclosed. In most cases, significant judgment is required to estimate the amount and timing of a loss to be recorded. As of December 31, 2021, there were no litigation matters that we consider to be probable or reasonably possible to have a material adverse outcome.

(18) QUARTERLY INFORMATION-UNAUDITED

	Fiscal quarter ended			
(In thousands, except per share data)	April 3, 2021	July 3, 2021	October 2, 2021	December 31, 2021
Net sales	$ 512,844	$ 571,352	$ 579,493	$ 635,204
Gross profit	234,986	265,384	264,204	295,090
Net income	84,676	88,770	117,461	118,219
Basic net income per common share	0.63	0.66	0.87	0.87
Diluted net income per common share	0.62	0.65	0.86	0.87

	Fiscal quarter ended			
(In thousands, except per share data)	March 28, 2020	June 27, 2020	September 26, 2020	December 31, 2020
Net sales	$ 412,327	$ 448,405	$ 480,987	$ 517,594
Gross profit	185,478	207,372	226,000	230,872
Net income	61,006	68,036	79,303	86,624
Basic net income per common share	0.45	0.51	0.59	0.64
Diluted net income per common share	0.45	0.50	0.58	0.63

(19) SUBSEQUENT EVENTS

We have evaluated subsequent events through February 4, 2022 and determined that no events or transactions met the definition of a subsequent event for purposes of recognition or disclosure in the accompanying financial statements.

ENTEGRIS, INC.
<u>2022 Performance-Based RSU Award Agreement</u>
(2020 Stock Plan)

In consideration of services rendered to Entegris, Inc. (the “Company”), the Company may periodically make equity incentive awards consisting of performance-based restricted stock units with respect to the Company’s Common Stock, $0.01 par value (“Stock”), to certain key employees, non-employee directors, consultants or advisors of the Company under the Company’s 2020 Stock Plan (as amended from time to time, the “Plan”). Any key employee, non-employee director, consultant or advisor (a “Participant”) who receives a performance-based restricted stock unit award (the “Award”) is notified in writing or via email and the Award is credited to the Participant’s account and reflected under the Stock Plans section on Fidelity’s NetBenefits website. To Accept the award; click on the “Begin your grant acceptance now” link located in the New Grant Alert notification *or* scroll down to and expand the Stock Plans section; then click on “Begin Acceptance” and follow the prompts. By accepting the Award, Participant: (i) acknowledges that Participant has received a copy of the Plan, of the related prospectus providing information concerning awards under the Plan and of the Company’s most recent Annual Report on Form 10-K; and (ii) accepts the Award and agrees with the Company that the Award is subject to the terms of the Plan and to the following terms and conditions:

Article I – PERFORMANCE-BASED RESTRICTED STOCK UNIT AWARD

1.1. *<u>Award Date</u>*. This Agreement shall take effect as of the date specified as the Award Date with respect to the Award in the Award summary provided to you online through the Portal (the “Award Date”).

1.2. *<u>Performance-based Restricted Stock Units Subject to Award</u>*. The Award consists of that number of performance-based restricted stock units (the “PRSU”) with respect to the Stock that has been approved for the Award to Participant by the Administrator as the target number of PRSUs (“Target PRSUs”). The Target PRSUs shall be subject to increase or decrease in accordance with Sections 1.3 and 1.4 below. Each PRSU is equivalent to one share of the Stock (subject to adjustment under the Plan). The Participant’s rights to the PRSU are subject to the restrictions described in this Agreement and in the Plan (which is incorporated herein by reference with the same effect as if set forth herein in full) in addition to such other restrictions, if any, as may be imposed by law.

1.3. *<u>Earned Performance-based Restricted Stock Units</u>*. The number of PRSUs earned under this Agreement (the “Earned PRSUs”) shall be equal to the Target PRSUs multiplied by the TSR Performance Multiplier (as defined herein). The “TSR Performance Multiplier” will be determined by comparing the Company’s total stockholder return to the total stockholder return of each of the companies in the Comparator Peer Group (as set forth below) over the period commencing on the Award Date and ending on the third anniversary of the Award Date (the “Performance Period”) to determine the Company’s TSR ranking against the Comparator Group. For purposes of computing total stockholder return: (i), any dividends paid by the Company or the companies in the

Comparator Group shall be treated as having been reinvested at the closing price as of the ex-dividend date; and (ii) the beginning stock price will be the average stock price over the 20 trading days ending on the Award Date and the ending stock price will be the average stock price over the 20 trading days ending on the last day of the Performance Period (adjusted, as applicable, for stock splits, reorganizations, recapitalizations, or similar corporate transactions during such period).

1.4. *Calculation of the TSR Performance Multiplier*. The TSR Performance Multiplier will be calculated as set forth in the following table based upon the Company's total stockholder return over the Performance Period when ranked against the total stockholder return over the Performance Period of each of the companies in the Comparator Peer Group:

Company TSR Percentile Rank	**TSR Performance Multiplier**
Below 25th percentile	0
25th percentile	50%
50th percentile	100%
85th percentile or above	200%

If the Company's total stockholder return percentile rank during the Performance Period is between the 25th and the 50th percentiles or between the 50th and the 85th percentiles, the TSR Performance Multiplier will be determined using straight line interpolation based on the actual percentile ranking.

As used herein, the "Comparator Peer Group" consists of those companies that are in the Philadelphia Semiconductor Index on the Award Date; provided that, except as provided below, the common stock (or similar equity security) of each such peer company is continually listed or traded on a national securities exchange from the first day of the Performance Period through the last trading day of the Performance Period. In the event a member of the Comparator Peer Group files for bankruptcy or liquidates due to an insolvency or is delisted due to failure to meet the national securities exchange's minimum market capitalization requirement, such company shall continue to be treated as a Comparator Peer Group member, and such company's ending price will be treated as $0 if the common stock (or similar equity security) of such company is no longer listed or traded on a national securities exchange on the last trading day of the Performance Period (and if multiple members of the Comparator Peer Group file for bankruptcy or liquidate due to an insolvency or are delisted for such reason, such members shall be ranked in order of when such bankruptcy or liquidation occurs, with earlier bankruptcies, liquidations or delistings ranking lower than later bankruptcies, liquidations or delistings). In the event of a formation of a new parent company by a Comparator Peer Group member, substantially all of the assets and liabilities of which consist immediately after the transaction of the equity interests in the original Comparator Peer Group member or the assets and liabilities of such Comparator Peer Group member immediately prior to the transaction, such new parent company shall be substituted for the Comparator Peer Group member to the extent (and for such period of time) as its common stock (or similar equity securities) are listed or traded on a national securities exchange but the common stock (or similar equity securities) of the original Comparator Peer Group member are not. In the event of a merger or other business combination of two Comparator Peer Group members (including, without limitation, the acquisition of one Comparator Peer Group member, or all or substantially all of its assets, by another Comparator Peer Group member), the surviving, resulting or successor entity, as the case may be, shall continue to be treated as a member of the Comparator Peer Group, provided that the common stock (or similar equity security) of such entity is listed or traded on a national securities exchange through the last trading day of the Performance Period. With respect to the preceding two sentences, the applicable stock prices shall be equitably and proportionately adjusted to the extent (if any) necessary to preserve the intended incentives of the awards and mitigate the impact of the transaction.

The Award shall be subject to limitation that, if the Company's absolute total shareholder return is negative, then the maximum number of shares that may be earned is the Target PRSUs.

1.5. *Vesting of PRSUs*. The term "vest" as used herein with respect to any PRSU means the lapsing of the restrictions described herein with respect to such PRSU. The Award shall not be vested as of the Award Date and shall be forfeitable by the Participant without consideration or compensation in accordance with Section 1.6 below unless and until otherwise vested pursuant to the terms of this Agreement. The Participant has no rights, partial or otherwise, in the Award and/or any Stock subject thereto unless and until the Award has been earned pursuant to Section 1.3 and vested pursuant to this Section 1.5. A number of PRSUs equal to the Earned PRSUs will become 100% vested (referred to as "Vested Units") on the last day of the Performance Period (the "Maturity Date"), provided that the Participant remains continuously employed by the Company or an Affiliate through the Maturity Date. Each Vested Unit shall be settled by the delivery of one share of Stock (subject to adjustment under the Plan). Subject to Section 2.3 below, settlement will occur as soon as practicable following certification by the Administrator of the number of Earned PRSUs and passage of the Maturity Date (or, if earlier, the date the Award becomes vested pursuant to the terms of Section 1.7 below), but in no event later than the earlier of (i) 90 days following the Maturity Date (or such earlier date that the Award becomes vested), or (ii) March 15th of the year following the year in which the Award becomes vested. No fractional shares of Stock shall be issued pursuant to this Agreement.

1.6. *Forfeiture Risk*. Subject to Section 1.7, If the Participant ceases to be employed or retained by the Company or an Affiliate for any reason, any then-outstanding PRSU that is not a Vested Unit acquired by the Participant hereunder shall be automatically and immediately forfeited. The Participant hereby appoints the Company as the attorney-in-fact of the Participant to take such actions as may be necessary or appropriate to effectuate the cancellation of a forfeited PRSU.

1.7. *Early Vesting of PRSUs*. This Section sets forth the exclusive circumstances under which the Participant may become entitled to Vested Units even though he or she is not employed through the Maturity Date: (i) If, prior to a Change in Control, the Participant dies, incurs a total and permanent disability (as that term is defined in the Company's disability insurance policy in effect on the Award Date), or terminates employment on account of Retirement from employment with the Company or an Affiliate, prior to the Maturity Date, he or she shall continue to be entitled to receive the Earned PRSUs hereunder, to the extent earned as of the earlier of the Maturity Date and the date of a Change in Control, but the amount otherwise payable shall be prorated to reflect the portion of the Performance Period during which the Participant was employed. (ii) In the event of a Change in Control where the Award is not continued or assumed by a public company, the Earned PRSU, to the extent earned pursuant to the next sentence, shall be fully vested immediately prior to the Change in Control. The number of Earned PRSUs at the time of a Change in Control shall be determined as of the date such Change in Control is consummated, rather than the Maturity Date (as defined in Section 1.5), with the number of Earned PRSUs determined as set forth in Section 1.4 above, based upon the Company's total stockholder return and the total stockholder return of each of the companies in the Comparator Peer Group through the date of the Change in Control (and, with respect to the Company, instead of the 20-business day average, taking into account the consideration per share to be paid in the Change in Control transaction). (iii) In the event of a Change in Control where the Award is continued or assumed by a public company, then payment of the Earned PRSUs calculated in accordance with clause (ii) above, shall continue to be contingent on the Participant's employment through the Maturity Date unless there is a Qualifying Termination within two years following the Change in Control. If a Qualifying Termination occurs, the restrictions on all unvested Earned PRSUs shall immediately lapse. The provisions of clauses (ii) and (iii) shall govern the Award notwithstanding the provisions of any Executive Change In Control Termination Agreement (or similar agreement) that may exist between the Company or an Affiliate and the Participant. The distribution of any Vested Units occurring by reason of this Section 1.7 shall be settled by the delivery of one share of Stock (subject to adjustment under the Plan) per Vested Unit. Settlement will occur as soon as practicable following the date the Award becomes vested pursuant to the terms of this Section 1.7, but in no event later than the earlier of (A) 90 days following the date the Award becomes vested, and (B) March 15th of the year following the year in which the Award becomes vested. No fractional shares of Stock shall be issued pursuant to this Agreement.

1.8. *Nontransferability of PRSUs*. The PRSU acquired by the Participant pursuant to this Agreement shall not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of except as provided below and in the Plan.

1.9. *Dividends Equivalent Rights.* The Participant shall not be entitled: (i) to receive any dividends or other distributions paid with respect to the Stock to which the PRSU relates, or (ii) to vote any Stock with respect to which the PRSU relates, unless and until, and only to the extent, the PRSU becomes vested and the Participant becomes a stockholder of record with respect to such shares of Stock. Notwithstanding the foregoing, as of each date on which the Company pays an ordinary cash dividend to record owners of shares of Stock, the Participant's account shall, as of each such dividend date, be credited with a cash amount (without interest) equal to the product of the total number of shares subject to the Target PRSU immediately prior to such dividend date multiplied by the dollar amount of the cash dividend paid per share of Stock by the Company on such dividend date (such amount, the "Dividend Equivalent Amount"). The Dividend Equivalent Amount, which shall be adjusted to reflect the number of Earned PRSUs, shall be subject to the same vesting conditions and settlement terms as the PRSU shares to which they relate.

1.10. *Sale of Vested Shares.* The Participant understands that Participant will be free to sell any Stock with respect to which the PRSU relates once the PRSU has vested and settled, subject to (i) satisfaction of any applicable tax withholding requirements with respect to the vesting of such PRSU; (ii) the completion of any administrative steps (for example, but without limitation, the transfer of certificates) that the Company may reasonably impose; and (iii) applicable requirements of federal and state securities laws.

1.11. *Certain Tax Matters*. The Participant expressly acknowledges that the award or vesting of the PRSU acquired hereunder may give rise to income subject to withholding. The Participant expressly acknowledges and agrees that Participant's rights hereunder are subject to Participant promptly paying to the Company all taxes required to be withheld in connection with such award, vesting, settlement and/or payment. Unless the Administrator determines otherwise, such payment of Participant's withholding tax obligations shall be made through net share settlement procedures whereby that number of the vesting shares needed to cover the withholding tax obligation (calculated using the Fair Market Value of the Company's stock on the date of vesting) shall be cancelled to fund the Company's payment of the withholding tax obligation and the net shares remaining after such cancellation shall be credited to Participant's account.

1.12 *Equitable Adjustments*. The Award is subject to adjustment pursuant to Section 15.1 of the Plan.

Article II – GENERAL PROVISIONS

2.1. *Definitions*. Except as otherwise expressly provided, all terms used herein shall have the same meaning as in the Plan. The following terms shall have the indicated meanings:

"Cause" means (a) "Cause" as defined in any individual agreement to which the Participant and the Company or an Affiliate are parties or (b) if there is no such agreement or if it does not define Cause, the Company's termination of the Participant's employment with the Company or any Affiliate following the occurrence of any one or more of the following: (i) the Participant's conviction of, or plea of guilty or nolo contendere to, a felony; (ii) the Participant's willful and continual failure to substantially perform the Participant's duties after written notification by the Company; (iii) the Participant's willful engagement in conduct that is materially injurious to the Company or an Affiliate monetarily or otherwise; (iv) the Participant's commission of an act of gross misconduct in connection with the performance of the Participant's duties; (v) the Participant's material breach of any employment, confidentiality, or other similar agreement between the Company or an Affiliate and the Participant; or (vi) prior to a Change in Control, such other events as shall be determined by the Administrator.

"Qualifying Termination" means the termination of a Participant's employment with the Company or an Affiliate (a) by the Company for any reason other than Cause, death, or total and permanent disability (as that term is defined in the Company's disability insurance policy in effect on the Award Date); or (b) by the Participant because of the occurrence, without the Participant's consent, of (i) a material reduction in the position, duties, or responsibilities of the Participant from those in effect immediately prior to such change; (ii) a reduction in the Participant's base salary; (iii) a relocation of the Participant's primary work location to a distance of more than 50 miles from its location as of immediately prior to such change; or (iv) a material breach by the Company or an Affiliate of any employment agreement with the Participant. In order to invoke a termination of employment pursuant to clause (b) of this definition, Participant shall provide written notice to the Company of the existence of one or more of the conditions described in clauses (i) through (iv) within 90 days following the Participant's knowledge of the initial existence of such condition or conditions, and the Company shall have 30 days following receipt of such written notice (the "Cure Period") during which it may remedy the condition(s). In the event that the Company fails to remedy the condition(s) covered by clause (b) of this definition during the Cure Period, the Participant must terminate employment, if at all, within 90 days following the Cure Period in order for such termination of employment to constitute a Qualifying Termination.

"Retirement" means [ ].

2.2. *No Understandings as to Employment etc*. The Participant further expressly acknowledges that nothing in the Plan or any modification thereto, in the Award or in this Agreement shall constitute or be evidence of any understanding, express or implied, on the part of the Company to employ or retain the Participant for any period or with respect to the terms of the Participant's employment or to give rise to any right to remain in the service of the Company or any Affiliate, and the Participant shall remain subject to discharge to the same extent as if the Plan had never been adopted or the Award had never been made.

2.3. *Compliance with Section 409A of the Code*. Notwithstanding any other provision of the Plan or this Agreement to the contrary, the Plan and this Agreement shall be construed or deemed to be amended as necessary to remain exempt from or comply with the requirements of Section 409A of the Code and to avoid the imposition of any additional or accelerated taxes or other penalties under Section 409A of the Code. The Committee, in its sole discretion, shall determine the requirements of Section 409A of the Code applicable to the Plan and this Agreement and shall interpret the terms of each consistently therewith. Under no circumstances, however, shall the Company, an

Affiliate, or a subsidiary have any liability under the Plan or this Agreement for any taxes, penalties, or interest due on amounts paid or payable pursuant to the Plan and/or this Agreement, including any taxes, penalties, or interest imposed under Section 409A of the Code. In the event that it is determined by the Company that, as a result of the deferred compensation tax rules under Section 409A of the Code (and any related regulations or other pronouncements thereunder) (the "Deferred Compensation Tax Rules"), benefits that the Participant is entitled to receive under the terms of this Agreement are deferred compensation subject to tax under the Deferred Compensation Tax Rules, (i) the Participant shall not be considered to have terminated employment for purposes hereof until the Participant would be considered to have incurred a "separation from service" within the meaning of the Deferred Compensation Tax Rules and (ii) the Company shall, in lieu of providing such benefit when otherwise due under this Agreement, instead provide such benefit on the first day on which such provision would not result in the Participant incurring any tax liability under the Deferred Compensation Tax Rules; which day, if the Participant is a "specified employee" (within the meaning of the Deferred Compensation Tax Rules), shall, in the event the benefit to be provided is due to the Participant's "separation from service" (within the meaning of the Deferred Compensation Tax Rules) with the Company and its subsidiaries, be the first day following the six-month period beginning on the date of such separation from service. Each amount to be paid or benefit to be provided under this Agreement shall be construed as a separately identified payment for purposes of the Deferred Compensation Tax Rules, and any payments described in this Agreement that are due within the "short term deferral period" as defined in the Deferred Compensation Tax Rules shall not be treated as deferred compensation unless applicable law requires otherwise.

2.4. *Data Protection Waiver*. Participant understands and agrees that in order to process and administer the Award and the Plan, the Company and the Administrator may process personal data and/or sensitive personal information concerning the Participant. Such data and information includes, but is not limited to, the information provided in the Award grant package and any changes thereto, other appropriate personal and financial data about Participant, and information about Participant's participation in the Plan and transactions under the Plan from time to time. Participant hereby gives his or her explicit consent to the Company and the Administrator to process any such personal data and/or sensitive personal information. Participant also hereby gives his or her explicit consent to the Company and the Administrator to transfer any such personal data and/or sensitive personal data outside the country in which Participant works, is employed or provides services and to the United States. The legal persons granted access to such Participant personal data are intended to include the Company, the Administrator, the outside plan administrator as selected by the Company from time to time, and any other compensation consultant or person that the Company or the Administrator may deem appropriate for the administration of the Plan or the Award. Participant has been informed of his or her right of access and correction to Participant's personal data by contacting the Company. Participant also understands that the transfer of the information outlined herein is important to the administration of the Award and the Plan and failure to consent to the transmission of such information may limit or prohibit Participant's participation under the Plan and/or void the Award.

2.5. *Savings Clause*. In the event that Participant is employed or provides services in a jurisdiction where the performance of any term or provision of this Agreement by the Company: (i) will result in a breach or violation of any statute, law, ordinance, regulation, rule, judgment, decree, order or statement of public policy of any court or governmental agency, board, bureau, body, department or authority, or (ii) will result in the creation or imposition of any penalty, charge, restriction, or material adverse effect upon the Company or an Affiliate, then any such term or provision shall be null, void and of no effect.

2.6. *Amendment*. The Company may amend the provisions of this Agreement at any time; provided that an amendment that would materially adversely affect the Participant's rights under this Agreement shall be subject to the written consent of the Participant. No course of conduct or failure or delay in enforcing the provisions of this Agreement shall affect the validity, binding effect or enforceability of this Agreement.

2.7. *Acts of Misconduct*. If Participant has allegedly committed an act of serious misconduct, including, but not limited to, embezzlement, fraud, dishonesty, unauthorized disclosure of trade secrets or confidential information, breach of fiduciary duty or nonpayment of an obligation owed to the Company, an executive officer of the Company may suspend Participant's rights under the Award, including the vesting of the Award and the settlement of vested PRSUs, subject to the Administrator's final decision regarding termination of the Award. No rights under the Award may be exercised during such suspension or after such termination.

2.8. *Disputes*. The Administrator or its delegate shall finally and conclusively determine any disagreement concerning the Award.

2.9. *Plan*. The terms and provisions of the Plan are incorporated herein by reference, a copy of which has been provided or made available to the Participant. In the event of a conflict or inconsistency between the terms and provisions of the Plan and the provisions of this Agreement, the Plan shall govern and control.

2.10. *Successors*. The terms of this Agreement shall be binding upon and inure to the benefit of the Company, its successors and assigns, and the Participant and the beneficiaries, executors, administrators, heirs and successors of the Participant.

2.11. *Entire Agreement*. This Agreement and the Plan contain the entire agreement and understanding of the parties hereto with respect to the subject matter contained herein and supersede all prior communications, representations and negotiations in respect thereof; provided, however, that to the extent that the Participant has entered into an employment agreement, severance agreement or change in control termination agreement with the Company that provides for vesting terms that are more favorable than the vesting terms set forth in this Agreement or the Plan, such more favorable vesting terms shall apply.

2.12 *Claw Back Policy*. This grant is subject to the terms of the Company's Claw Back Policy, as it may be amended, modified, superseded or replaced from time to time.

ENTEGRIS, INC.

2022 RSU Award Agreement

(2020 Stock Plan)

In consideration of services rendered to Entegris, Inc. (the "Company"), the Company may periodically make equity incentive awards consisting of restricted stock units with respect to the Company's Common Stock, $0.01 par value ("Stock"), to certain key employees, non-employee directors, consultants or advisors of the Company under the Company's 2020 Stock Plan (as amended from time to time, the "Plan"). Any key employee, non-employee director, consultant or advisor (a "Participant") who receives a restricted stock unit award (the "Award") is notified in writing or via email alert. The Award is credited to the Participant's account and reflected under the Stock Plans section on Fidelity's NetBenefits website. To Accept the award; click on the "Begin your grant acceptance now" link located in the New Grant Alert notification *or* scroll down to and expand the Stock Plans section; then click on "Begin Acceptance" and follow the prompts. By accepting the Award, Participant: (i) acknowledges that Participant has received a copy of the Plan, of the related prospectus providing information concerning awards under the Plan and of the Company's most recent Annual Report on Form 10-K; and (ii) accepts the Award and agrees with the Company that the Award is subject to the terms of the Plan and to the following terms and conditions:

Article I – RSU Award

1.1. *Award Date*. This Agreement shall take effect as of the date specified in the Stock Plans section as of the Award Date provided to you online through Fidelity's NetBenefits website (the "Award Date").

1.2. *Restricted Stock Units Subject to Award*. The Award consists of that number of restricted stock units (the "RSU") with respect to the Stock that has been approved for the Award to Participant by the Administrator. Each RSU is equivalent to one share of the Stock. The Participant's rights to the RSU are subject to the restrictions described in this Agreement and in the Plan (which is incorporated herein by reference with the same effect as if set forth herein in full) in addition to such other restrictions, if any, as may be imposed by law.

1.3. *Meaning of Certain Terms*. The term "vest" as used herein with respect to any RSU means the lapsing of the restrictions described herein with respect to such RSU.

1.4. *Nontransferability of RSUs*. The RSU acquired by the Participant pursuant to this Agreement shall not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of except as provided below and in the Plan.

1.5. *Forfeiture Risk*. Except as otherwise provided in this Agreement, if the Participant ceases to be employed or retained by the Company or an Affiliate for any reason, any then-outstanding and unvested RSU acquired by the Participant hereunder shall be automatically and immediately forfeited. The Participant hereby appoints the Company as the attorney-in-fact of the Participant to take such actions as may be necessary or appropriate to effectuate the cancellation of a forfeited RSU.

1.6. *Vesting and Settlement of RSUs*. The RSU acquired hereunder shall vest in accordance with the provisions of this Article I, Section 1.6 and applicable provisions of the Plan, as follows:

[ ]

Notwithstanding the foregoing, no RSU shall vest on any vesting date specified above unless: (A) the Participant is then, and since the Award Date has continuously been, employed or retained by the Company or an Affiliate (subject to Sections 2.2 and 2.3); and (B) the Participant has fulfilled the obligations specified in Section 1.9 below. Upon vesting, each RSU shall entitle Participant to receive one share of Stock (subject to adjustment under the Plan).

Vested RSUs shall be settled in shares of Stock (or, in the discretion of the Administrator, in cash equal to the Fair Market Value thereof). Subject to Section 2.12, settlement and delivery of the applicable number of shares of Stock (or cash equivalent, if applicable) shall be made as soon as practicable following vesting, but in no event later than 30 days after the applicable vesting date. No fractional shares of Stock shall be issued pursuant to this Agreement.

1.7. *Dividend Equivalent Rights*. The Participant shall not be entitled: (i) to receive any dividends or other distributions paid with respect to the Stock to which the RSU relates, or (ii) to vote any Stock with respect to which the RSU relates, unless and until, and only to the extent, the RSU becomes vested and the Participant becomes a stockholder of record with respect to such shares of Stock. Notwithstanding the foregoing, as of each date on which the Company pays an ordinary cash dividend to record owners of shares of Stock, the Participant's account shall, as of each such dividend date, be credited with a cash amount (without interest) equal to the product of the total number of shares subject to the RSU immediately prior to such dividend date multiplied by the dollar amount of the cash dividend paid per share of Stock by the Company on such dividend date (such amount, the "Dividend Equivalent Amount"). The Dividend Equivalent Amount shall be subject to the same vesting conditions and settlement terms as the RSU shares to which they relate.

1.8. *Sale of Vested Shares*. The Participant understands that Participant will be free to sell any Stock with respect to which the RSU relates once the RSU has vested and settled, subject to (i) satisfaction of any applicable tax withholding requirements with respect to the vesting of such RSU; (ii) the completion of any administrative steps (for example, but without limitation, the transfer of certificates) that the Company may reasonably impose; and (iii) applicable requirements of federal and state securities laws.

1.9. *Certain Tax Matters*. The Participant expressly acknowledges that the award or vesting of the RSU acquired hereunder may give rise to income subject to withholding. The Participant expressly acknowledges and agrees that Participant's rights hereunder are subject to Participant promptly paying to the Company all taxes required to be withheld in connection with such award, vesting, settlement and/or payment. Unless the Administrator determines otherwise, such payment of Participant's withholding tax obligations shall be made through net share settlement procedures whereby that number of the vesting shares needed to cover the withholding tax obligation (calculated using the Fair Market Value of the Company's stock on the date of vesting) shall be cancelled to fund the Company's payment of the withholding tax obligation and the net shares remaining after such cancellation shall be credited to Participant's account.

Article II – GENERAL PROVISIONS

2.1. *Definitions*. Except as otherwise expressly provided, all terms used herein shall have the same meaning as in the Plan.

2.2. *Change in Control*

(a) *Assumption or Substitution*.

(i) If the Change in Control is one in which there is an acquiring or surviving entity, the Administrator may provide for the assumption or continuation of some or all outstanding Awards or for the grant of new awards in substitution therefor by the acquiror or survivor or an affiliate of the acquiror or survivor.

(ii) Only to the extent consistent with Section 409A of the Code, in the event of a Change in Control in which the successor company assumes or substitutes for the RSU (or in which the Company is the ultimate parent corporation and continues the Award), if Participant's employment with such successor company (or the Company) or an affiliate thereof is involuntarily terminated without Cause by the successor employer or Participant resigns for Good Reason, in either case within 24 months following such Change in Control: the restrictions, limitations and other conditions applicable to the RSU shall lapse and the RSU shall become free of all restrictions, limitations and conditions and become fully vested.

(b) *Awards Not Assumed or Substituted*. In the event of a Change in Control in which the successor company does not assume or substitute for the RSU (or in which the Company is the ultimate parent corporation and does not continue the Award): the restrictions, limitations and other conditions applicable to the RSU shall lapse and the RSU shall become free of all restrictions, limitations and conditions and become fully vested, provided that if the RSU constitutes nonqualified deferred compensation pursuant to Section 409A, the RSU will not be settled until the earliest to occur of the regularly scheduled vesting date, Participant's retirement in accordance with Section 2.3 and Participant's termination without Cause or for Good Reason, subject to application of a six-month delay if the Participant is a specified employee under Section 409A.

(c) *Good Reason Definition*. For purposes of this Section 2.2, "Good Reason" means (i) "Good Reason" as defined in any individual agreement to which Participant and the Company or an Affiliate are parties, or (ii) if there is no such agreement or if it does not define Good Reason, without the Participant's prior written consent: (A) a reduction in the Participant's base salary; (B) a relocation of the Participant's primary work location to a distance of more than 50 miles from its location as of immediately prior to such change; or

(C) a material breach by the Company or an Affiliate of any employment agreement with the Participant. In order to invoke a termination of employment for Good Reason, a Participant shall provide written notice to the Company of the existence of one or more of the conditions described in clauses (A) through (C) within 90 days following the Participant's knowledge of the initial existence of such condition or conditions, and the Company shall have 30 days following receipt of such written notice (the "Cure Period") during which it may remedy the condition(s). In the event that the Company fails to remedy the condition(s) constituting Good Reason during the Cure Period, the Participant must terminate employment, if at all, within 90 days following the Cure Period in order for such termination to constitute a termination of employment for Good Reason.

(d) *Cause Definition*. "Cause" means (i) "Cause" as defined in any individual agreement to which the Participant and the Company or an Affiliate are parties or (ii) if there is no such agreement or if it does not define Cause, the Company's termination of the Participant's employment with the Company or any Affiliate following the occurrence of any one or more of the following: (A) the Participant's conviction of, or plea of guilty or nolo contendere to, a felony; (B) the Participant's willful and continual failure to substantially perform the Participant's duties after written notification by the Company; (C) the Participant's willful engagement in conduct that is materially injurious to the Company or an Affiliate monetarily or otherwise; (D) the Participant's commission of an act of gross misconduct in connection with the performance of the Participant's duties; or (E) the Participant's material breach of any employment, confidentiality, or other similar agreement between the Company or an Affiliates and the Participant.

2.3. *Retirement*. If Participant is an employee of the Company or Affiliate and ceases to be an employee due to retirement with the consent of the Administrator, Participant will be entitled to immediate vesting of all unvested RSUs awarded pursuant to this Agreement. As used herein the term "retirement with the consent of the Administrator" means that Participant's retirement must be with the consent of the Administrator, which consent may be granted or withheld in the discretion of the Administrator. In the event that Participant ceases to be an employee under circumstances that would otherwise qualify for retirement but the consent of the Administrator has not been granted, then Participant shall not be entitled to the benefits of this Section 2.3.

2.4. *Equitable Adjustments*. The Award is subject to adjustment pursuant to Section 15.1 of the Plan.

2.5. *No Understandings as to Employment etc*. The Participant further expressly acknowledges that nothing in the Plan or any modification thereto, in the Award or in this Agreement shall constitute or be evidence of any understanding, express or implied, on the part of the Company to employ or retain the Participant for any period or with respect to the terms of the Participant's employment or to give rise to any right to remain in the service of the Company or any Affiliate, and the Participant shall remain subject to discharge to the same extent as if the Plan had never been adopted or the Award had never been made.

2.6. *Data Protection Waiver*. Participant understands and agrees that in order to process and administer the Award and the Plan, the Company and the Administrator may process personal data and/or sensitive personal information concerning the Participant. Such data and information includes, but is not limited to, the information provided in the Award grant package and any changes thereto, other appropriate personal and financial data about Participant, and information about Participant's participation in the Plan and transactions under the Plan from time to time. Participant hereby gives his or her explicit consent to the Company and the Administrator to process any such personal data and/or sensitive personal information. Participant also hereby gives his or her explicit consent to the Company and the Administrator to transfer any such personal data and/or sensitive personal data outside the country in which Participant works, is employed or provides services and to the United States. The legal persons granted access to such Participant personal data are intended to include the Company, the Administrator, the outside plan administrator as selected by the Company from time to time, and any other compensation consultant or person that the Company or the Administrator may deem appropriate for the administration of the Plan or the Award. Participant has been informed of his or her right of access and correction to Participant's personal data by contacting the Company. Participant also understands that the transfer of the information outlined herein is important to the administration of the Award and the Plan and failure to consent to the transmission of such information may limit or prohibit Participant's participation under the Plan and/or void the Award.

2.7. *Savings Clause*. In the event that Participant is employed or provides services in a jurisdiction where the performance of any term or provision of this Agreement by the Company: (i) will result in a breach or violation of any statute, law, ordinance, regulation, rule, judgment, decree, order or statement of public policy of any court or governmental agency, board, bureau, body, department or authority, or (ii) will result in the creation or imposition of any penalty, charge, restriction, or material adverse effect upon the Company or an Affiliate, then any such term or provision shall be null, void and of no effect.

2.8. *Amendment*. The Company may amend the provisions of this Agreement at any time; provided that an amendment that would materially adversely affect the Participant's rights under this Agreement shall be subject to the written consent of the Participant. No course of conduct or failure or delay in enforcing the provisions of this Agreement shall affect the validity, binding effect or enforceability of this Agreement.

2.9. *Acts of Misconduct*. If Participant has allegedly committed an act of serious misconduct, including, but not limited to, embezzlement, fraud, dishonesty, unauthorized disclosure of trade secrets or confidential information, breach of fiduciary duty or nonpayment of an obligation owed to the Company, an executive officer of the Company may suspend Participant's rights under the Award, including the vesting of the Award and the settlement of vested RSUs, subject to the Administrator's final decision regarding termination of the award. No rights under the Award may be exercised during such suspension or after such termination.

2.10. *Disputes*. The Administrator or its delegate shall finally and conclusively determine any disagreement concerning the Award.

2.11. *Plan*. The terms and provisions of the Plan are incorporated herein by reference, a copy of which has been provided or made available to the Participant. In the event of a conflict or inconsistency between the terms and provisions of the Plan and the provisions of this Agreement, the Plan shall govern and control.

2.12. *Compliance with Section 409A of the Code*. Notwithstanding any other provision of the Plan or this Agreement to the contrary, the Plan and this Agreement shall be construed or deemed to be amended as necessary to remain exempt from or comply with the requirements of Section 409A of the Code and to avoid the imposition of any additional or accelerated taxes or other penalties under Section 409A of the Code. The Committee, in its sole discretion, shall determine the requirements of Section 409A of the Code applicable to the Plan and this Agreement and shall interpret the terms of each consistently therewith. Under no circumstances, however, shall the Company, an Affiliate, or a subsidiary have any liability under the Plan or this Agreement for any taxes, penalties, or interest due on amounts paid or payable pursuant to the Plan and/or this Agreement, including any taxes, penalties, or interest imposed under Section 409A of the Code. In the event that it is determined by the Company that, as a result of the deferred compensation tax rules under Section 409A of the Code (and any related regulations or other pronouncements thereunder) (the “Deferred Compensation Tax Rules”), benefits that the Participant is entitled to receive under the terms of this Agreement are deferred compensation subject to tax under the Deferred Compensation Tax Rules, (i) the Participant shall not be considered to have terminated employment for purposes hereof until the Participant would be considered to have incurred a “separation from service” within the meaning of the Deferred Compensation Tax Rules and (ii) the Company shall, in lieu of providing such benefit when otherwise due under this Agreement, instead provide such benefit on the first day on which such provision would not result in the Participant incurring any tax liability under the Deferred Compensation Tax Rules; which day, if the Participant is a “specified employee” (within the meaning of the Deferred Compensation Tax Rules), shall, in the event the benefit to be provided is due to the Participant’s “separation from service” (within the meaning of the Deferred Compensation Tax Rules) with the Company and its subsidiaries, be the first day following the six-month period beginning on the date of such separation from service. Each amount to be paid or benefit to be provided under this Agreement shall be construed as a separately identified payment for purposes of the Deferred Compensation Tax Rules, and any payments described in this Agreement that are due within the “short term deferral period” as defined in the Deferred Compensation Tax Rules shall not be treated as deferred compensation unless applicable law requires otherwise.

2.13. *Successors*. The terms of this Agreement shall be binding upon and inure to the benefit of the Company, its successors and assigns, and the Participant and the beneficiaries, executors, administrators, heirs and successors of the Participant.

2.14. *Entire Agreement*. This Agreement and the Plan contain the entire agreement and understanding of the parties hereto with respect to the subject matter contained herein and supersede all prior communications, representations and negotiations in respect thereof; provided, however, that to the extent that the Participant has entered into an employment agreement, severance agreement or change in control termination agreement with the Company that provides for vesting terms that are more favorable than the vesting terms set forth in this Agreement or the Plan, such more favorable vesting terms shall apply.

2.15 *Claw Back Policy*. This grant is subject to the terms of the Company's Claw Back Policy, as it may be amended, modified, superseded or replaced from time to time.

ENTEGRIS, INC.
2022 Stock Option Award Agreement
(2020 Stock Plan)

In consideration of services rendered to Entegris, Inc. (the “Company”), the Company may periodically make equity incentive awards consisting of stock options with respect to the Company’s Common Stock, $0.01 par value (“Stock”), to certain key employees, non-employee directors, consultants or advisors of the Company under the Company’s 2010 Stock Plan (as amended from time to time, the “Plan”). Any key employee, non-employee director, consultant or advisor (a “Participant”) who receives a stock option award (the “Award”) is notified in writing or via email and the Award is credited to the Participant’s account as reflected on the Overview tab under the Stock Options Plan section on Fidelity’s NetBenefits website. By clicking on the “Accept” button for the Award in the Stock Options Plan section on the Overview tab or by otherwise receiving the benefits of the Award, Participant: (i) acknowledges that Participant has received a copy of the Plan, of the related prospectus providing information concerning awards under the Plan and of the Company’s most recent Annual Report on Form 10-K; and (ii) accepts the Award and agrees with the Company that the Award is subject to the terms of the Plan and to the following terms and conditions:

Article I –Stock Option Grant

1.1. *Option Grant*. Effective as of the grant date specified in the Stock Options Plan section provided to you online (the “Grant Date”), the Company hereby grants Participant a non-statutory stock option to purchase that number of shares of Stock that has been approved for the Award to the Participant by the Administrator (“Option”). The shares of Stock awarded are specified in the Stock Options Plan section in the Granted column online through Fidelity’s NetBenefits website. The Option is not intended to be an incentive stock option under Section 422 of the Internal Revenue Code of 1986, as amended, and will be interpreted accordingly.

1.2. *Option Exercise Price*. The exercise (grant) price of the Option shall be 100% of the closing price of the Stock on the NASDAQ stock market on the Grant Date. The exercise price is provided to Participant online through Fidelity’s NetBenefits website.

1.3. *Option Vesting Schedule*. This Option shall vest and become exercisable, except as hereinafter provided, in whole or in part, as follows:

[ ]

1.4. *Expiration of Option*. To the extent that the Option shall not have been exercised, this Option shall expire at 5:00 p.m. local time at the Company’s headquarters on ________, _____ and no part of the Option may be exercised thereafter. If an expiration, termination or forfeiture date described herein falls on a weekday, Participant must exercise the Option before 5:00 p.m. local time at the Company’s headquarters on that date. If an expiration, termination or forfeiture date described herein falls on a weekend or any other day on which the NASDAQ stock market is not open, Participant must exercise the Option before 5:00 p.m. local time at the Company’s headquarters on the last NASDAQ business day prior to the expiration, termination or forfeiture date.

1.5. *Exercise of Option*. When and as vested, this Option may be exercised up to the number of shares of Stock specified in Section 1.1 above only by serving written notice on the designated stock plan administrator. Payment of the Option exercise price specified in Section 1.2 above may be made (i) in cash or by certified check, (ii) through net share settlement procedures whereby that number of the Option shares being exercised that are needed to cover the payment of the Option exercise price (calculated using the Fair Market Value of the Company's stock on the date of exercise) shall be cancelled to fund the payment of the Option exercise price, (iii) by broker assisted sale of shares to satisfy the Option exercise price; or (iv) by any other method specified in the Plan or as permitted by the Administrator. No fractional shares of Stock shall be issued pursuant to this Agreement. Participant will have the rights of a stockholder only after the shares of Stock have been issued to the Participant in accordance with this Agreement.

1.6. *No Assignment of Option*. This Option may not be assigned or transferred except as may otherwise be provided by the terms of this Agreement.

1.7. *Equitable Adjustments*. The Award is subject to adjustment pursuant to Section 15.1 of the Plan.

1.8. *Termination of Employment or Service with the Company*. All exercisable Options granted herein must be exercised within ninety (90) days following the date on which the employment or services of Participant with the Company or an Affiliate terminates (i.e., last day worked, excluding any severance period), or, if earlier, prior to the original expiration date of the Option ("Termination Date"), or be forfeited, except as provided in Sections 2.2 and 2.3 below and as follows:

(a) In the event of Participant's death during employment/services, each Option granted hereunder will be exercisable, whether or not vested on or prior to the date of Participant's death, until the earlier of: (1) the first anniversary of Participant's date of death; or (2) the original expiration date of the Option. In the event of Participant's death during a Special Exercise Period as specified in Section 2.3 below, each Option will continue to be exercisable in accordance with the provisions of that Section.

(b) In the event of the termination of employment/services of Participant due to Disability, Participant may exercise the Option, whether or not vested on or prior to the date of employment or service termination, at any time prior to the earlier of the original expiration date of the Option and 365 days following the later of the date of Participant's separation from service due to Participant's Disability or the date of determination of Participant's Disability, *provided*, *however*, that while the claim of Disability is pending, Options that were unvested at termination of services may not be exercised and Options that were vested at termination of services may be exercised only during the period set forth in the introductory clause to this Section 1.8. The Option shall terminate on the earlier of the original expiration date of the Option and 365 days following the later of the date of Participant's separation from service due to Participant's Disability or the date of determination of Participant's Disability, to the extent that it is unexercised. For these purposes "Disability" shall be determined in accordance with the standards and procedures of the then-current Long-Term Disability policies maintained by the Company, which is generally a physical condition arising from an illness or injury which renders an individual incapable of performing work in any occupation, as determined by the Company.

(c) If Participant's employment/services is terminated for "Cause", all granted but unexercised stock Options, whether vested or unvested, shall be forfeited on Participant's Termination Date.

1.9. *Suspension of Option Exercises*. For administrative or other reasons, the Company may, from time to time, suspend the ability of Participants to exercise options for limited periods of time. Notwithstanding the above, the Company shall not be obligated to deliver any shares of Stock during any period when the Company determines that the exercisability of the Option or the delivery of shares hereunder would violate any federal, state or other applicable laws.

1.10. *Withholding of Income Taxes*. The Company shall have no obligation to issue shares upon exercise of this Option unless the Participant has satisfied any tax withholding obligation with respect to such exercise. Payment of Participant's withholding tax obligations may be made through any method specified in the Plan or as permitted by the Administrator.

Article II – GENERAL PROVISIONS

2.1. *Definitions*. Except as otherwise expressly provided, all terms used herein shall have the same meaning as in the Plan.

2.2. *Change in Control*.

(a) *Assumption or Substitution*.

(i) If the Change in Control is one in which there is an acquiring or surviving entity, the Administrator may provide for the assumption or continuation of some or all outstanding Awards or for the grant of new awards in substitution therefor by the acquiror or survivor or an affiliate of the acquiror or survivor.

(ii) In the event of a Change in Control in which the successor company assumes or substitutes for the Option (or in which the Company is the ultimate parent corporation and continues the Award), if Participant's employment with such successor company (or the Company) or an affiliate thereof is involuntarily terminated without Cause by the successor employer or Participant resigns for Good Reason, in either case within 24 months following such Change in Control: the Option will immediately vest, become fully exercisable, and may thereafter be exercised for 24 months (but in no event after the original expiration date specified in Section 1.4 above). For the purposes of this Section 2.2, the Option shall be considered assumed or substituted for if following the Change in Control the Award confers the right to purchase or receive, for each share of Stock subject to the Option immediately prior to the Change in Control, the consideration (whether stock, cash or other securities or property) received in the transaction constituting a Change in Control by holders of Stock for each Share held on the effective date of such transaction (and if holders were offered a choice of consideration, the type of consideration chosen by the holders of a majority of the outstanding Stock); *provided*, *however*, that if such consideration received in the transaction constituting a Change in Control is not solely common stock of the successor company, the Administrator may, with the consent of the successor company, provide that the consideration to be received upon the exercise or vesting of the Option, for each Share subject thereto, will be solely common stock of the successor company substantially equal in fair market value to the per Share consideration received by holders of Stock in the transaction constituting a Change in Control. The determination of such substantial equality of value of consideration shall be made by the Administrator in its sole discretion and its determination shall be conclusive and binding.

(b) *Awards Not Assumed or Substituted*. In the event of a Change in Control in which the successor company does not assume or substitute for the Option (or in which the Company is the ultimate parent corporation and does not continue the Award): the Option shall immediately vest and become fully exercisable.

(c) *Good Reason Definition*. For purposes of this Section 2.2, “Good Reason” means (i) “Good Reason” as defined in any individual agreement to which Participant and the Company or an Affiliate are parties, or (ii) if there is no such agreement or if it does not define Good Reason, without the Participant’s prior written consent: (A) a reduction in the Participant’s base salary; (B) a relocation of the Participant’s primary work location to a distance of more than 50 miles from its location as of immediately prior to such change; or (C) a material breach by the Company or an Affiliate of any employment agreement with the Participant. In order to invoke a termination of employment for Good Reason, a Participant shall provide written notice to the Company of the existence of one or more of the conditions described in clauses (A) through (C) within 90 days following the Participant’s knowledge of the initial existence of such condition or conditions, and the Company shall have 30 days following receipt of such written notice (the “Cure Period”) during which it may remedy the condition(s). In the event that the Company fails to remedy the condition(s) constituting Good Reason during the Cure Period, the Participant must terminate employment, if at all, within 90 days following the Cure Period in order for such termination to constitute a termination of employment for Good Reason.

(d) *Cause Definition*. “Cause” means (i) “Cause” as defined in any individual agreement to which the Participant and the Company or an Affiliate are parties or (ii) if there is no such agreement or if it does not define Cause, the Company’s termination of the Participant’s employment with the Company or any Affiliate following the occurrence of any one or more of the following: (A) the Participant’s conviction of, or plea of guilty or nolo contendere to, a felony; (B) the Participant’s willful and continual failure to substantially perform the Participant’s duties after written notification by the Company; (C) the Participant’s willful engagement in conduct that is materially injurious to the Company or an Affiliate monetarily or otherwise; (D) the Participant’s commission of an act of gross misconduct in connection with the performance of the Participant’s duties; or (E) the Participant’s material breach of any employment, confidentiality, or other similar agreement between the Company or an Affiliate and the Participant.

2.3. *Retirement*. If Participant is an employee of the Company or an Affiliate and ceases to be an employee due to retirement with the consent of the Administrator, Participant will be entitled to a special exercise period with respect to the Option (the "Special Exercise Period") which will begin on Participant's retirement date and will end on the earlier of the 4th anniversary of Participant's retirement date or the expiration date specified in Section 1.4 above. During the Special Exercise Period, the Option will continue to vest in accordance with the schedule specified in Section 1.3 above and will be exercisable to the same extent that it would have been exercisable had Participant remained in service with the Company or an Affiliate. As used herein the term "retirement with the consent of the Administrator" means that Participant's retirement must be with the consent of the Administrator, which consent may be granted or withheld in the discretion of the Administrator. In the event that Participant ceases to be an employee under circumstances that would otherwise qualify for retirement but the consent of the Administrator has not been granted, then Participant shall not be entitled to the benefits of this Section 2.3.

2.4. _No Understandings as to Employment, etc_. The Participant further expressly acknowledges that nothing in the Plan or any modification thereto, in the Award or in this Agreement shall constitute or be evidence of any understanding, express or implied, on the part of the Company to employ or retain the Participant for any period or with respect to the terms of the Participant's employment or to give rise to any right to remain in the service of the Company or any Affiliate, and the Participant shall remain subject to discharge to the same extent as if the Plan had never been adopted or the Award had never been made.

2.5. _Acts of Misconduct_. If Participant has allegedly committed an act of serious misconduct, including, but not limited to, embezzlement, fraud, dishonesty, unauthorized disclosure of trade secrets or confidential information, breach of fiduciary duty or nonpayment of an obligation owed to the Company, an Executive Officer of the Company may suspend Participant's rights under the Award, including the vesting of Options and the exercise of vested Options, subject to the Administrator's final decision regarding termination of the award. No rights under the Award may be exercised during such suspension or after such termination.

2.6. _Data Protection Waiver._ Participant understands and agrees that in order to process and administer the Award and the Plan, the Company and the Administrator may process personal data and/or sensitive personal information concerning the Participant. Such data and information includes, but is not limited to, the information provided in the Award grant package and any changes thereto, other appropriate personal and financial data about Participant, and information about Participant's participation in the Plan and transactions under the Plan from time to time. Participant hereby gives his or her explicit consent to the Company and the Administrator to process any such personal data and/or sensitive personal information. Participant also hereby gives his or her explicit consent to the Company and the Administrator to transfer any such personal data and/or sensitive personal data outside the country in which Participant works, is employed or provides services and to the United States. The legal persons granted access to such Participant personal data are intended to include the Company, the Administrator, the outside plan administrator as selected by the Company from time to time, and any other compensation consultant or person that the Company or the Administrator may deem appropriate for the administration of the Plan or the Award. Participant has been informed of his or her right of access and correction to Participant's personal data by contacting the Company.

Participant also understands that the transfer of the information outlined herein is important to the administration of the Award and the Plan and failure to consent to the transmission of such information may limit or prohibit Participant's participation under the Plan and/or void the Award.

2.7. _Disputes_. The Administrator or its delegate shall finally and conclusively determine any disagreement concerning the Award.

2.8. _Savings Clause_. In the event that Participant is employed or provides services in a jurisdiction where the performance of any term or provision of this Agreement by the Company: (i) will result in a breach or violation of any statute, law, ordinance, regulation, rule, judgment, decree, order or statement of public policy of any court or governmental agency, board, bureau, body, department or authority, or (ii) will result in the creation or imposition of any penalty, charge, restriction, or material adverse effect upon the Company or an Affiliate, then any such term or provision shall be null, void and of no effect.

2.9. _Amendment_. The Company may amend the provisions of this Agreement at any time; provided that an amendment that would materially adversely affect the Participant's rights under this Agreement shall be subject to the written consent of the Participant. No course of conduct or failure or delay in enforcing the provisions of this Agreement shall affect the validity, binding effect or enforceability of this Agreement.

2.10. _Plan_. The terms and provisions of the Plan are incorporated herein by reference, a copy of which has been provided or made available to the Participant. In the event of a conflict or inconsistency between the terms and provisions of the Plan and the provisions of this Agreement, the Plan shall govern and control.

2.11. _Successors_. The terms of this Agreement shall be binding upon and inure to the benefit of the Company, its successors and assigns, and the Participant and the beneficiaries, executors, administrators, heirs and successors of the Participant.

2.12. _Entire Agreement_. This Agreement and the Plan contain the entire agreement and understanding of the parties hereto with respect to the subject matter contained herein and supersede all prior communications, representations and negotiations in respect thereof; provided, however, that to the extent that the Participant has entered into an employment agreement, severance agreement or change in control termination agreement with the Company that provides for vesting and/or exercise terms that are more favorable than the vesting and/or exercise terms set forth in this Agreement or the Plan, such more favorable vesting and/or exercise terms shall apply.

2.13 _Claw Back Policy_. This grant is subject to the terms of the Company's Claw Back Policy, as it may be amended, modified, superseded or replaced from time to time.

THIRD AMENDMENT TO LEASE AGREEMENT

This **THIRD AMENDMENT TO LEASE AGREEMENT** (this "**Amendment**"), is made as of the 21st day of October, 2021, by and between RIVERTECH OWNER LLC, a Delaware limited liability company (as successor-in-interest to KBS RIVERTECH, LLC, a Delaware limited liability company, as successor-in-interest to Nortel Networks HPOCS Inc.) ("**Landlord**"), and ENTEGRIS, INC., a Delaware corporation (as successor-in-interest to Mykrolis Corporation) ("**Tenant**").

RECITALS:

WHEREAS, Landlord and Tenant are parties to that certain Lease Agreement, dated as of April 1, 2002, as amended by that certain Amendment of Lease dated April 1, 2012, as further amended by that certain Second Amendment of Lease, dated March 8, 2016 (as may be further amended, modified or supplemented from time to time, the "**Lease**"), relating to certain Premises comprising Building 2 of RiverTech Park, located at 129 Concord Road, Billerica, Massachusetts, all as more particularly described and set forth in the Lease;

WHEREAS, Tenant desires to undertake certain Alterations as further described below; and

WHEREAS, subject to the satisfaction of the express conditions and provisions set forth in this Amendment hereinbelow, Landlord agrees to provide its consent to the Proposed Work, subject to the express terms and provisions hereof;

NOW THEREFORE, in consideration of the foregoing recitals and for further good and valuable consideration, the receipt and adequacy whereof are hereby acknowledged, Landlord and Tenant do hereby agree as follows:

1. Incorporation of Recitals. The recitals set forth above are true and correct, incorporated herein and made a part of this Amendment as if set forth herein in full.

2. Capitalized Terms and Conflicts. All capitalized terms used in this Amendment that are not defined in this Amendment shall have the meanings ascribed to such terms in the Lease. In the event of any conflict between the terms of the Lease and the terms of this Amendment, the definitions set forth in this Amendment shall supersede and control.

3. Proposed Work.

a. Tenant has notified Landlord that it proposes to undertake certain Alterations (as such term is defined in Section 15 of the Lease) within the Premises at its sole cost and expense, which comprises of the construction of a biological waste treatment process facility within the Premises, as more particularly described and depicted on Attachment A attached hereto (hereinafter referred to as the "**Proposed Work**" and the improvements constructed upon the Premises shall be referred to as the "**Biological Waste Treatment Process Facility**"). In connection with the foregoing, Tenant hereby requests that Landlord provide its consent to the Proposed Work as required by Section 15 of the Lease. Subject to the terms and provisions of this Amendment, Landlord hereby consents to the conduct by Tenant of the Proposed Work, if and only if each of the following conditions precedent are satisfied, in Landlord's sole but reasonable discretion:

i. Receipt by Tenant and Landlord of written confirmation from the Building Inspector/Zoning Enforcement Officer of the Town of Billerica, or other such documentation acceptable to Landlord in its sole and absolute discretion, that the Biological Waste Treatment Process Facility falls within an allowed use in the

Industrial District in which the Premises are located under the Billerica Zoning By-Laws;

ii. Receipt by Tenant and Landlord of a site plan approval special permit by the Planning Board of the Town of Billerica, or written confirmation from the Building Inspector/Zoning Enforcement Officer of the Town of Billerica that the construction of the Biological Waste Treatment Process Facility does not require a site plan special permit;

iii. Receipt by Tenant and Landlord, at Tenant's sole cost and expense, of any and all necessary permits, consents and approvals, such as, without limitation, from the Billerica Sewer Department and the Department of Environmental Protection, to conduct the Proposed Work and maintain and operate the Biological Waste Treatment Process Facility in accordance with all applicable laws and requirements.

iv. Landlord shall have received confirmation to its reasonable satisfaction that no underground utilities are impacted by the Proposed Work, including by Tenant having conducted a Ground Penetrating Radar scan in the Premises to ensure same.

b. Additionally, in connection with Tenant's request for Landlord approval of the Proposed Work, the following shall apply:

i. Tenant covenants and agrees to timely apply for and obtain all required permits, consents and approvals necessary for all stages of the Proposed Work, and shall comply with the foregoing and all conditions set forth therein.

ii. Tenant covenants and agrees to diligently prosecute all stages of the Proposed Work to completion, at Tenant's sole cost and expense.

iii. Landlord shall have the right to review and approve any and all requests, applications, submittals, and the like, submitted by or on behalf of Tenant to governmental authorities in connection with the Proposed Work and the operation and maintenance of the Biological Waste Treatment Process Facility, which such approval Landlord shall not unreasonably withhold or delay.

c. Once constructed, the following shall apply to the Biological Waste Treatment Process Facility:

i. Landlord shall have the right to evaluate the systems in the Biological Waste Treatment Process Facility from time to time with engineers selected by Landlord to ensure continued operation and compliance with applicable laws and requirements.

ii. Tenant shall comply with all discharge compliance regulations required by the Town of Billerica, including but not limited to the monitoring, sampling and reporting on all discharge produced under the existing waste water discharge permit in effect with respect to the Premises, as well as any additional permit for the Biological Waste Treatment Process Facility.

iii. Tenant shall provide Landlord with updated training, spec and O&M Plans showing how the existing Building Management System is used at the Biological Waste Treatment Process Facility in order to monitor applicable waste water discharge requirements, including without limitation to monitor and alarm the system for proper chemical balancing and temperature prior to discharge into the municipal sewer system. Any reports in connection with same shall be shared in a timely manner with Landlord.

d. The following is hereby added to the end of the first sentence of Section 22(a) of the Lease prior to the last parenthetical therein: “or which arises, or is claimed to arise, from the Proposed Work and/or operating and maintenance of the Biological Waste Treatment Process Facility”.

e. Upon the expiration or earlier termination of the Lease, at Landlord’s election (in its sole and absolute discretion) made not later than one hundred eighty (180) days prior to the expiration of the Lease, Tenant shall be obligated to decommission and remove any and all improvements placed on the Premises relating to the Proposed Work (including without limitation the Biological Waste Treatment Process Facility), and restore the Premises to substantially the condition that existed before the Biological Waste Treatment Process Facility was constructed, which shall be completed in compliance with all laws, permits and ordinances then in effect, including without limitation any and all parking requirements then applicable and any environmental requirements then in effect, at its sole cost and expense, and shall repair any damage caused by such removal and restoration. Without limitation of the foregoing, and for the avoidance of any doubt, upon removal of the Biological Waste Treatment Process Facility, Tenant shall restore the parking lot and the parking spaces that existed before the Biological Waste Treatment Process Facility was constructed. If Tenant shall fail to remove the Biological Waste Treatment Process Facility and restore the Premises to substantially the condition that existed before the Biological Waste Treatment Process Facility was constructed, Landlord may, at its option, in its sole and absolute discretion, remove the Biological Waste Treatment Process Facility to restore the Premises, and Tenant agrees to pay Landlord, within thirty (30) days after the date of any demand by Landlord for reimbursement, any and all expenses incurred by Landlord in such removal and restoration, including without limitation consultant fees, contractor costs, disposal costs, court costs and reasonable attorneys’ fees.

f. Notwithstanding anything to the contrary, if Tenant shall default in the performance of any of its agreements, covenants, obligations and provisions in this Amendment (e.g., Tenant shall fail to perform the Proposed Work and/or operate the Biological Waste Treatment Process Facility in accordance with the terms, conditions and provisions of this Amendment) beyond any applicable notice and cure period, unless imminent risk to persons or property, Landlord may, at its option, in its sole and absolute discretion, perform any such agreement, covenant, obligation and provision instead of Tenant, and Tenant agrees to pay Landlord, within thirty (30) days after the date of any demand by Landlord for reimbursement, any and all expenses incurred by Landlord in the performance of same.

4. Notices. From and after the date hereof, Landlord’s address for purposes of Section 36 of the Lease shall be as follows unless and until otherwise specified by Landlord:

RiverTech Owner LLC
c/o Rockpoint Group, L.L.C.
Woodlawn Hall at Old Parkland
3953 Maple Avenue, Suite 300
Dallas, TX 75219
Attn: General Counsel
Email: ron@rockpoint.com

With copies to:

c/o Rockpoint Group, L.L.C.
Woodlawn Hall at Old Parkland
3953 Maple Avenue, Suite 300
Dallas, TX 75219
Attn: Fred Borges and Joseph Goldman
Email: fb@rockpoint.com and jg@rockpoint.com

Griffith Properties LLC
22 Boston Wharf Road, 7th Floor
Boston, Massachusetts 02110
Attention: Marci G. Loeber
Email: mloeber@griffithproperties.com

5. Ratification of Lease. Except as amended and modified by this Amendment, all the terms, provisions, agreements, covenants and conditions of the Lease are hereby affirmed and ratified.

6. Execution/Entire Agreement. This Amendment, together with the Lease as affected hereby, constitutes the entire agreement of the parties, and may not be amended except by written instrument signed by all parties. This Amendment shall have the effect of an agreement under seal and shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

7. Counterparts. This Amendment may be executed in multiple counterparts, including without limitation electronically by .PDF or such other electronic format, each of which shall be deemed an original and all of which together shall constitute one and the same document.

8. Governing Law. This Amendment and the rights and obligations of the parties hereto shall be interpreted, governed and enforced in accordance with the laws of the State in which the Premises is located.

[Remainder of page intentionally blank; signatures follow]

IN WITNESS WHEREOF, Landlord and Tenant have executed this Amendment as of the date and year first above written.

LANDLORD:

RIVERTECH OWNER LLC,
a Delaware limited liability company

By: /s/ Ron J. Hoyl
Name: Ron J. Hoyl
Its: Vice President

TENANT:

ENTEGRIS, INC., a Delaware corporation

By: /s/ Neil Richards
Name: Neil Richards
Its: SVP, Global Operations & Supply Chain

Exhibit 21

Subsidiaries of Entegris, Inc.

Name of Subsidiary	Jurisdiction
ATMI International Trading Co. Ltd.	China
ATMI Semiconductor New Materials Xi'an Co., Ltd.	China
Entegris Canada Limited	Canada
Digital Specialty Chemicals UK Limited	United Kingdom
Entegris Asia LLC	Delaware
Entegris Asia-U.S. LLC	Delaware
Entegris Asia Pte. Ltd.	Singapore
Entegris Ecosys LLC	Delaware
Entegris GmbH	Germany
Entegris GP, Inc.	Delaware
Entegris International Holdings B.V.	The Netherlands
Entegris International Holdings II B.V.	The Netherlands
Entegris International Holdings III B.V.	The Netherlands
Entegris International Holdings IV LLC	Delaware
Entegris International Holdings V LLC	Delaware
Entegris International Holdings VI LLC	Delaware
Entegris International Holdings VII LLC	The Netherlands
Entegris International Holdings, Inc.	Delaware
Entegris Ireland Unlimited Company	Ireland
Entegris Israel Ltd.	Israel
Entegris Japan Co. Ltd.	Japan
Entegris Korea Co., Ltd.	South Korea
Entegris Korea II Ltd.	South Korea
Entegris Malaysia Sdn. Bhd.	Malaysia
Entegris (Shanghai) Microelectronics Trading Company Ltd.	China
Entegris Pacific Ltd.	Delaware
Entegris Professional Solutions, Inc.	Delaware
Entegris Sarl	Luxembourg
Entegris SAS	France
Entegris Singapore Pte. Ltd.	Singapore
Entegris Specialty Materials, LLC	Delaware
Entegris Taiwan Enterprises Partnership	Taiwan
Entegris Taiwan Holdings, Inc.	Delaware
Entegris Taiwan Technologies Co. Ltd.	Taiwan
Hanguk Entegris Co., Ltd	South Korea
Hangzhou Anow Filtration and Materials Co., Ltd.	China
Hangzhou AiNuo Microfiltration Co., Ltd.	China
Nihon Entegris G.K.	Japan
Poco Graphite, Inc.	Delaware
Yosemite Merger Sub. Inc.	Delaware

EXHIBIT 23

Consent of Independent Registered Public Accounting Firm

We consent to the incorporation by reference in the registration statements (Nos. 333-127599, 333-167178, 333-203789, 333-203790, 333-211444, 333-237905, and 333-53382 on Form S-8 and No. 333-262172 on Form S-4) of our reports dated February 4, 2022, with respect to the consolidated financial statements of Entegris, Inc. and the effectiveness of internal control over financial reporting.

/s/ KPMG LLP

Minneapolis, Minnesota
February 4, 2022

Exhibit 24

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that the undersigned Directors and Officers of **Entegris, Inc.** (the “Corporation”), do hereby constitute and appoint Bertrand Loy and Gregory B. Graves and each of them individually, their true and lawful attorneys and agents to execute on behalf of the Corporation the Form 10-K Annual Report of the Corporation for the fiscal year ended December 31, 2021, together with all such amendments thereto on Form 10-K/A as well as additional instruments related thereto which such attorneys and agents may deem to be necessary and desirable to enable the Corporation to comply with the requirements of the Securities Exchange Act of 1934, as amended, and any regulations, orders, or other requirements of the United States Securities and Exchange Commission thereunder in connection with the preparation and filing of said documents, including specifically, but without limitation of the foregoing, power and authority to sign the names of each of such Directors and Officers on his behalf, as such Director or Officer, as indicated below to the said Form 10-K Annual Report or documents filed or to be filed as a part of or in connection with such Form 10-K Annual Report; and each of the undersigned hereby ratifies and confirms all that said attorneys and agents shall do or cause to be done by virtue thereof.

SIGNATURE	TITLE	DATE
/s/ Bertrand Loy Bertrand Loy	President, Chief Executive Officer and Director	February 4, 2022
/s/ Paul L. H. Olson Paul L. H. Olson	Chairman of the Board, Director	February 4, 2022
/s/ Michael A. Bradley Michael A. Bradley	Director	February 4, 2022
/s/ Rodney Clark Rodney Clark	Director	February 4, 2022
/s/ James F. Gentilcore James F. Gentilcore	Director	February 4, 2022
/s/ Yvette Kanouff Yvette Kanouff	Director	February 4, 2022
/s/ James P. Lederer James P. Lederer	Director	February 4, 2022
/s/ Azita Saleki-Gerhardt Azita Saleki-Gerhardt	Director	February 4, 2022

Exhibit 31.1

CERTIFICATIONS

I, Bertrand Loy, certify that:

1. I have reviewed this Annual Report on Form 10-K of Entegris, Inc.;

2. Based on my knowledge, this annual 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 annual report, fairly present in all material respects, the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this annual report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 4, 2022

/s/ Bertrand Loy

Bertrand Loy
Chief Executive Officer
(Principal Executive Officer)

Exhibit 31.2

CERTIFICATIONS

I, Gregory B. Graves, certify that:

1. I have reviewed this Annual Report on Form 10-K of Entegris, Inc.;

2. Based on my knowledge, this annual 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 annual report, fairly present in all material respects, the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this annual report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 4, 2022

/s/ Gregory B. Graves

Gregory B. Graves
Chief Financial Officer
(Principal Financial Officer)

EXHIBIT 32.1

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906
OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K (the “Report”) of Entegris, Inc, a Delaware corporation (the “Company”), for the period ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof, I, Bertrand Loy, President and Chief Executive Officer of the Company, hereby certify pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 that:

(1) The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: February 4, 2022

/s/ Bertrand Loy
Bertrand Loy
Chief Executive Officer

EXHIBIT 32.2

CERTIFICATION PURSUANT TO 18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO SECTION 906
OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K (the “Report”) of Entegris, Inc, a Delaware corporation (the “Company”), for the period ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof, I, Gregory B. Graves, Chief Financial Officer of the Company, hereby certify pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 that:

(1) The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: February 4, 2022

/s/ Gregory B. Graves
Gregory B. Graves
Chief Financial Officer