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, 2019
OR

☐

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Transition Period from to
Commission File Number 1-15885

MATERION CORPORATION
(Exact name of registrant as specified in its charter)

Ohio	**34-1919973**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**

6070 Parkland Blvd., Mayfield Heights, Ohio	**44124**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code
216-486-4200
Securities registered pursuant to Section 12(b) of the Act:

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

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

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

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

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

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

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

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐		

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

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

The aggregate market value of common shares, no par value, held by non-affiliates of the registrant (based upon the closing sale price on the New York Stock Exchange) on June 28, 2019 was $1,368,001,720.

As of January 31, 2020, there were 20,405,347 common shares, no par value, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for the 2020 Annual Meeting of Shareholders are incorporated by reference into Part III.

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Forward-looking Statements

Portions of the narrative set forth in this document that are not statements of historical or current facts are forward-looking statements. Our actual future performance may materially differ from that contemplated by the forward-looking statements as a result of a variety of factors. These factors include, in addition to those mentioned elsewhere herein:

- Actual net sales, operating rates, and margins for 2020;
- The global economy, including the impact of tariffs and trade agreements;
- The impact of any U.S. Federal Government shutdowns and sequestrations;
- The condition of the markets which we serve, whether defined geographically or by segment, with the major market segments being: semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center;
- Changes in product mix and the financial condition of customers;
- Our success in developing and introducing new products and new product ramp-up rates;
- Our success in passing through the costs of raw materials to customers or otherwise mitigating fluctuating prices for those materials, including the impact of fluctuating prices on inventory values;
- Our success in identifying acquisition candidates and in acquiring and integrating such businesses;
- The impact of the results of acquisitions on our ability to fully achieve the strategic and financial objectives related to these acquisitions;
- Our success in implementing our strategic plans and the timely and successful completion and start-up of any capital projects;
- Other financial and economic factors, including the cost and availability of raw materials (both base and precious metals), physical inventory valuations, metal financing fees, tax rates, exchange rates, interest rates, pension costs and required cash contributions and other employee benefit costs, energy costs, regulatory compliance costs, the cost and availability of insurance, credit availability, and the impact of the Company’s stock price on the cost of incentive compensation plans;
- The uncertainties related to the impact of war, terrorist activities, and acts of God;
- Changes in government regulatory requirements and the enactment of new legislation that impacts our obligations and operations;
- The conclusion of pending litigation matters in accordance with our expectation that there will be no material adverse effects; and
- The risk factors set forth elsewhere in Item 1A of this Form 10-K.

Item 1. **BUSINESS**

THE COMPANY

Materion Corporation (referred to herein as the Company, our, we, or us), through its wholly owned subsidiaries, is an integrated producer of high-performance advanced engineered materials used in a variety of electrical, electronic, thermal, and structural applications with $1.2 billion in net sales in 2019. The Company was incorporated in Ohio in 1931 and has approximately 2,600 employees. Our products are sold into numerous end markets, including semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center.

SEGMENT INFORMATION

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

Performance Alloys and Composites

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

- *Advanced Alloys* manufactures and globally provides to our customers three upstream (primary) product lines: alloyed metals, high-performance beryllium products, and beryllium hydroxide. Alloyed metals are made with copper and/or nickel (with or without beryllium) in ingot, shot, billet, plate, rod, bar, tube forms, and customized shapes. Depending on the application, the materials may provide one or a combination of superior strength, specific strength, wear and corrosion resistance, thermal and electrical conductivity, tribological benefits, and machinability. Applications for alloyed metals products include oil & gas drilling and production components, bearings, bushings, welding electrodes, plastic injection or metal die casting mold tooling, and electrical or electronic connectors. Major end markets for alloyed metals include industrial, automotive, aerospace and defense, energy, and telecom and data center. Alloyed metals compete with companies around the world that produce alloys with similar properties. Key competitors include NGK Insulators, IBC Advanced Alloys Corp., Ningxia Orient Tantalum Industry Co., Ltd., Ulba Metallurgical, Le Bronze Alloys, Minotti Metals, SA, KME AG & Co. KG, Aurubis AG, MKM Mansfelder Kupfer und Messing GmbH, AMPCO Metal, and Chuetsu Metal Works Ltd. High performance beryllium products are primarily beryllium metal products, which may also be alloys or other mixtures with aluminum and may be beryllium oxide. The materials are manufactured in billet, ingot, plate, sheet, powder, and customized shape forms. These materials are used in applications that require high stiffness and/or low density or high thermal conductivity and/or high electrical resistance, which are provided from the unique combination of material properties, or in applications requiring specific interactions with sub-atomic, high-energy particles, or in applications requiring strong affinity for oxygen such as in the manufacture of primary aluminum and magnesium. Direct competitors include American Beryllia Inc., CBL Ceramics Limited, CoorsTek, Inc., Ulba Metallurgical, and Ningxia Orient Tantalum Industry Co., Ltd. Beryllium hydroxide is produced at our milling operations in Utah from our bertrandite ore mine and purchased beryl ore. The hydroxide is used primarily as a raw material input for beryllium-containing alloys and, to a lesser extent, beryllium products. A key competitor is Ulba Metallurgical.
- *Specialty Materials* produces and provides our customers various thicknesses of precision strip products as well as various diameters of rod and wire products. The strip, rod, and wire products are beryllium and non-beryllium containing alloys that are made primarily with copper and nickel to provide unique combinations of high conductivity, high reliability, and high formability for use as connectors, contacts, springs, switches, relays, shielding, and bearings. In addition, Specialty Materials also produces and provides unique engineered strip metal products, which incorporate clad inlay and overlay metals, including precious and base metal electroplated systems, electron beam welded systems, contour profiled systems, and solder-coated metal systems. These engineered strip metal products provide a variety of thermal, electrical, or mechanical properties from a surface area or particular section of the material. Our precision cladding and plating capabilities allow for precious metal or other base metals to be applied in continuous strip form, only where it is needed, reducing the material cost to our customers as well as providing design flexibility and performance. Major end markets

include consumer electronics, telecom and data center, automotive, aerospace and defense, industrial, and energy. Key competitors include NGK Insulators, Wieland Electric, Inc., Aurubis Stolberg GmbH, Diehl Metall Stiftung & Co. KG, Nippon Mining, Wickeder Group, Heraeus Inc., AMI Doduco, Inc., and other North American continuous strip and plating companies.

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

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

Advanced Materials

Advanced Materials produces advanced chemicals, microelectronics packaging, precious metal, non-precious metal, and specialty metal products, including vapor deposition targets, frame lid assemblies, clad and precious metal pre-forms, high temperature braze materials, and ultra-pure wire. These products are used in micro-electromechanical systems and power management integrated circuits, radio frequency devices, storage, display, architectural glass, solar, optical coating, and other applications within the semiconductor, energy, and industrial end markets. Advanced Materials also has metal recovery operations and in-house refining that allow for the recycling of precious metals.

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

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

Precision Coatings

The Precision Coatings segment includes the following businesses:

Precision Optics produces sputter-coated precision thin film coatings and optical filter materials. Based in Westford, Massachusetts, the group has manufacturing facilities in the United States and China.

Large Area Coatings produces high-performance sputter-coated precision flexible thin film materials. Based in Windsor, Connecticut, the business manufactures and distributes coated and converted thin film material solutions primarily for medical testing and diagnosis applications.

Precision Coatings' products are sold directly from its facilities throughout the United States and Asia, as well as through direct sales offices and independent sales representatives throughout the world. Principal competition includes companies such as Viavi Corporation and Eastman Chemical Company and a number of smaller regional and national suppliers.

Other

The Other segment is comprised of unallocated corporate costs.

OTHER GENERAL INFORMATION

Products

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

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

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

Approximately 750 customers purchase our products throughout the semiconductor, industrial, aerospace and defense, automotive, energy, consumer electronics, and telecom and data center end markets. No single customer accounted for more than 10% of our total net sales for 2019.

Availability of Raw Materials

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

Patents and Licenses

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

Backlog

The backlog of unshipped orders as of December 31, 2019, 2018, and 2017 was $176.4 million, $266.0 million, and $204.0 million, respectively. Backlog is generally represented by purchase orders that may be terminated under certain conditions. We expect that substantially all of our backlog of orders at December 31, 2019 will be filled over the next 18 months.

Regulatory Matters

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

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

Available Information

We are subject to the informational requirements of the Securities Exchange Act of 1934. Therefore, we file periodic reports, proxy statements, and other information with the Securities and Exchange Commission (SEC). The SEC maintains an internet site (http://www.sec.gov) that contains reports, proxy and information statements, and other information regarding issuers that file electronically.

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

Executive Officers of the Registrant

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

Item 1A. RISK FACTORS

Our business, financial condition, results of operations, and cash flows can be affected by a number of factors, including, but not limited to, those set forth below and elsewhere in this Form 10-K, any one of which could cause our actual results to vary materially from recent results or from our anticipated future results. Therefore, an investment in us involves some risks, including the risks described below. The risks discussed below are not the only risks that we may experience. If any of the following risks occur, our business, results of operations, or financial condition could be negatively impacted.

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

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

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

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

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

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

In 2019, 17% of our value-added sales was derived from sales to customers in the aerospace and defense end market. A portion of these customers operate under contracts with the U.S. Government, which are vulnerable to termination at any time, for convenience or default. Some of the reasons for cancellation include, but are not limited to, budgetary constraints or re-appropriation of government funds, timing of contract awards, violations of legal or regulatory requirements, and changes in political agenda. If cancellations were to occur, it would result in a reduction in our revenue. Furthermore, significant reductions to defense spending could occur over the next several years due to government spending cuts, which could have a significant adverse impact on us. For example, high-margin defense application delays and/or push-outs may adversely impact our results of operations, including quarterly earnings.

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

We operate in markets characterized by rapidly changing technology and evolving customer specifications and industry standards. New products may quickly render an existing product obsolete and unmarketable. For example, for many years thermal and mechanical performance have been at the forefront of device packaging for wireless communications infrastructure devices. In recent years, a tremendous effort has been put into developing simpler packaging solutions comprised of copper and other similar components. Our growth and future results of operations depend in part upon our ability to enhance existing products and introduce newly developed products on a timely basis that conform to prevailing and evolving industry standards, meet or exceed technological advances in the marketplace, meet changing customer specifications, achieve market acceptance, and respond to our competitors' products.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Disruptions or volatility in global financial markets could adversely impact our financial performance.

Global economic conditions may cause volatility and disruptions in the capital and credit markets. Should global economic conditions deteriorate or access to credit markets be reduced, customers may experience difficulty in obtaining adequate financing, thereby impacting our sales. Our exposure to bad debt losses may also increase if customers are unable to pay for products previously ordered and/or delivered. Negative or uncertain financial and macroeconomic conditions may have a significant adverse impact on our sales, profitability, and results of operations. If current global economic conditions deteriorate, it could trigger an economic downturn of the same or greater severity as the one experienced in 2008 and 2009. This could have a negative impact on our sales and result in potential non-cash goodwill and asset impairment charges.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

We sell to customers outside of the United States from our United States and international operations. Revenue from international operations (principally Europe and Asia) accounted for approximately 37% in 2019, 40% in 2018, and 44% in 2017 of Net sales. We anticipate that international shipments will account for a significant portion of our sales for the foreseeable future. There are a number of risks associated with international business activities, including:

- burdens to comply with multiple and potentially conflicting foreign laws and regulations, including export requirements, tariffs and other barriers, environmental health and safety requirements, increasingly complex requirements concerning privacy and data security, including the European Union's General Data Protection Regulation, and unexpected changes in any of these factors;

- difficulty in obtaining export licenses from the U.S. Government;

- political and economic instability and disruptions, including terrorist attacks;

- disadvantages of competing against companies from countries that are not subject to U.S. laws and regulations, including the Foreign Corrupt Practices Act (FCPA);

- potentially adverse tax consequences due to overlapping or differing tax structures;

- fluctuations in currency exchange rates; and

- disruptions in our business or the businesses of our suppliers or customers due to cyber security incidents, public health concerns (including viral outbreaks, such as the coronavirus) or natural disasters.

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

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

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

New laws or regulations, or changes in existing laws or regulations, or the manner of their interpretation or enforcement, could increase our cost of doing business and restrict our ability to operate our business or execute our strategies. In particular, there may be significant changes in U.S. laws and regulations and existing international trade agreements by the current U.S. presidential administration that could affect a wide variety of industries and businesses, including those businesses we own and operate. If the current U.S. presidential administration materially modifies U.S. laws and regulations and international trade agreements, our business, financial condition, and results of operations could be adversely affected.

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

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

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

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

If exposed to respirable beryllium fumes, dusts, or powder, some individuals may demonstrate an allergic reaction to beryllium and may later develop a chronic lung disease known as chronic beryllium disease (CBD). Some people who are diagnosed with CBD do not develop clinical symptoms at all. In others, the disease can lead to scarring and damage of lung tissue, causing clinical symptoms that include shortness of breath, wheezing, and coughing. Severe cases of CBD can cause disability or death.

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

The health risks relating to exposure to beryllium have been, and will continue to be, a significant issue confronting the beryllium-containing products industry. The health risks associated with beryllium have resulted in product liability claims, employee, and third-party lawsuits. As of December 31, 2019, we had one CBD case outstanding.

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

Our bertrandite ore mining and beryllium-related manufacturing operations and some of our customers' businesses are subject to extensive health and safety regulations that impose, and will continue to impose, significant costs and liabilities, and future regulation could increase those costs and liabilities, or effectively prohibit production or use of beryllium-containing products.

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

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

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

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

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

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

In the conduct of our business, we collect, use, transmit, store, and report data on information systems and interact with customers, vendors, and employees. Increased global information technology (IT) security threats and more sophisticated and targeted computer crime pose a risk to the security of our systems and networks and the confidentiality, availability, and integrity of our data. Despite our security measures, our IT systems and infrastructure may be vulnerable to customer viruses, cyber-attacks, security breaches caused by employee error or malfeasance, or other disruptions. Any such threat could compromise our networks and the information stored there could be accessed, publicly disclosed, lost, or stolen. A security breach of our computer systems could interrupt or damage our operations or harm our reputation, resulting in a loss of sales, operating profits, and assets. In addition, we could be subject to legal claims or proceedings and/or liability under laws that protect the privacy of personal information and regulatory penalties if confidential information relating to customers, suppliers, employees, or other parties is misappropriated from our computer systems.

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

Item 1B. UNRESOLVED STAFF COMMENTS

None.

Item 2. PROPERTIES

We operate manufacturing plants, service and distribution centers, and other facilities throughout the world. During 2019, we made effective use of our productive capacities at our principal facilities. We believe that the quality and production capacity of our facilities is sufficient to maintain our competitive position for the foreseeable future. Information as of December 31, 2019, with respect to our facilities that are owned or leased, and the respective segments in which they are included, is set forth below:

Location	Owned or Leased	Approximate Number of Square Feet
Corporate and Administrative Offices		
Mayfield Heights, Ohio [(1)(2)]	Leased	79,130
Manufacturing Facilities		
Albuquerque, New Mexico [(2)]	Owned/Leased	13,000/63,223
Alzenau, Germany [(2)]	Leased	136,433
Bloomfield, Connecticut [(3)]	Leased	44,800
Brewster, New York [(2)]	Leased	75,000
Buffalo, New York [(2)]	Owned	97,000
Delta, Utah [(1)]	Owned	100,836
Elmore, Ohio [(1)]	Owned/Leased	681,000/191,000
Farnborough, England [(1)]	Leased	10,000
Fremont, California [(1)]	Leased	40,000
Limerick, Ireland [(2)]	Leased	23,000
Lincoln, Rhode Island [(1)]	Owned/Leased	130,000/26,451
Lorain, Ohio [(1)]	Owned	55,000
Milwaukee, Wisconsin [(2)]	Owned	98,750
Reading, Pennsylvania [(1)]	Owned	128,863
Santa Clara, California [(2)]	Leased	5,800
Shanghai, China [(3)]	Leased	101,400
Singapore [(1)(2)]	Leased	24,500
Subic Bay, Philippines [(2)]	Leased	5,000
Suzhou, China [(2)]	Leased	21,743
Taoyuan City, Taiwan [(2)]	Leased	32,523
Tucson, Arizona [(1)]	Owned	53,000
Tyngsboro, Massachusetts [(3)]	Leased	38,000
Westford, Massachusetts [(3)]	Leased	53,000
Wheatfield, New York [(2)]	Owned	35,000
Windsor, Connecticut [(3)]	Leased	34,700
Service, Sales, and Distribution Centers		
Elmhurst, Illinois [(1)]	Leased	28,500
Maastricht, The Netherlands [(2)]	Leased	450
Seoul, Korea [(2)]	Leased	13,654
Stuttgart, Germany [(1)]	Leased	24,800
Tokyo, Japan [(1)]	Leased	7,200
Warren, Michigan [(1)]	Leased	34,500

(1) PAC

(2) Advanced Materials

(3) Precision Coatings

In addition to the above, the Company holds certain mineral rights on 7,500 acres in Juab County, Utah, from which the beryllium-bearing ore, bertrandite, is mined by the open pit method. A portion of these mineral rights are held under lease. Ore reserve data can be found in Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations."

Item 3. LEGAL PROCEEDINGS

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

Beryllium Claims

As of December 31, 2019, our subsidiary, Materion Brush Inc., was a defendant in one beryllium case. In 2019, one new beryllium case was filed. In Ronald Dwayne Manning v. Arconic Inc. et al., case number 19CI000219, filed in the Superior Court of the State of California, Tehama County, the Company is one of four named defendants and 120 Doe defendants. The plaintiff alleges that he contracted beryllium disease from exposures to beryllium-containing products during his employment as an auto mechanic, welder, sprinkler installer, and movie projector operator, and asserts claims for negligence, strict liability, fraudulent concealment, and breach of implied warranties. The plaintiff seeks economic damages, non-economic damages, consequential damages, and punitive damages. The Company believes that it has substantive defenses and intends to vigorously defend this suit.

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

The Company was one of six defendants in a case filed on April 7, 2015 in the Superior Court of the State of California, Los Angeles County, titled Godoy et al. v. The Argen Corporation et al., BC578085. This was a survival and wrongful death complaint. The complaint alleged that the decedent worked at H. Kramer & Co. in California and alleged that he worked as a dental lab technician at various dental labs in California, and that he suffered from CBD and other injuries as a result of grinding, melting and handling beryllium-containing products. The complaint alleged causes of action for negligence, strict liability - failure to warn, strict liability - design defect, fraudulent concealment, and breach of implied warranties. Plaintiffs other than the personal representative of the decedent sought compensatory damages. The survival action brought by the decedent's designated personal representative sought all damages sustained by decedent that he would have been entitled to recover had he lived, including punitive damages. The Company filed a demurrer on May 29, 2015. At a hearing on September 29, 2015, the court granted the demurrer, dismissing all claims against the Company, without leave to amend the complaint. On February 3, 2016, the plaintiffs filed a notice of appeal. On June 23, 2016, the California Supreme Court in a case titled Ramos v. Brenntag Specialties, 2016 WL 3435777, issued a unanimous opinion disapproving the case precedent upon which the Company's successful demurrer had been based. Based on this decision, the parties stipulated that the judgment entered in favor of the defendants be reversed and the matter remanded to the trial court for further proceedings. On July 30, 2018, the trial court granted summary adjudication in favor of all defendants on the survival action on the ground that the action was barred by the statute of limitations. On August 7, 2018, the Company filed a Notice of Entry of Order Granting Summary Adjudication in Favor of Defendants on Plaintiffs' Survival Action. The entry of this Order by the trial court eliminated the punitive damages claim from the action. Trial in the Godoy case, which was originally scheduled for March 12, 2019, was continued to September 4, 2019. In 2019, the Company settled this matter for an immaterial amount, and the case was dismissed.

Item 4. MINE SAFETY DISCLOSURES

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

PART II

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

Market Information

The Company's common shares are listed on the New York Stock Exchange under the symbol "MTRN". As of February 3, 2020, there were 745 shareholders of record.

Share Repurchases

The following table presents information with respect to repurchases of common stock made by us during the three months ended December 31, 2019.

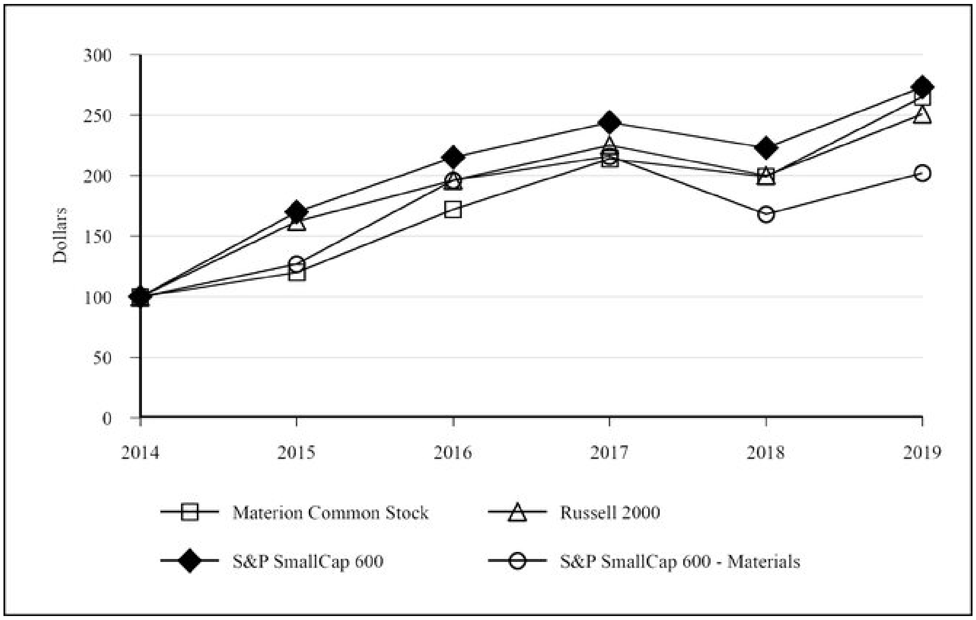
Period	Total Number of Shares Purchased (1)	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs (2)	Maximum Dollar Value that May Yet Be Purchased Under the Plans or Programs (2)
September 28 through November 1, 2019	—	$ —	—	$ 15,081,991
November 2 through November 29, 2019	230	59.50	—	15,081,991
November 30 through December 31, 2019	—	—	—	15,081,991
Total	230	$ 59.50	—	$ 15,081,991

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

(2) On January 14, 2014, we announced that our Board of Directors authorized the repurchase of up to $50.0 million of our common stock; this Board authorization does not have an expiration date. During the three months ended December 31, 2019, we did not repurchase any shares under this program.

Performance Graph

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



	2015	2016	2017	2018	2019
Materion Corporation	$ 120	$ 172	$ 214	$ 199	$ 265
Russell 2000	162	196	225	200	251
S&P SmallCap 600	170	215	244	223	273
S&P SmallCap 600 - Materials	127	196	216	168	202

The above graph assumes that the value of our common shares and each index was $100 on December 31, 2014 and that all applicable dividends were reinvested.

Item 6. SELECTED FINANCIAL DATA

Materion Corporation and Subsidiaries

(Thousands except per share data)	2019	2018	2017	2016	2015
For the year					
Net sales	**$ 1,185,424**	$ 1,207,815	$ 1,139,447	$ 969,236	$ 1,025,272
Income before income taxes(1)	**61,990**	16,342	36,396	25,315	42,818
Income tax expense (benefit)(2)	**11,330**	(4,504)	24,945	(425)	10,660
Net income	**50,660**	20,846	11,451	25,740	32,158
Earnings per share of common stock:					
Basic	**2.49**	1.03	0.57	1.29	1.60
Diluted	**2.45**	1.01	0.56	1.27	1.58
Dividends per share of common stock	**0.435**	0.415	0.395	0.375	0.355
Depreciation, depletion, and amortization	**41,116**	35,524	42,751	45,651	37,817
Capital expenditures	**24,251**	27,702	27,516	27,177	29,505
Mine development expenditures	**2,277**	6,558	1,560	9,861	22,585
Year-end position					
Net current assets	**$ 369,547**	$ 299,573	$ 283,834	$ 254,907	$ 249,616
Ratio of current assets to current liabilities	**4.0 to 1**	3.1 to 1	3.2 to 1	3.8 to 1	3.6 to 1
Property, plant, and equipment:					
At cost	**916,965**	898,251	891,789	861,267	833,834
Cost less depreciation, depletion, and amortization	**232,276**	251,018	255,578	252,631	263,629
Total assets	**852,670**	800,341	791,084	741,298	742,293
Long-term liabilities(3)	**112,432**	101,401	161,097	150,853	157,182
Long-term debt	**1,260**	2,066	2,827	3,605	4,276
Shareholders' equity	**610,677**	553,906	494,981	494,089	482,957

(1) Income before income taxes for 2019 includes a non-cash impairment charge of $14.1 million. For additional information, refer to Note L of the Consolidated Financial Statements. Income before income taxes for 2018 includes pension settlement charges totaling $41.4 million. For additional information, refer to Note N of the Consolidated Financial Statements.

(2) Income tax expense (benefit) includes the impact of the Tax Cuts and Jobs Act (TCJA) signed into law on December 22, 2017 totaling expense of $17.1 million and a benefit of $11.1 million in 2017 and 2018, respectively. For additional information, refer to Note G of the Consolidated Financial Statements.

(3) Long-term liabilities include long-term obligations relating to Retirement and post-employment benefits, Unearned income, Operating lease liabilities, Finance lease liabilities, and Other long-term liabilities.

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

OVERVIEW

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

RESULTS OF OPERATIONS

(Thousands except per share data)	2019	2018	2017
Net sales	**$ 1,185,424**	$ 1,207,815	$ 1,139,447
Value-added sales	**733,689**	738,958	677,697
Gross margin	**259,144**	251,105	212,829
Gross margin as a % of Value-added sales	**35%**	34%	31%
Selling, general, and administrative (SG&A) expense	**147,164**	153,489	144,280
SG&A expense as a % of Value-added sales	**20%**	21%	21%
Research and development (R&D) expense	**18,271**	15,187	13,981
R&D expense as a % of Value-added sales	**2%**	2%	2%
Goodwill impairment charges	**11,560**	—	—
Asset impairment charges	**2,581**	—	—
Restructuring expense	**785**	5,599	644
Other — net	**11,783**	15,334	13,893
Operating profit	**67,000**	61,496	40,031
Other non-operating expense — net	**3,431**	42,683	1,452
Interest expense — net	**1,579**	2,471	2,183
Income before income taxes	**61,990**	16,342	36,396
Income tax expense (benefit)	**11,330**	(4,504)	24,945
Net income	**50,660**	20,846	11,451
Diluted earnings per share	**2.45**	1.01	0.56

2019 Compared to 2018

Net sales of $1,185.4 million in 2019 decreased $22.4 million from $1,207.8 million in 2018. Net sales in the Advanced Materials segment decreased $12.9 million due to the lower mix of precious metal-containing products and the mix of customer-supplied material. In addition, net sales in the Precision Coatings segment declined $9.1 million driven by lower sales of blood glucose test strip products. These changes more than offset the favorable impact of precious metal and copper prices, which increased net sales in 2019 by approximately $35.4 million.

Value-added sales is a non-GAAP financial measure that removes the impact of pass-through metal costs and allows for analysis without the distortion of the movement or volatility in metal prices and changes in mix due to customer-supplied material. Internally, we manage our business on this basis, and a reconciliation of net sales, the most directly comparable GAAP financial measure, to value-added sales is included herein. Value-added sales of $733.7 million in 2019 were down 1% compared to 2018. The reduction in value-added sales was due to lower demand in the automotive, telecom and data center, consumer electronics, and semiconductor end markets, partially offset by increased value-added sales into the aerospace and defense end market.

Gross margin was $259.1 million in 2019, or a 3% increase from the $251.1 million gross margin recorded in 2018. Gross margin expressed as a percentage of value-added sales increased to 35% in 2019 from 34% in 2018. The increase in gross margin was primarily due to commercial and manufacturing performance improvements.

SG&A expenses totaled $147.2 million in 2019 as compared to $153.5 million in 2018. The decrease in SG&A expenses was primarily driven by lower variable expenses related to financial targets. Expressed as a percentage of value-added sales, SG&A expenses were 20% and 21% in 2019 and 2018, respectively.

R&D expense consists primarily of direct personnel costs for pre-production evaluation and testing of new products, prototypes, and applications. R&D expense was $18.3 million, an increase of 20% compared to 2018 and increased to 2.5% as a percentage of value-added sales in 2019. The increase in R&D expense reflects additional investment in new product and application development.

Goodwill and Asset impairment charges includes non-recurring charges relating to goodwill and other assets in our Precision Coatings segment. Refer to Note L to the Consolidated Financial Statements for additional discussion.

Restructuring expense consists primarily of cost reduction actions taken in order to align costs with commensurate business levels. These actions are generally accomplished through elimination of vacant positions, consolidation of roles, and staff reduction. In 2019, we recorded $0.8 million of expenses related to restructuring actions taken in Large Area Coatings (a reporting unit in the Precision Coatings segment) and the Other segment. In 2018, we recorded $5.6 million of expenses related to restructuring actions taken in our Advanced Materials segment. Refer to Note D to the Consolidated Financial Statements for additional discussion.

Other-net totaled expense of $11.8 million and $15.3 million in 2019 and 2018, respectively. In 2019, metal consignment fees, amortization of intangible assets, and foreign currency losses decreased $1.8 million, $0.9 million, and $0.8 million, respectively. Refer to Note E of the Consolidated Financial Statements for the major components of Other-net.

Other non-operating expense-net includes components of pension and post-retirement expense other than service costs. In 2019, other non-operating expense-net included a non-cash pre-tax pension curtailment charge of $3.3 million associated with the pension plan amendment to freeze the pay and service amounts used to calculate pension benefits effective December 31, 2019. In 2018, other non-operating expense included $41.4 million in pension settlements, primarily related to the purchase of a group annuity contract to relieve the Company of responsibility for certain pension benefit obligations. Refer to Note N of the Consolidated Financial Statements for details of the components of net periodic benefit costs.

Interest expense - net was $1.6 million in 2019 and $2.5 million in 2018. The decrease in interest expense in 2019 compared to 2018 is primarily due to interest income on investments held in money market accounts.

Income tax expense (benefit) for 2019 was $11.3 million of expense versus a benefit of $4.5 million in 2018. The impact of the TCJA was the primary factor for the tax benefit in 2018. The effects of percentage depletion, excess tax benefits from equity compensation, and the foreign derived intangible income deduction were the primary factors for the difference between the effective and statutory tax rates in 2019. Refer to Note G to the Consolidated Financial Statements for further details on income taxes.

See the Management Discussion and Analysis section of our Annual Report on Form 10-K for the year ended December 31, 2018 for a discussion of our results for 2018 compared to 2017.

Segment Disclosures

The Company consists of four reportable segments: Performance Alloys and Composites, Advanced Materials, Precision Coatings, and Other. The Other reportable segment includes unallocated corporate costs.

Performance Alloys and Composites

(Thousands)	2019	2018	2017
Net sales	**$ 500,201**	$ 500,590	$ 429,442
Value-added sales	**428,084**	425,471	363,465
Operating profit	**70,652**	58,832	21,978

2019 Compared to 2018

Net sales from the Performance Alloys and Composites segment of $500.2 million in 2019 were flat compared to 2018. In addition, the change in precious metal and copper prices was not material.

Value-added sales of $428.1 million in 2019 were 1% higher than value-added sales of $425.5 million in 2018. The increase in value-added sales was primarily driven by application wins and strong demand in the aerospace and defense end market, partially offset by reduced value-added sales into the automotive end market driven by softer demand in Europe and Asia.

Performance Alloys and Composites generated operating profit of $70.7 million, or 17% of value-added sales, in 2019 as compared to $58.8 million, or 14% of value-added sales, in 2018. Operating profit in 2019 was favorably impacted by favorable product mix and improved manufacturing performance.

Advanced Materials

(Thousands)	2019	2018	2017
Net sales	$ 573,763	$ 586,643	$ 590,789
Value-added sales	224,254	223,714	228,062
Operating profit	24,740	17,651	32,763

2019 Compared to 2018

Net sales from the Advanced Materials segment of $573.8 million in 2019 were 2% lower than net sales of $586.6 million in 2018. The decline in net sales was due to the lower mix of precious metal-containing products and the mix of customer-supplied material, partially offset by the impact of favorable pass-through metal prices of $33.0 million.

Value-added sales of $224.3 million increased slightly compared to value-added sales of $223.7 million in 2018.

Advanced Materials generated operating profit of $24.7 million in 2019, compared to $17.7 million in 2018. Increased operating profit in 2019, compared to 2018, was the result of cost savings realized primarily from restructuring actions taken in 2018, which included a $5.6 million restructuring charge, partially offset by unfavorable sales mix and reduced manufacturing yields.

Precision Coatings

(Thousands)	2019	2018	2017
Net sales	$ 111,460	$ 120,582	$ 119,216
Value-added sales	87,310	94,231	90,678
Operating (loss) profit	(3,550)	11,468	8,445

2019 Compared to 2018

Net sales from the Precision Coatings segment of $111.5 million in 2019 decreased 8% compared to net sales of $120.6 million in 2018 primarily due to decreased sales volume, partially offset by a $5.8 million favorable impact of pass-through precious metal prices.

Value-added sales of $87.3 million in 2019 decreased 7% compared to value-added sales of $94.2 million in 2018. The decrease was driven by reduced value-added sales related to blood glucose test trip products, partially offset by increased value-added sales of $1.5 million into the industrial end market.

The Precision Coatings segment generated operating loss of $3.6 million in 2019, compared to an operating profit of $11.5 million in 2018. The decrease in operating profit was driven by a goodwill impairment charge of $11.6 million and an other assets impairment charge of $2.6 million related to our Large Area Coatings (LAC) business, as well as $0.3 million of restructuring actions taken in 2019.

Other

(Thousands)	2019	2018	2017
Net sales	$ —	$ —	$ —
Value-added sales	(5,959)	(4,458)	(4,508)
Operating loss	(24,842)	(26,455)	(23,155)

2019 Compared to 2018

The Other reportable segment in total includes unallocated corporate costs.

Corporate costs of $24.8 million in 2019 decreased $1.7 million as compared to $26.5 million in 2018. As a percent of total Company value-added sales, corporate costs decreased to 3% in 2019 from 4% in 2018. The decrease in corporate costs in 2019 compared to 2018 is reflective of lower variable expenses related to financial targets.

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

A reconciliation of net sales to value-added sales, a non-GAAP financial measure, for each reportable segment and for the Company in total for 2019, 2018, and 2017 is as follows:

(Thousands)	2019	2018	2017
Net sales			
Performance Alloys and Composites	$ 500,201	$ 500,590	$ 429,442
Advanced Materials	573,763	586,643	590,789
Precision Coatings	111,460	120,582	119,216
Other	—	—	—
Total	$ 1,185,424	$ 1,207,815	$ 1,139,447
Less: pass-through metal costs			
Performance Alloys and Composites	$ 72,117	$ 75,119	$ 65,977
Advanced Materials	349,509	362,929	362,727
Precision Coatings	24,150	26,351	28,538
Other	5,959	4,458	4,508
Total	$ 451,735	$ 468,857	$ 461,750
Value-added sales			
Performance Alloys and Composites	$ 428,084	$ 425,471	$ 363,465
Advanced Materials	224,254	223,714	228,062
Precision Coatings	87,310	94,231	90,678
Other	(5,959)	(4,458)	(4,508)
Total	$ 733,689	$ 738,958	$ 677,697

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

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

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

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

FINANCIAL POSITION

Cash Flow

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

(Thousands)	2019	2018	2017
Net cash provided by operating activities	**$ 99,222**	$ 76,374	$ 67,795
Net cash (used in) investing activities	**(26,484)**	(33,828)	(43,358)
Net cash (used in) financing activities	**(18,054)**	(13,605)	(15,445)
Effects of exchange rate changes	**(322)**	(140)	1,388
Net change in cash and cash equivalents	**$ 54,362**	$ 28,801	$ 10,380

Net cash provided by operating activities totaled $99.2 million in 2019 versus $76.4 million in 2018. During 2019, we contributed $4.5 million to our domestic pension plan, compared to contributions of $42.0 million in 2018. Working capital requirements used cash of $18.5 million during 2019 compared to providing $5.8 million in 2018. Cash flows used in accounts receivable increased $16.7 million. Three-month trailing days sales outstanding (DSO) was approximately 47 days at December 31, 2019 versus 41 days at December 31, 2018. Inventory reduction initiatives generated a cash flow benefit of $24.0 million in 2019 compared to a benefit of $4.2 million in 2018, related primarily to our Performance Alloys and Composites business. Cash flows from accounts payable and accrued expenses used cash of approximately $18.6 million compared to providing $8.8 million in the prior year due to higher incentive compensation payments tied to improved financial performance. Price movements of precious and base metals are essentially passed to customers. Therefore, while sudden movements in the price of metals can cause a temporary imbalance in our cash receipts and payments in either direction, once prices stabilize, our cash flow tends to stabilize as well.

Net cash used in investing activities was $26.5 million in 2019 compared to $33.8 million in 2018, reflecting lower levels of mine development and capital spending.

Net cash used in financing activities increased $4.5 million from 2018 primarily due to deferred financing fees recorded in 2019 related to our precious metal and credit agreements, as well as increased payments of withholding taxes for stock-based compensation awards.

Dividends per common share increased 5% to $0.435 per share in 2019. Total dividend payments to common shareholders were $8.9 million in 2019 and $8.4 million in 2018. In May 2019, the Board of Directors declared an increase in our quarterly dividend from $0.105 to $0.11 per share. We intend to pay a quarterly dividend on an ongoing basis, subject to a continuing strong capital structure and a determination that the dividend remains in the best interest of our shareholders.

Liquidity

We believe that cash flow from operations plus the available borrowing capacity and our current cash balance are adequate to support operating requirements, capital expenditures, projected pension plan contributions, the current dividend and share repurchase programs, environmental remediation projects, and strategic acquisitions. At December 31, 2019, cash and cash equivalents held by our foreign operations totaled $15.0 million. We do not expect restrictions on repatriation of cash held outside of the United States to have a material effect on our overall liquidity, financial condition, or the results of operations for the foreseeable future.

A summary of key data relative to our liquidity, including the outstanding debt, cash balances, and available borrowing capacity, as of December 31, 2019 and December 31, 2018 is as follows:

	December 31,	
(Thousands)	2019	2018
Cash	$ 125,007	$ 70,645
Total outstanding debt	2,218	3,041
Net cash	122,789	67,604
Available borrowing capacity	$ 340,906	$ 275,488

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

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

In September 2019, we amended and restated the agreement governing our $375.0 million revolving credit facility (Credit Agreement). The maturity date of the Credit Agreement was extended from 2020 to 2024, and the Credit Agreement provides more favorable interest rates under certain circumstances. In addition, the Credit Agreement provides the Company and its subsidiaries with additional capacity to enter into facilities for the consignment, borrowing, or leasing of precious metals and copper, and provides enhanced flexibility to finance acquisitions and other strategic initiatives. Borrowings under the Credit Agreement are secured by substantially all of the assets of the Company and its direct subsidiaries, with the exception of non-mining real property and certain other assets.

The Credit Agreement allows the Company to borrow money at a premium over LIBOR or prime rate and at varying maturities. The premium resets quarterly according to the terms and conditions available under the agreement. The Credit Agreement includes restrictive covenants relating to restrictions on additional indebtedness, acquisitions, dividends, and stock repurchases. In addition, the Credit Agreement includes covenants subject to a maximum leverage ratio and a minimum fixed charge coverage ratio. We were in compliance with all of our debt covenants as of December 31, 2019 and December 31, 2018. Cash on hand does not affect the covenants or the borrowing capacity under our debt agreements.

Portions of our business utilize off-balance sheet consignment arrangements to finance metal requirements. Expansion of business volumes and/or higher metal prices can put pressure on the consignment line limitations from time to time. In August 2019, we entered into a precious metals consignment agreement, maturing on August 27, 2022, which replaced the consignment agreement that would have matured on September 30, 2019. The available and unused capacity under the metal financing lines expiring in August 2022 totaled approximately $140.7 million as of December 31, 2019, compared to $133.9 million as of December 31, 2018, under the metal financing lines that expired on September 30, 2019. The availability is determined by Board approved levels and actual line capacity.

Contractual Obligations

A summary of payments to be made under long-term debt agreements, operating leases, significant capital leases, pension plan contributions, and material purchase commitments by year is as follows:

(Millions)	2020	2021	2022	2023	2024	There-after	Total
Total debt [1]	$ 0.9	$ 1.3	$ —	$ —	$ —	$ —	$ 2.2
Finance lease payments [2]	2.2	2.2	2.2	1.5	1.2	20.9	30.2
Interest payments on total debt [3]	0.1	—	—	—	—	—	0.1
Non-cancelable lease payments [4]	7.8	6.7	4.8	3.8	1.9	3.3	28.3
Pension plan contributions [5]	—	—	—	—	—	—	—
Other long-term liabilities [6]	1.0	2.7	0.4	0.6	0.6	0.6	5.9
Purchase obligations	5.7	0.6	0.3	0.5	0.5	—	7.6
Total	$ 17.7	$ 13.5	$ 7.7	$ 6.4	$ 4.2	$ 24.8	$ 74.3

(1) Total debt relates to installment payments on our fixed rate industrial development revenue bonds that mature in 2021.

(2) The finance lease payments include facilities relating to our Elmore, Ohio and Alzenau, Germany sites.

(3) These amounts represent future interest payments related to our total debt.

(4) The non-cancelable lease payments represent payments under operating leases with initial lease terms in excess of one year as of December 31, 2019.

(5) Our domestic defined benefit pension plan is overfunded as of December 31, 2019. Contributions in future periods, if any, will be dependent upon regulatory requirements, the plan funded ratio, plan investment performance, discount rates, actuarial assumptions, plan amendments, our contribution objectives, and other factors. We anticipate funding those contributions with cash on hand, cash generated from operations, or borrowings under our existing lines of credit. It is not practical to estimate the required contributions beyond 2020 at the present time.

(6) Other long-term liabilities include environmental remediation costs. We have an active environmental compliance program. We estimate the probable cost of identified environmental remediation projects and establish reserves accordingly. The environmental remediation reserve balance was $5.9 million at December 31, 2019 and $6.5 million at December 31, 2018.

Environmental projects tend to be long term, and the associated payments are typically made over a number of years. Refer to Note R to the Consolidated Financial Statements for further discussion.

Off-balance Sheet Obligations

We maintain the majority of the precious metals and copper we use in production on a consignment basis in order to reduce our exposure to metal price movements and to reduce our working capital investment. Refer to Item 7A "Quantitative and Qualitative Disclosures about Market Risk." The notional value of off-balance sheet precious metals and copper was $309.3 million as of December 31, 2019 versus $316.1 million as of December 31, 2018. We were in compliance with all of the covenants contained in the consignment agreements as of December 31, 2019 and December 31, 2018. Refer to Note I for additional information.

ORE RESERVES

We have proven and probable reserves of beryllium-bearing bertrandite ore in Juab County, Utah. We own approximately 90 percent of the proven reserves, with the remaining reserves leased from the State of Utah. We augment our proven reserves of bertrandite ore through the purchase of imported beryl ore from time to time. This beryl ore, which is approximately four percent beryllium, is also processed at the Utah extraction facility. Approximately 90 percent of the beryllium in ore is recovered in the extraction process. Estimating the quantity and/or grade of ore reserves requires the size, shape, and depth of ore bodies to be determined by analyzing geological data such as drilling samples. Economic assumptions used to estimate reserves change from period to period, and as additional geological and operational data is generated during the course of operations, estimates of reserves may change from period to period.

The term "proven reserves" means reserves for which (a) quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and/or quality are computed from the results of detailed sampling, (b) the sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of reserves are well-established, and (c) the ore is commercially recoverable through open-pit methods.

The term "probable reserves" means reserves for which quantity and grade and/or quality are computed from information similar to that used for proven reserves, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for proven reserves, is high enough to assume continuity between points of observation.

	Proven	Probable	Total
As of December 31, 2019			
Tonnage (in thousands)	**7,851**	**962**	**8,813**
Grade (% beryllium)	**0.246%**	**0.258%**	**0.248%**
Beryllium pounds (in millions)	**38.67**	**4.97**	**43.64**
As of December 31, 2018			
Tonnage (in thousands)	8,047	945	8,992
Grade (% beryllium)	0.248%	0.257%	0.249%
Beryllium pounds (in millions)	39.96	4.85	44.81

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

(Thousands of Pounds of Beryllium)	2019	2018	2017	2016	2015
Domestic ore	**358**	368	326	339	439
Purchased ore	**3**	—	12	23	26
Unyielded total	**361**	368	338	362	465
Annual yield	**90%**	88%	88%	88%	89%
Beryllium produced	**324**	324	296	318	412
% of mill capacity	**50%**	50%	47%	42%	55%

CRITICAL ACCOUNTING POLICIES

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

Revenue Recognition

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

1) Identify the contract with a customer

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

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

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

2) Identify the performance obligations in the contract

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

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

3) Determine the transaction price

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

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

If the contract contains a single performance obligation, the entire transaction price is allocated to the single performance obligation. Contracts that contain multiple performance obligations require an allocation of the transaction price to each performance obligation based on the relative standalone selling price. The Company typically determines standalone selling price based on the price at which the performance obligation is sold separately. If the standalone selling price is not observable through past transactions, management uses judgment to estimate the standalone selling price taking into account available information such as market conditions and internally approved pricing guidelines related to the performance obligations.

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

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

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

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

Other considerations

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

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

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

Accrued Liabilities

We have various accruals on our balance sheet that are based in part upon our judgment, including accruals for litigation, environmental remediation, and workers' compensation costs. When a loss is probable, we establish accrual balances based on the reasonably estimable loss or range of loss as determined by a review of the available facts and circumstances by management and independent advisors and specialists, as appropriate. When no point of loss is more likely than another, the accrual is established at the low end of the estimated reasonable range. Litigation and environmental accruals are established only for identified and/or asserted claims; future claims, therefore, could give rise to increases to the accruals. The accruals are adjusted as facts and circumstances change, as well as for changes in our strategies or the pertinent regulatory requirements. Since these accruals are estimates, the ultimate resolution may be greater or less than the established accrual balance for a variety of reasons, including court decisions, additional discovery, inflation levels, cost control efforts, and resolution of similar cases. Changes to the accruals would then result in an additional charge or credit to the income statement in the period when the change is made. Refer to Note R of the Consolidated Financial Statements.

Legal claims may be subject to partial or complete insurance recovery. The accrued liability is recorded at the gross amount of the estimated cost and the insurance recoverable, if any, is recorded as an asset and is not netted against the liability. The accrued legal liability includes the estimated indemnity cost only, if any, to resolve the claim through a settlement or court verdict. The legal defense costs are not included in the accrual and are expensed in the period incurred, with the level of expense in a given year affected by the number and types of claims we are actively defending.

Non-employee claims for chronic beryllium disease (CBD) are covered by insurance, subject to certain limitations. The insurance covers defense costs and indemnity payments (resulting from settlements or court verdicts) and is subject to various levels of deductibles. In 2019 and 2018, defense and indemnity costs were less than the deductible.

Pensions

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

Beginning in 2017, the Company has elected to use a spot-rate approach to estimate the service and interest cost components of net periodic benefit cost for its defined benefit pension plans. The spot-rate approach applies separate discount rates (along the yield curve) for each projected benefit payment in the calculation.

Our pension plan investment strategies are governed by a policy adopted by the Board of Directors. A senior management team oversees a group of outside investment analysts and brokerage firms that implement these strategies. The future return on pension assets is dependent upon the plan's asset allocation, which changes from time to time, and the performance of the underlying investments. As a result of our review of various factors, we used an expected rate of return on plan assets assumption of 6.25% at December 31, 2019 and 6.75% at December 31, 2018. This assumption is reflective of management's view of the long-term returns in the marketplace, as well as changes in risk profiles and available investments. Should the assets earn an average return less than the expected return assumption over time, in all likelihood the future pension expense would increase.

The impact of a change in the discount rate or expected rate of return assumption on pension expense can vary from year to year depending upon the undiscounted liability level, the current discount rate, the asset balance, other changes to the plan, and other factors. A 0.25 percentage point decrease to the discount rate would increase the 2020 projected pension expense approximately $31 thousand. A 0.25 percentage point decrease in the expected rate of return assumption would increase the 2020 projected pension expense by approximately $0.4 million.

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

Last In, First Out (LIFO) Inventory

The prices of certain major raw materials that we use, including copper, nickel, gold, silver, and other precious metals, fluctuate during a given year. Where possible, such changes in material costs, in either direction, are generally reflected in selling price adjustments, particularly with precious metals and copper.

The prices of labor and other factors of production, including supplies and utilities, generally increase with inflation. Portions of these cost increases may be offset by manufacturing improvements and other efficiencies. From time to time, we will revise our billing practices to include an energy surcharge in an attempt to recover a portion of our higher energy costs from our customers. However, market factors, alternative materials, and competitive pricing may limit our ability to offset all or a portion of a cost increase with higher prices.

We use the LIFO method for costing the majority of our domestic inventories. Under the LIFO method, inflationary cost increases are charged against the current period cost of goods sold in order to more closely match the cost with the associated revenue. The carrying value of the inventory is based upon older costs and, as a result, the LIFO cost of the inventory on the balance sheet is typically, but not always, lower than it would be under most alternative costing methods. The LIFO cost may also be lower than the current replacement cost of the inventory. The LIFO inventory value tends to be less volatile during years of fluctuating costs than the inventory value would be using other costing methods.

The LIFO impact on the income statement in any given year is dependent upon the inflation rate effect on raw material purchases and manufacturing conversion costs, the level of purchases in a given year, and changes in the inventory mix and quantities.

Deferred Taxes

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

We had valuation allowances of $17.7 million and $15.9 million associated with certain federal, state, and foreign deferred tax assets as of year-end 2019 and 2018, respectively, primarily for net operating loss carryforwards.

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

Precious Metal Physical Inventory Counts

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

Impairment of Goodwill and Long-Lived Assets

Goodwill is reviewed annually for impairment or more frequently if impairment indicators arise. The Company conducted its annual goodwill impairment assessment as of the first day of the fourth quarter.

Goodwill is assigned to the reporting unit, which is the operating segment level or one level below the operating segment. Goodwill within the Advanced Materials segment totaled $50.2 million as of December 31, 2019. Within the Precision Coatings segment, goodwill totaled $26.9 million, with $17.8 million and $9.1 million relating to the Precision Optics and LAC reporting units, respectively, as of December 31, 2019. The remaining $1.9 million is related to the Performance Alloys and Composites segment.

For the purpose of the goodwill impairment assessment, we have the option to perform a qualitative assessment (commonly referred to as "step zero") to determine whether further quantitative analysis for impairment of goodwill or indefinite-lived intangible assets is necessary. At the September 28, 2019 annual assessment date, we opted to perform a "step zero" qualitative assessment for each of our reporting units. The results of the step zero indicated that no goodwill impairment existed. However, as further described in the subsequent paragraph, the Company performed an interim impairment analysis for the LAC reporting unit in the third quarter of 2019.

As of September 29, 2018, the Company determined that the fair value of the LAC reporting unit exceeded the carrying value by approximately 50 percent, which indicated no impairment at that time. The sales growth assumption for the LAC reporting unit was based on expected future orders. A key input into our valuation analysis is our sales growth assumptions, which can be impacted by increased competition, pricing pressures, and contract negotiations with new and existing customers. These factors impact both the timing and magnitude of sales of our products. Precious metal prices, particularly palladium used by our LAC reporting unit and its customer base, have fluctuated significantly in recent years. Palladium price movements have increased competitive pricing pressure in the LAC business. The key risk with precious metal pricing volatility is the possibility that rising prices could deter our customers from purchasing our products, which would adversely affect our net sales and operating profit.

During the third quarter of 2019, we began to experience a decline in sales volume with a significant customer. Based on an assessment that the decline in sales volume was expected to continue, the Company initiated a restructuring plan at the end of September to reduce the LAC reporting unit's cost structure. The Company considered these factors to be impairment indicators. As a result, the Company performed an interim impairment analysis as of September 27, 2019 related to the LAC reporting unit. The Company first reviewed long-lived assets, which resulted in an impairment charge of $2.6 million in the third quarter of 2019. The Company then performed a "step one" quantitative interim goodwill impairment test.

In the step one test, we estimated the fair value of the LAC reporting unit using a discounted cash flow (DCF) model. We prepared an operating forecast, which included several assumptions including future sales growth from new products and applications, as well as assumptions regarding future industry-specific market conditions, capital expenditures, and working capital changes. This forecast was reviewed and approved by management and served as the basis for the assumptions used in the DCF model. The DCF model included five years of forecasted cash flows from this process, plus cash flows projected to be generated from the end of the forecasted period into perpetuity. In addition to the estimate of future cash flows, other significant estimates involved in the determination of fair value of the reporting unit were the discount rate and growth rate used in the DCF model. The discount rate used in the DCF model considered market and industry data as well as a specific risk premium. The growth rate for the purpose of calculating cash flows through perpetuity was set after the forecasted period.

As a result of this analysis, we recorded an $11.6 million impairment charge in the third quarter of 2019. These non-cash charges were recorded in Goodwill impairment charges and Asset impairment charges in the Consolidated Statements of Income. The remaining balance of goodwill for the LAC reporting unit as of December 31, 2019 is $9.1 million. The Company may determine in connection with future impairment tests that some or all of the remaining carrying value of the LAC reporting unit's goodwill balance may be impaired.

Item 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

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

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

We are charged a consignment fee by the financial institutions that own the precious metals. This fee is a function of the market price of the metal, the quantity of metal we have on hand, and the rate charged by the institution. Because of market forces and competition, the fee can only be charged to customers in a limited case-by-case basis. Should the market price of precious metals that we have on consignment increase by 20% from the prices on December 31, 2019, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately $1.7 million on an annual basis. This calculation assumes no changes in the quantity of metal held on consignment or the underlying fee and that none of the additional fees are charged to customers.

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

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

In certain circumstances, we may elect to fix the price of precious metals for a customer for a stated quantity over a specified period of time. In those cases, we may secure hedge contracts whose terms match the terms in the agreement with our customer so that the gain or loss on the contract with the customer due to subsequent movements in the precious metal price will generally be offset by a gain or loss on the hedge contract. At December 31, 2019, we did not have a material amount of such hedge contracts outstanding.

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

We consign the majority of our copper inventory requirements. As with precious metals, the available capacity under the existing lines is a function of the quantity and price of metal on hand. Should the market cost of copper increase by 20% from the price as of December 31, 2019, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately

$0.1 million on an annual basis. This calculation assumes no changes in the quantity of inventory or the underlying fee and that none of the additional fees are charged to customers.

Lower of cost or net realizable value. In our manufacturing processes, we use various metals that are not widely used by others or actively traded and, therefore, there is no established efficient market for derivative financial instruments that could be used to effectively hedge the related price exposures. For certain applications, our pricing practice with respect to these metals is to establish the selling price based upon our cost to purchase the material, limiting our price exposure. However, the inventory carrying value may be exposed to market fluctuations. The inventory value is maintained at the lower of cost or net realizable value and if the market value were to drop below the carrying value, the inventory would have to be reduced accordingly and a charge recorded against cost of sales. This risk is mainly associated with long manufacturing lead-time items and with sludges and scrap materials, which generally have longer processing times to be refined or processed into a usable form for further manufacturing and are typically not covered by specific sales orders from customers. We did not record any material lower of cost or net realizable value charges in 2019, 2018, or 2017 as a result of market price fluctuations of metals in our inventories.

Interest rates. We are exposed to changes in interest rates on our cash balances. We may also be exposed to changes in interest rates if we incur future borrowings under our Credit Agreement. We may manage this interest rate exposure by maintaining a combination of short-term and long-term debt and variable and fixed rate instruments. We may also use interest rate swaps to fix the interest rate on variable rate obligations, as we deem appropriate. There were no interest rate derivatives outstanding as of December 31, 2019. Excess cash is typically invested in high quality instruments that mature in 90 days or less. Investments are made in compliance with policies approved by the Board of Directors.

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

The notional value of outstanding currency contracts was $42.0 million as of December 31, 2019. If the dollar weakened 10% against the currencies we have hedged from the December 31, 2019 exchange rates, the reduced gain and/or increased loss on the outstanding contracts as of December 31, 2019 would reduce pre-tax profits by approximately $4.2 million in 2019. This calculation does not take into account the increase in margins as a result of translating foreign currency sales at the more favorable exchange rates, any changes in margins from potential volume fluctuations caused by currency movements, or the translation effects on any other foreign currency denominated income statement or balance sheet item.

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

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

Our bank lines are established with a number of different banks in order to mitigate our exposure with any one financial institution. All of the banks in our bank group had credit in good standing as of December 31, 2019. The financial statement impact from the risk of one or more of the banks in our bank group reducing our lines due to their insolvency or other causes cannot be estimated at the present time.

Item 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Management's Report on Internal Control over Financial Reporting

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

Materion Corporation and subsidiaries' management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2019. In making this assessment, it used the framework set forth by the Committee of Sponsoring Organizations of the Treadway Commission (the COSO criteria) in Internal Control - Integrated Framework (2013).

Based on our assessment we believe that, as of December 31, 2019, the Company's internal control over financial reporting is effective.

The effectiveness of our internal control over financial reporting as of December 31, 2019 has been audited by Ernst & Young LLP, an independent registered public accounting firm, as stated in their report.

Report of Independent Registered Public Accounting Firm

To the Shareholders and Board of Directors of Materion Corporation

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Materion Corporation and subsidiaries (the Company) as of December 31, 2019 and 2018, the related consolidated statements of income, comprehensive income (loss), shareholders' equity and cash flows for each of the three years in the period ended December 31, 2019 and the related notes and financial statement schedule listed in the Index at Item 15(a) (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019, in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2019, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated February 13, 2020 expressed an unqualified opinion thereon.

Adoption of New Accounting Standard

ASU No. 2016-02
As discussed in Note A to the consolidated financial statements, the Company changed its method of accounting for leases in 2019 due to the adoption of ASU 2016-02, Leases (Topic 842).

Basis for Opinion

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

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

Critical Audit Matters

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

	Reconciliation of Precious Metals Consignment Inventory
Description of the matter	At December 31, 2019, the notional value of the Company's off-balance sheet precious metals was $309.3 million. As discussed in Note I to the consolidated financial statements, the Company uses estimates to measure the precious metal content within various refinement streams which can vary over time based upon the input materials, yield rates, and other process parameters. Auditing the reconciliation of precious metals consignment inventory is complex due to the highly detailed nature of the inventory reconciliation and the amount of information that is obtained from third parties. A physical inventory is performed by the Company on a quarterly basis to verify the existence of inventory. The precious metals inventory reconciliation includes estimates based on assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volume of solutions and other materials within the refinery, data from refine vendors, and other factors. The reconciliation of precious metals consignment inventory presents the resulting calculated weight of the precious metals generated from these estimates within the Company's refine operations. This calculated weight may differ, from what the Company's records indicate should be on hand, which would then result in an adjustment to pre-tax income.
How we addressed the matter in our audit	We obtained an understanding, evaluated the design and tested the operating effectiveness of controls over the Company's reconciliation of the precious metals consignment inventory processes. This included controls over management's review of the significant inputs into and underlying the reconciliation. To test the Company's reconciliation of the precious metals physical consignment inventory, our procedures included, among others, evaluating the significant assumptions and data used to estimate the total value of the precious metal which was identified through the physical inventory. We observed the physical inventory process, tested inventory activity from the date of observation through December 31 2019, evaluated the underlying data used in the reconciliation, and confirmed the consigned inventory held with the third parties. We assessed the historical accuracy of management's estimates, which are based on assays, assumed recovery percentages developed from actual historical data and other analyses, the total estimated volume of solutions and other materials within the refinery, data from their refine vendors, and other factors and assessed the historical accuracy of management's analysis to evaluate the assumptions that were most significant to the calculated weight of the precious metal inventory.

	Quantitative Impairment Assessment of Large Area Coatings Goodwill
Description of the matter	As discussed in Note L to the consolidated financial statements, during third quarter of 2019, the Large Area Coatings (LAC) reporting unit began to experience a decline in sales volume from a significant customer and initiated a restructuring plan. The Company considered these factors to be impairment indicators and as a result the Company performed a quantitative goodwill impairment analysis utilizing a discounted cash flow analysis to determine the fair value of the reporting unit. As a result, the Company recognized a $11.6 million impairment charge, which is the amount by which the carrying value exceeded the estimated fair value of the reporting unit. Auditing the interim quantitative impairment assessment of the LAC reporting unit is complex as the income approach requires the Company to make assumptions and estimates regarding future market conditions, growth rates, capital expenditures, and working capital changes. The fair value of the reporting unit is based on a number of subjective factors including; consideration of valuation approaches, consideration of the Company's business outlook, and assumptions regarding the weighted average cost of capital (discount rate), annual growth rates, terminal growth rate and estimated future cash flows.
How we addressed the matter in our audit	We obtained an understanding, evaluated the design and tested the operating effectiveness of controls over the Company's quantitative goodwill impairment process to determine the fair value of the LAC reporting unit and measure the goodwill impairment. This included controls over management's review of the significant assumptions underlying the fair value determination. To test the estimated fair value of the LAC reporting unit, we performed audit procedures that included, among others, assessing methodologies and testing the significant assumptions discussed above and the underlying data used by the Company in its analysis. We compared the significant assumptions used by management to current industry and economic trends. We assessed the historical accuracy of management's estimates and performed sensitivity analyses of significant assumptions to evaluate the changes in the fair value of the reporting unit that would result from changes in the assumptions. We involved our specialist to assist in the evaluation of the forecast assumptions (e.g. annual growth rates, weighted average cost of capital (WACC), and terminal growth rate) used in the assessment.

/s/ Ernst & Young LLP

We have served as the Company's auditor since at least 1958, but we are unable to determine the specific year.
Cleveland, Ohio
February 13, 2020

Report of Independent Registered Public Accounting Firm

To the Shareholders and the Board of Directors of Materion Corporation

Opinion on Internal Control over Financial Reporting

We have audited Materion Corporation and subsidiaries' internal control over financial reporting as of December 31, 2019, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, Materion Corporation and subsidiaries (the Company) maintained, in all material respects, effective internal control over financial reporting as of December 31, 2019, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of Materion Corporation and subsidiaries as of December 31, 2019 and 2018, the related consolidated statements of income, comprehensive income (loss), shareholders' equity and cash flows for each of the three years in the period ended December 31, 2019 and the related notes and financial statement schedule listed in the Index at Item 15(a) and our report dated February 13, 2020 expressed an unqualified opinion thereon.

Basis for Opinion

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

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

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

Definition and Limitations of Internal Control Over Financial Reporting

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

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

/s/ Ernst & Young LLP

Cleveland, Ohio
February 13, 2020

Materion Corporation and Subsidiaries
Years Ended December 31, 2019, 2018, and 2017

Consolidated Statements of Income

(Thousands except per share amounts)	**2019**	2018	2017
Net sales	**$ 1,185,424**	$ 1,207,815	$ 1,139,447
Cost of sales	**926,280**	956,710	926,618
Gross margin	**259,144**	251,105	212,829
Selling, general, and administrative expense	**147,164**	153,489	144,280
Research and development expense	**18,271**	15,187	13,981
Goodwill impairment charges (Note L)	**11,560**	—	—
Asset impairment charges (Note L)	**2,581**	—	—
Restructuring expense (Note D)	**785**	5,599	644
Other — net (Note E)	**11,783**	15,334	13,893
Operating profit	**67,000**	61,496	40,031
Other non-operating expense — net (Note N)	**3,431**	42,683	1,452
Interest expense — net (Note F)	**1,579**	2,471	2,183
Income before income taxes	**61,990**	16,342	36,396
Income tax expense (benefit) (Note G)	**11,330**	(4,504)	24,945
Net income	**$ 50,660**	$ 20,846	$ 11,451
Basic earnings per share:			
Net income per share of common stock	**$ 2.49**	$ 1.03	$ 0.57
Diluted earnings per share:			
Net income per share of common stock	**$ 2.45**	$ 1.01	$ 0.56
Weighted-average number of shares of common stock outstanding:			
Basic	**20,365**	20,212	20,027
Diluted	**20,655**	20,613	20,415

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

Materion Corporation and Subsidiaries
Years Ended December 31, 2019, 2018, and 2017

Consolidated Statements of Comprehensive Income (Loss)

(Thousands)	2019	2018	2017
Net income	**$ 50,660**	$ 20,846	$ 11,451
Other comprehensive income:			
Foreign currency translation adjustment	**(421)**	(484)	1,552
Derivative and hedging activity, net of tax benefit (expense) of $5, $672, and ($271)	**(4)**	138	(1,074)
Pension and post-employment benefit adjustment, net of tax (expense) of ($4,741), ($13,300), and ($13,820)	**13,197**	45,049	(17,234)
Other comprehensive income (loss)	**12,772**	44,703	(16,756)
Comprehensive income (loss)	**$ 63,432**	$ 65,549	$ (5,305)

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

Materion Corporation and Subsidiaries
Years Ended December 31, 2019, 2018, and 2017

Consolidated Statements of Cash Flows

(Thousands)	2019	2018	2017
Cash flows from operating activities:			
Net income	$ 50,660	$ 20,846	$ 11,451
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation, depletion, and amortization	41,116	35,524	42,751
Amortization of deferred financing costs in interest expense	962	1,009	919
Stock-based compensation expense (non-cash)	7,170	5,313	4,957
Amortization of pension and post-retirement costs	386	5,551	4,865
Loss on sale of property, plant, and equipment	344	518	234
Deferred income tax expense (benefit)	2,584	(1,318)	20,256
Impairment charges	14,141	—	—
Net pension curtailments and settlements	3,328	41,406	—
Changes in assets and liabilities net of acquired assets and liabilities:			
Decrease (increase) in accounts receivable	(23,933)	(7,219)	(18,484)
Decrease (increase) in inventory	24,031	4,234	(9,462)
Decrease (increase) in prepaid and other current assets	1,418	1,162	(11,606)
Increase (decrease) in accounts payable and accrued expenses	(18,575)	8,820	34,433
Increase (decrease) in unearned revenue	(2,538)	477	4,336
Increase (decrease) in interest and taxes payable	(805)	435	(514)
Domestic pension plan contributions	(4,500)	(42,000)	(16,000)
Other — net	3,433	1,616	(341)
Net cash provided by operating activities	99,222	76,374	67,795
Cash flows from investing activities:			
Payments for purchase of property, plant, and equipment	(24,251)	(27,702)	(27,516)
Payments for mine development	(2,277)	(6,558)	(1,560)
Payments for acquisition	—	—	(16,504)
Proceeds from sale of property, plant, and equipment	44	432	2,222
Net cash used in investing activities	(26,484)	(33,828)	(43,358)
Cash flows from financing activities:			
Proceeds from issuance of long-term debt	—	—	55,000
Repayment of long-term debt	(823)	(777)	(55,797)
Principal payments under finance lease obligations	(1,200)	(861)	(843)
Cash dividends paid	(8,856)	(8,389)	(7,913)
Deferred financing costs	(2,130)	—	(300)
Repurchase of common stock	(199)	(422)	(1,086)
Payments of withholding taxes for stock-based compensation awards	(4,846)	(3,156)	(4,506)
Net cash used in financing activities	(18,054)	(13,605)	(15,445)
Effects of exchange rate changes	(322)	(140)	1,388
Net change in cash and cash equivalents	54,362	28,801	10,380
Cash and cash equivalents at beginning of period	70,645	41,844	31,464
Cash and cash equivalents at end of period	$ 125,007	$ 70,645	$ 41,844

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

Materion Corporation and Subsidiaries
December 31, 2019 and 2018

Consolidated Balance Sheets

(Thousands)		2019		2018
Assets				
Current assets				
Cash and cash equivalents (Note A)	$	**125,007**	$	70,645
Accounts receivable (Note A)		**154,751**		130,538
Inventories, net (Notes A and I)		**190,390**		214,871
Prepaid and other current assets		**21,839**		23,299
Total current assets		**491,987**		439,353
Deferred income taxes (Notes A and G)		**1,666**		5,616
Property, plant, and equipment (Notes A and J)		**916,965**		898,251
Less allowances for depreciation, depletion, and amortization		**(684,689)**		(647,233)
Property, plant, and equipment — net		**232,276**		251,018
Operating lease, right-of-use asset (Note K)		**23,413**		—
Intangible assets (Notes A and L)		**6,380**		6,461
Other assets (Note N)		**17,937**		7,236
Goodwill (Notes A and L)		**79,011**		90,657
Total Assets	$	**852,670**	$	800,341
Liabilities and Shareholders' Equity				
Current liabilities				
Short-term debt (Note M)	$	**868**	$	823
Accounts payable		**43,206**		49,622
Salaries and wages		**41,167**		47,501
Other liabilities and accrued items		**32,477**		33,301
Income taxes (Notes A and G)		**1,342**		2,615
Unearned revenue		**3,380**		5,918
Total current liabilities		**122,440**		139,780
Other long-term liabilities		**11,560**		14,764
Operating lease liabilities (Note K)		**18,091**		—
Finance lease liabilities (Note K)		**17,424**		15,221
Retirement and post-employment benefits (Note N)		**32,466**		38,853
Unearned income (Notes A and J)		**32,891**		32,563
Long-term income taxes (Notes A and G)		**3,451**		2,993
Deferred income taxes (Notes A and G)		**2,410**		195
Long-term debt (Note M)		**1,260**		2,066
Shareholders' equity				
Serial preferred stock (no par value; 5,000 authorized shares, none issued)		**—**		—
Common stock (no par value; 60,000 authorized shares, issued shares of 27,148 for both 2019 and 2018)		**249,674**		234,704
Retained earnings		**589,888**		548,374
Common stock in treasury (6,744 shares for 2019 and 6,906 shares for 2018)		**(186,845)**		(175,426)
Accumulated other comprehensive loss (Note O)		**(45,462)**		(58,234)
Other equity		**3,422**		4,488
Total shareholders' equity		**610,677**		553,906
Total Liabilities and Shareholders' Equity	$	**852,670**	$	800,341

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

Materion Corporation and Subsidiaries
Years Ended December 31, 2019, 2018, and 2017

Consolidated Statements of Shareholders' Equity

	Common Shares		Shareholders' Equity					
(Thousands)	**Common Shares**	**Common Shares Held in Treasury**	**Common Stock**	**Retained Earnings**	**Common Stock In Treasury**	**Accumulated Other Comprehensive Income (Loss)**	**Other Equity**	**Total**
Balance at January 1, 2017	**19,949**	**7,200**	**$ 212,702**	**$ 517,903**	**$ (154,399)**	**$ (86,181)**	**$ 4,064**	**$ 494,089**
Net income	—	—	—	11,451	—	—	—	11,451
Other comprehensive income (loss)	—	—	—	—	—	(2,081)	—	(2,081)
Tax Cuts and Jobs Act Reclassification	—	—	—	14,675	—	(14,675)	—	—
Cash dividends declared ($0.395 per share)	—	—	—	(7,913)	—	—	—	(7,913)
Stock-based compensation activity	296	(296)	10,750	—	(5,794)	—	—	4,956
Payments for withholding taxes for stock-based compensation awards	(108)	108	—	—	(4,506)	—	—	(4,506)
Repurchase of shares	(32)	32	—	—	(1,086)	—	—	(1,086)
Directors' deferred compensation	2	(2)	32	—	(343)	—	382	71
Balance at December 31, 2017	**20,107**	**7,042**	**$ 223,484**	**$ 536,116**	**$ (166,128)**	**$ (102,937)**	**$ 4,446**	**$ 494,981**
Net income	—	—	—	20,846	—	—	—	20,846
Other comprehensive income (loss)	—	—	—	—	—	2,722	—	2,722
Net pension curtailments and settlements	—	—	—	—	—	41,406	—	41,406
Tax Cuts and Jobs Act Reclassification	—	—	—	(575)	—	575	—	—
Cumulative effect of accounting change	—	—	—	425	—	—	—	425
Cash dividends declared ($0.415 per share)	—	—	—	(8,389)	—	—	—	(8,389)
Stock-based compensation activity	202	(203)	11,131	(49)	(5,768)	—	—	5,314
Payments for withholding taxes for stock-based compensation awards	(60)	60	—	—	(3,156)	—	—	(3,156)
Repurchase of shares	(10)	10	—	—	(422)	—	—	(422)
Directors' deferred compensation	3	(3)	89	—	48	—	42	179
Balance at December 31, 2018	**20,242**	**6,906**	**$ 234,704**	**$ 548,374**	**$ (175,426)**	**$ (58,234)**	**$ 4,488**	**$ 553,906**
Net income	—	—	—	50,660	—	—	—	50,660
Other comprehensive income (loss)	—	—	—	—	—	9,444	—	9,444
Net pension curtailments and settlements	—	—	—	—	—	3,328	—	3,328
Cumulative effect of accounting change	—	—	—	(179)	—	—	—	(179)
Cash dividends declared ($0.435 per share)	—	—	—	(8,856)	—	—	—	(8,856)
Stock-based compensation activity	252	(252)	14,876	(111)	(7,595)	—	—	7,170
Payments for withholding taxes for stock-based compensation awards	(89)	89	—	—	(4,846)	—	—	(4,846)
Repurchase of shares	(5)	5	—	—	(199)	—	—	(199)
Directors' deferred compensation	4	(4)	94	—	1,221	—	(1,066)	249
Balance at December 31, 2019	**20,404**	**6,744**	**$ 249,674**	**$ 589,888**	**$ (186,845)**	**$ (45,462)**	**$ 3,422**	**$ 610,677**

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

Note A — Significant Accounting Policies

(Dollars in thousands)

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

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

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

Consolidation: The Consolidated Financial Statements include the accounts of Materion Corporation and its subsidiaries. All of the Company's subsidiaries were wholly owned as of December 31, 2019. Intercompany accounts and transactions are eliminated in consolidation.

Cash Equivalents: All highly liquid investments with a maturity of three months or less when purchased are considered to be cash equivalents. At December 31, 2019, the Company had $104.5 million of cash equivalents invested in institutional money market funds. The carrying value of the money market funds approximates fair value due to their short-term maturities.

Accounts Receivable: An allowance for doubtful accounts is maintained for the estimated losses resulting from the inability of customers to pay amounts due. The allowance is based upon identified delinquent accounts, customer payment patterns, and other analyses of historical data and trends. The allowance for doubtful accounts was $392 and $616 at December 31, 2019 and 2018, respectfully. The Company extends credit to customers based upon their financial condition, and collateral is not generally required.

Inventories: Inventories are stated at the lower of cost or net realizable value. The cost of the majority of domestic inventories is determined using the last-in, first-out (LIFO) method to reflect a better matching of costs and revenues. The remaining inventories are stated principally at average costs. Inventories valued on the LIFO cost method were approximately 45% and 57% of inventories in 2019 and 2018, respectively.

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

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

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

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

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

Drilling and related costs are capitalized for an ore body where proven and probable reserves exist, and the activities are directed at obtaining additional information on the ore body. All other drilling and related costs are expensed as incurred. Drilling costs incurred during the production phase for operational ore control are allocated to inventory costs and then included as a component of costs applicable to sales.

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

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

Goodwill and Other Intangible Assets: Goodwill is reviewed annually for impairment or more frequently if impairment indicators arise. The Company conducts its annual goodwill and indefinite-lived intangible asset impairment assessment as of the first day of the fourth quarter, or more frequently under certain circumstances. Goodwill is assigned to the reporting unit, which is the operating segment level or one level below the operating segment. Intangible assets with finite lives are amortized using the straight-line method or effective interest method, as applicable, over the periods estimated to be benefited, which is generally 20 years or less. Finite-lived intangible assets are also reviewed for impairment if facts and circumstances warrant.

Long-Lived Asset Impairment: In accordance with Accounting Standards Codification ("ASC") 360, "Property, Plant and Equipment," management performs impairment tests of long-lived assets, including property and equipment, whenever an event occurs or circumstances change that indicate that the carrying value may not be recoverable or the useful life of the asset has changed. Upon indications of impairment, assets and liabilities are grouped at the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities. The asset group would be considered impaired when the estimated future undiscounted cash flows generated by the asset group are less than its carrying value. If such undiscounted cash flows indicate that the carrying value of the asset group is not recoverable, impairment losses are measured by comparing the estimated fair value of the asset group to its carrying amount.

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

Asset Retirement Obligation: The Company records a liability to recognize the legal obligation to remove an asset at the time the asset is acquired or when the legal liability arises. The liability is recorded for the present value of the ultimate obligation by discounting the estimated future cash flows using a credit-adjusted risk-free interest rate. The liability is accreted over time, with the accretion charged to expense. An asset equal to the fair value of the liability is recorded concurrent with the liability and depreciated over the life of the underlying asset. The Company's asset retirement obligation related to its mine located in Utah for the years ended December 31, 2019 and 2018 was $1.4 million and $1.3 million, respectively.

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

Advertising Costs: The Company expenses all advertising costs as incurred. Advertising costs were $677 in 2019, $1,196 in 2018, and $1,252 in 2017.

Stock-based Compensation: The Company recognizes stock-based compensation expense based on the grant date fair value of the award over the period during which an employee is required to provide service in exchange for the award. The fair value of restricted stock units is based on the closing price of the Company's common shares on the grant date. Stock appreciation rights (SARs) are granted with an exercise price equal to the closing price of the Company's common shares on the date of grant. The fair value of SARs is determined using a Black-Scholes option-pricing model, which incorporates assumptions regarding the expected volatility, the expected option life, the risk-free interest rate, and the expected dividend yield. See Note P for additional information about stock-based compensation.

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

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

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

New Pronouncements Adopted: In February 2016, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2016-02 (Topic 842), *Leases*, which eliminates the off-balance-sheet accounting for leases. This guidance requires lessees to report their operating leases as both an asset and liability on the balance sheet and disclose key information about leasing arrangements. The Company adopted this guidance as of January 1, 2019 using the modified retrospective method and applied it retrospectively through a cumulative-effect adjustment to retained earnings. The Company applied the transitional package of practical expedients allowed by the standard to not reassess the identification, classification, and initial direct costs of leases commencing before this ASU's effective date; however, the Company did not elect the hindsight transitional practical expedient. The Company also applied the practical expedient to not separate lease and non-lease components to new leases as well as existing leases through transition. The Company made an accounting policy election not to apply recognition requirements of the guidance to short-term leases (leases less than twelve months in duration).

Results for reporting periods beginning after January 1, 2019 are presented under Topic 842, while prior period amounts are not adjusted and continue to be reported in accordance with legacy generally accepted accounting principles.

The Company recorded a net reduction to opening retained earnings of $0.2 million as of January 1, 2019 due to the cumulative impact of adopting Topic 842, with the impact primarily related to derecognition of a built-to-suit lease. Refer to Note K for additional disclosures relating to the Company's leasing arrangements.

In January 2017, the FASB issued ASU 2017-04, *Intangibles - Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment*, which intended to simplify the subsequent measurement of goodwill. This ASU eliminates the requirement for an entity to calculate the implied fair value of goodwill in measuring an impairment charge. Instead, an entity will perform its annual, or interim, goodwill impairment testing by comparing the fair value of a reporting unit with its carrying amount and recording an impairment charge for the amount by which the carrying amount exceeds the fair value. The Company adopted this guidance as of January 1, 2019, and the adoption did not have a material effect on the Company's consolidated financial statements. Refer to Note L for additional disclosures related to goodwill.

In August 2017, the FASB issued ASU 2017-12, *Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities*, which amends and simplifies existing guidance to allow companies to more accurately present the economic effects of risk management activities in the financial statements. The Company adopted this guidance as of January 1, 2019, and the adoption did not have a material effect on the Company's consolidated financial statements.

New Pronouncements Issued: In June 2016, the FASB issued ASU 2016-13, *Financial Instruments - Credit Losses*. This ASU requires an entity to change its accounting approach in determining impairment of certain financial instruments, including trade receivables, from an "incurred loss" to a "current expected credit loss" model. The standard will be effective for fiscal years beginning after December 15, 2019, including interim periods within such fiscal years. Early adoption is permitted. The Company is nearing completion of its assessment process, as well as the impact to the consolidated financial statements. The adoption of this ASU is not expected to have a material impact on the Company's results of operations, cash flows, or debt covenants.

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

Note B — Segment Reporting and Geographic Information

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

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

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

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

The Other reportable segment includes unallocated corporate costs and assets.

Financial information for reportable segments was as follows:

(Thousands)	Performance Alloys and Composites	Advanced Materials	Precision Coatings	Other	Total
2019					
Net sales	**$ 500,201**	**$ 573,763**	**$ 111,460**	**$ —**	**$ 1,185,424**
Intersegment sales	**38**	**70,047**	**—**	**—**	**70,085**
Operating profit (loss)	**70,652**	**24,740**	**(3,550)**	**(24,842)**	**67,000**
Depreciation, depletion, and amortization	**24,437**	**8,955**	**5,695**	**2,029**	**41,116**
Expenditures for long-lived assets	**15,520**	**7,572**	**1,045**	**2,391**	**26,528**
Total Assets	**400,022**	**215,368**	**78,981**	**158,299**	**852,670**
2018					
Net sales	$ 500,590	$ 586,643	$ 120,582	$ —	$ 1,207,815
Intersegment sales	37	50,460	—	—	50,497
Operating profit (loss)	58,832	17,651	11,468	(26,455)	61,496
Depreciation, depletion, and amortization	17,434	8,575	7,066	2,449	35,524
Expenditures for long-lived assets	15,396	15,523	1,983	1,358	34,260
Total Assets	410,239	207,183	90,537	92,382	800,341
2017					
Net sales	$ 429,442	$ 590,789	$ 119,216	$ —	$ 1,139,447
Intersegment sales	114	58,056	—	—	58,170
Operating profit (loss)	21,978	32,763	8,445	(23,155)	40,031
Depreciation, depletion, and amortization	23,209	7,354	9,721	2,467	42,751
Expenditures for long-lived assets	10,427	13,318	3,048	2,283	29,076
Total Assets	418,798	202,389	97,504	72,393	791,084

Intersegment sales are eliminated in consolidation.

The primary measures of evaluating segment performance are operating profit and net sales. From an assets perspective, segments are evaluated based upon a return on invested capital metric, which includes inventory (excluding the impact of LIFO), accounts receivable, and property, plant, and equipment.

Other geographic information includes the following:

(Thousands)	2019	2018	2017
Net sales			
United States	**$ 743,345**	$ 726,881	$ 650,675
Asia	**256,114**	270,672	265,991
Europe	**169,132**	186,081	205,118
All other	**16,833**	24,181	17,663
Total	**$ 1,185,424**	$ 1,207,815	$ 1,139,447
Long-lived assets by country deployed			
United States	**$ 194,596**	$ 215,395	$ 227,412
All other	**37,680**	35,623	28,166
Total	**$ 232,276**	$ 251,018	$ 255,578

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

Long-lived assets are comprised of property, plant, and equipment based on physical location.

The following table disaggregates revenue for each segment by end market for 2019 and 2018:

(Thousands)	Performance Alloys and Composites	Advanced Materials	Precision Coatings	Other	Total
2019					
End Market					
Semiconductor	$ 5,353	$ 432,658	$ 711	$ —	$ 438,722
Industrial	106,334	29,917	14,253	—	150,504
Aerospace and Defense	109,717	5,647	20,731	—	136,095
Consumer Electronics	72,360	1,254	18,201	—	91,815
Automotive	69,057	8,179	969	—	78,205
Energy	41,101	74,613	—	—	115,714
Telecom and Data Center	61,344	2,981	—	—	64,325
Other	34,935	18,514	56,595	—	110,044
Total	$ 500,201	$ 573,763	$ 111,460	$ —	$ 1,185,424
2018					
End Market					
Semiconductor	$ 5,020	$ 436,807	$ 1,460	$ —	$ 443,287
Industrial	111,149	32,246	12,756	—	156,151
Aerospace and Defense	88,041	3,813	20,044	—	111,898
Consumer Electronics	62,816	1,002	18,838	—	82,656
Automotive	93,720	7,843	1,362	—	102,925
Energy	40,877	72,027	—	—	112,904
Telecom and Data Center	67,157	2,792	—	—	69,949
Other	31,810	30,113	66,122	—	128,045
Total	$ 500,590	$ 586,643	$ 120,582	$ —	$ 1,207,815

Note C — Revenue Recognition

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

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

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

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

Transaction Price Allocated to Future Performance Obligations: ASC 606 requires that the Company disclose the aggregate amount of transaction price that is allocated to performance obligations that have not yet been satisfied at December 31, 2019. Remaining performance obligations include non-cancelable purchase orders and customer contracts. The guidance provides certain practical expedients that limit this requirement. As such, the Company does not disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less. After considering the practical expedient, at December 31, 2019, the aggregate amount of the transaction price allocated to remaining performance obligations was approximately $42.3 million.

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

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

(Thousands)	**December 31, 2019**	December 31, 2018	$ change	% change
Accounts receivable, trade	**$ 141,168**	$ 124,498	$ 16,670	13 %
Unbilled receivables	**13,583**	4,619	8,964	194 %
Unearned revenue	**3,380**	5,918	(2,538)	(43)%

Accounts receivable, trade represents payments due from customers relating to the transfer of the Company's products and services. The Company believes that its receivables are collectible and appropriate allowances for doubtful accounts have been recorded. Impairment losses (bad debt) incurred relating to our receivables were immaterial during 2019.

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

Unearned revenue is recorded for consideration received from customers in advance of satisfaction of the related performance obligations. The Company recognized approximately $5.0 million of the unearned amounts as revenue during 2019.

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

Note D — Restructuring

In 2019, the Company initiated a restructuring plan in the Large Area Coatings (LAC) business (a reporting unit in the Precision Coatings segment) to reduce headcount, idle certain machinery and equipment, and exit a facility in Windsor, Connecticut. Costs associated with this plan also included severance and related costs for 19 employees. Remaining severance payments related to these initiatives of $0.1 million are reflected within Other liabilities and accrued items in the Consolidated Balance Sheets.

In addition, in each of the last three years, the Company completed cost reduction actions in order to align costs with commensurate business levels. These actions were accomplished through elimination of vacant positions, consolidation of roles, and staff reduction. Costs associated with these actions in 2019 were in the Other segment and included severance associated with seven employees and other related costs. Remaining severance payments related to these initiatives of $0.1 million are reflected within Other liabilities and accrued items in the Consolidated Balance Sheets. The Company expects that the remaining severance payments will be substantially paid by the end of 2020 and does not expect to incur additional costs related to these initiatives.

Costs associated with these actions in 2018 were in the Advanced Materials segment and included severance associated with approximately forty employees and other related costs. Remaining severance payments amount to approximately $1.3 million as of December 31, 2019.

Costs associated with these actions in 2017 were within the Other and Precision Coatings segments and included severance associated with twenty-three employees and other related costs. The severance payments were substantially paid by the end of 2017.

These costs are presented in the Company's segment results as follows:

(Thousands)	**2019**	**2018**	**2017**
Performance Alloys & Composites	**$ —**	$ —	$ (16)
Advanced Materials	**—**	5,599	—
Precision Coatings	**328**	—	431
Other	**457**	—	229
Total	**$ 785**	$ 5,599	$ 644

Note E — Other-net

Other-net is summarized for 2019, 2018, and 2017 as follows:

		(Income) Expense	
(Thousands)	**2019**	**2018**	**2017**
Metal consignment fees	**$ 9,247**	$ 10,999	$ 8,782
Amortization of intangible assets	**1,400**	2,265	4,629
Foreign currency loss (gain)	**666**	1,487	(722)
Net loss (gain) on disposal of fixed assets	**344**	518	234
Rental income	**(87)**	(416)	(168)
Other items	**213**	481	1,138
Total other-net	**$ 11,783**	$ 15,334	$ 13,893

Note F — Interest expense-net

The following chart summarizes the interest incurred, capitalized, and paid for 2019, 2018, and 2017:

(Thousands)	**2019**	**2018**	**2017**
Interest incurred, net	**$ 1,641**	$ 2,870	$ 2,608
Less: Capitalized interest	**62**	399	425
Total net expense	**$ 1,579**	$ 2,471	$ 2,183
Interest paid	**$ 1,799**	$ 1,436	$ 1,646

The decrease in interest expense for 2019 versus 2018 was primarily due to interest income received on investments held in money market accounts. The increase in interest expense in 2018 compared to 2017 was primarily due to interest expense recorded for a finance lease entered into in 2017 in connection with the acquisition of the high-performance target materials business of the

Heraeus Group. Amortization of deferred financing costs within interest expense was $1.0 million in 2019, $1.0 million in 2018, and $0.9 million in 2017.

Note G — Income Taxes

On December 22, 2017, comprehensive tax legislation commonly referred to as the Tax Cuts and Jobs Act (TCJA) was enacted in the United States. The SEC staff issued Staff Accounting Bulletin No. 118 (SAB 118) to address the application of U.S. GAAP in situations where a registrant did not have the necessary information available, prepared, or analyzed in reasonable detail to complete the accounting for certain income tax effects of the TCJA. The Company applied the guidance in SAB 118 when accounting for the enactment-date effects of the TCJA in 2017 and throughout 2018. As of December 31, 2017, the Company had not completed its accounting for the enactment-date income tax effects of the TCJA under ASC 740 for the following items: remeasurement of deferred tax assets and liabilities, the one-time transition tax on earnings of foreign subsidiaries, and the policy election to account for global intangible low-taxed income (GILTI) as a period cost. In 2017, the Company recorded a total provisional amount of $17.1 million, which was recognized and included as a component of income tax expense. The $17.1 million provisional amount included $5.0 million of tax expense for the re-measurement of deferred tax assets, $6.1 million of tax expense for the transition tax on the mandatory deemed repatriation of foreign earnings, a $9.5 million valuation allowance recorded on foreign tax credits that were deemed unrealizable as a result of the TCJA, and a $3.5 million tax benefit for the generation of foreign tax credits.

The Company completed its accounting for all of the enactment-date income tax effects of the TCJA in the fourth quarter of 2018. During 2018, the Company recognized adjustments to the provisional amounts recorded as of December 31, 2017 and included the adjustments as a component of income tax expense. In 2018, the Company recorded a $11.1 million net tax benefit related to the enactment-date effects of the TCJA, including a $2.8 million tax benefit for the re-measurement of deferred tax assets and liabilities, a $1.2 million tax benefit for the one-time transition tax on the mandatory deemed repatriation of foreign earnings, and a $7.1 million tax benefit related to the generation of foreign tax credits and the reversal of the valuation allowance related to foreign tax credits.

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

(Thousands)	2019	2018	2017
Income before income taxes:			
Domestic	**$ 56,725**	$ 20,272	$ 28,327
Foreign	**5,265**	(3,930)	8,069
Total income before income taxes	**$ 61,990**	$ 16,342	$ 36,396
Income tax expense:			
Current income tax expense:			
Domestic	**$ 7,544**	$ (5,896)	$ 1,912
Foreign	**1,202**	2,710	2,777
Total current	**$ 8,746**	$ (3,186)	$ 4,689
Deferred income tax expense (benefit):			
Domestic	**$ 1,326**	$ (4,083)	$ 19,935
Foreign	**1,258**	2,765	321
Total deferred	**$ 2,584**	$ (1,318)	$ 20,256
Total income tax expense (benefit)	**$ 11,330**	$ (4,504)	$ 24,945

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

	2019	2018	2017
U.S. federal statutory rate	**21.0 %**	21.0 %	35.0 %
State and local income taxes, net of federal tax effect	**1.0**	0.1	2.3
Effect of excess of percentage depletion over cost depletion	**(4.5)**	(17.8)	(10.0)
Manufacturing production deduction, including impact of NOL carryback	**—**	6.3	(0.8)
Foreign derived intangible income deduction	**(3.2)**	(2.9)	—
Non-deductible goodwill impairment	**1.2**	—	—
Tax Cuts and Jobs Act impact	**2.5**	(67.8)	47.1
Foreign rate differential	**(0.1)**	1.5	(3.4)
Research and development tax credit	**(1.2)**	(7.6)	(2.6)
Foreign tax credit	**(0.3)**	(1.9)	(1.1)
Foreign repatriation	**0.4**	2.0	1.3
Incremental fixed asset basis	**—**	—	(3.4)
Adjustment to unrecognized tax benefits	**0.2**	2.7	2.8
Stock compensation - excess tax benefits	**(3.4)**	(4.4)	(1.9)
Valuation allowance	**2.2**	38.7	2.4
Other items	**2.5**	2.5	0.8
Effective tax rate	**18.3 %**	(27.6)%	68.5 %

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

	December 31,	
(Thousands)	**2019**	**2018**
Asset (liability)		
Post-employment benefits other than pensions	**$ 1,626**	$ 2,198
Other reserves	**543**	693
Deferred compensation	**3,314**	3,539
Environmental reserves	**1,384**	1,463
Inventory	**2,740**	3,032
Lease liabilities	**4,614**	—
Pensions	**5,149**	8,105
Accrued compensation expense	**5,364**	6,215
Net operating loss and credit carryforwards	**13,513**	12,002
Research and development tax credit carryforward	**25**	744
Foreign tax credit carryforward	**—**	2,385
Subtotal	**38,272**	40,376
Valuation allowance	**(17,676)**	(15,917)
Total deferred tax assets	**20,596**	24,459
Depreciation	**(10,780)**	(10,280)
Lease assets	**(4,428)**	—
Amortization	**(2,426)**	(3,635)
Mine development	**(3,706)**	(5,123)
Total deferred tax liabilities	**(21,340)**	(19,038)
Net deferred tax (liabilities) assets	**$ (744)**	$ 5,421

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

At December 31, 2019, for income tax purposes, the Company had foreign net operating loss carryforwards of $29.4 million that do not expire, and $6.5 million that expire in calendar years 2020 through 2027, of which $0.5 million expires within the next twelve months. The Company also had state net operating loss carryforwards of $21.6 million that expire in calendar years 2020 through 2037 and state tax credits of $3.6 million that expire in calendar years 2020 through 2034. A valuation allowance of $11.6 million has been provided against certain foreign and state net operating loss carryforwards and state tax credits due to uncertainty of their realization.

The Company files income tax returns in the U.S. federal jurisdiction, and in various state, local, and foreign jurisdictions. With limited exceptions, the Company is no longer subject to U.S. federal examinations for years before 2015, state and local examinations for years before 2016, and foreign examinations for tax years before 2011.

A reconciliation of the Company's unrecognized tax benefits for the year-to-date periods ended December 31, 2019 and 2018 is as follows:

(Thousands)	**2019**	**2018**
Balance at January 1	**$ 2,883**	$ 2,944
Additions to tax provisions related to the current year	**—**	443
Additions to tax positions related to prior years	**399**	4
Reduction to tax positions related to prior years	**—**	(508)
Lapses on statutes of limitations	**(61)**	—
Balance at December 31	**$ 3,221**	$ 2,883

Included in the balance of unrecognized tax benefits, including interest and penalties, as of December 31, 2019 and December 31, 2018 are $2.4 million and $2.2 million, respectively, of tax benefits that would affect the Company's effective tax rate if recognized. It is reasonably possible that the amount of unrecognized tax benefits will change in the next twelve months; however, we do not expect the change to have a material impact on the Consolidated Statements of Income or the Consolidated Balance Sheets.

The Company recognizes interest and penalties related to unrecognized tax benefits on the income tax expense line in the accompanying Consolidated Statements of Income. Accrued interest and penalties are included on the related tax liability line in the Consolidated Balance Sheets. The amount of interest and penalties, net of the related tax benefit, recognized in earnings was immaterial during 2019, 2018, and 2017. As of December 31, 2019 and 2018, accrued interest and penalties, net of the related tax benefit, were immaterial.

Income taxes paid during 2019, 2018, and 2017, were approximately $9.3 million, $2.6 million, and $8.1 million, respectively.

No additional income taxes have been provided for any remaining undistributed foreign earnings not subject to the transition tax, or any additional outside basis difference inherent in these entities, as these amounts continue to be indefinitely reinvested in foreign operations as of December 31, 2019. The amount of such unrepatriated earnings totaled $84.8 million as of December 31, 2019. It is not practicable to estimate the additional income taxes and applicable withholding taxes that would be payable on the remittance of such undistributed earnings.

Note H — Earnings Per Share

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

(Thousands except per share amounts)	2019	2018	2017
Numerator for basic and diluted EPS:			
Net income	**$ 50,660**	$ 20,846	$ 11,451
Denominator:			
Denominator for basic EPS:			
Weighted-average shares outstanding	**20,365**	20,212	20,027
Effect of dilutive securities:			
Stock appreciation rights	**72**	170	174
Restricted stock units	**75**	85	96
Performance-based restricted stock units	**143**	146	118
Diluted potential common shares	**290**	401	388
Denominator for diluted EPS:			
Adjusted weighted-average shares outstanding	**20,655**	20,613	20,415
Basic EPS	**$ 2.49**	$ 1.03	$ 0.57
Diluted EPS	**$ 2.45**	$ 1.01	$ 0.56

Equity awards covering shares of common stock totaling 71,199 in 2019, 65,112 in 2018, and 124,319 in 2017 were excluded from the diluted EPS calculation as their effect would have been anti-dilutive.

Note I — Inventories, net

Inventories in the Consolidated Balance Sheets are summarized as follows:

	December 31,	
(Thousands)	2019	2018
Raw materials and supplies	**$ 35,612**	$ 33,182
Work in process	**177,780**	195,879
Finished goods	**25,506**	30,643
Subtotal	**238,898**	259,704
Less: LIFO reserve balance	**48,508**	44,833
Inventories	**$ 190,390**	$ 214,871

The liquidation of LIFO inventory layers increased cost of sales by $0.9 million and $1.2 million in 2019 and 2018, respectively, and reduced cost of sales by $0.8 million in 2017.

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

The Company maintains the majority of the precious metals and copper used in production on a consignment basis in order to reduce our exposure to metal price movements and to reduce our working capital investment. The notional value of off-balance sheet precious metals and copper was $309.3 million as of December 31, 2019 versus $316.1 million as of December 31, 2018.

Note J — Property, Plant, and Equipment

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

	December 31,	
(Thousands)	2019	2018
Land	$ **4,874**	$ 4,874
Buildings	**150,323**	149,701
Machinery and equipment	**639,310**	631,421
Software	**44,652**	42,678
Construction in progress	**16,699**	14,468
Allowances for depreciation	**(669,250)**	(642,365)
Subtotal	**186,608**	200,777
Finance leases	**26,069**	22,150
Allowances for depreciation	**(3,569)**	(2,412)
Subtotal	**22,500**	19,738
Mineral resources	**4,980**	4,980
Mine development	**30,058**	27,979
Allowances for amortization and depletion	**(11,870)**	(2,456)
Subtotal	**23,168**	30,503
Property, plant, and equipment — net	$ **232,276**	$ 251,018

The Company received $63.5 million from the U.S. Department of Defense (DoD), in previous periods, for reimbursement of the DoD's share of the cost of equipment. This amount was recorded in property, plant, and equipment and the reimbursements are reflected in Unearned income on the Consolidated Balance Sheets. The equipment was placed in service during 2012, and its full cost is being depreciated in accordance with Company policy. The unearned income liability is being reduced ratably with the depreciation expense recorded over the life of the equipment.

Unearned income was reduced by $4.4 million and $4.3 million in 2019 and 2018, respectively, and credited to cost of sales in the Consolidated Statements of Income, offsetting the impact of the depreciation expense on the associated equipment on the Company's cost of sales and gross margin.

We recorded depreciation and depletion expense of $30.3 million in 2019, $33.3 million in 2018, and $38.1 million in 2017. Depreciation, depletion, and amortization as shown on the Consolidated Statement of Cash Flows is also net of the reduction in the unearned income liability in 2019, 2018, and 2017. The net book value of capitalized software was $7.9 million and $8.0 million at December 31, 2019 and December 31, 2018, respectively. Depreciation expense related to software was $2.4 million, $2.6 million, and $2.4 million in 2019, 2018, and 2017, respectively.

Note K — Leasing Arrangements

The Company leases warehouse and manufacturing real estate, and manufacturing and computer equipment under operating leases with lease terms ranging up to 25 years. Several operating lease agreements contain options to extend the lease term and/or options for early termination. The lease term consists of the non-cancelable period of the lease, periods covered by options to extend the lease if the Company is reasonably certain to exercise the option, and periods covered by an option to terminate the lease if the Company is reasonably certain not to exercise the option. The weighted average remaining lease term for the Company's operating and finance leases as of December 31, 2019 was 4.69 years and 19.47 years, respectively.

The discount rate implicit within the leases is generally not determinable, and, therefore, the Company determines the discount rate based on its incremental borrowing rate. The incremental borrowing rate for leases is determined based on the lease term in which lease payments are made, adjusted for impacts of collateral. The weighted average discount rate used to measure the Company's operating and finance lease liabilities as of December 31, 2019 was 5.91% and 5.31%, respectively.

The components of operating and finance lease cost for 2019 were as follows:

(Thousands)		2019
Components of lease expense		
Operating lease cost	**$**	**9,835**
Finance lease cost		
Amortization of right-of-use assets		**1,414**
Interest on lease liabilities		**1,028**
Total lease cost	**$**	**12,277**

Operating lease expense under ASC 840 amounted to $11.6 million and $9.3 million during 2018 and 2017, respectively. The Company straight-lines its expense of fixed payments for operating leases over the lease term and expenses the variable lease payments in the period incurred. These variable lease payments are not included in the calculation of right-of-use assets or lease liabilities.

Supplemental balance sheet information related to the Company's operating and finance leases as of December 31, 2019 was as follows:

(Thousands)		Dec. 31, 2019
Supplemental balance sheet information		
Operating Leases		
Operating lease right-of-use assets	$	23,413
Other liabilities and accrued items		6,542
Operating lease liabilities		18,091
Finance Leases		
Property, plant, and equipment	$	26,069
Allowances for depreciation, depletion, and amortization		(3,570)
Finance lease assets, net	$	22,499
Other liabilities and accrued items	$	1,265
Finance lease liabilities		17,424
Total principal payable on finance leases	$	18,689

Future maturities of the Company's lease liabilities as of December 31, 2019 are as follows:

(Thousands)		Finance Leases		Operating Leases
2020	$	2,224	$	7,759
2021		2,224		6,725
2022		2,224		4,754
2023		1,515		3,807
2024		1,160		1,891
2025 and thereafter		20,875		3,341
Total lease payments		30,222		28,277
Less amount of lease payment representing interest		11,533		3,644
Total present value of lease payments	$	18,689	$	24,633

As of December 31, 2018, prior to the adoption of Topic 842, future minimum payments under capital leases and operating leases having initial or non-cancelable lease terms in excess of one year were as follows:

(Thousands)	Capital Leases	Operating Leases
2019	$ 2,172	$ 7,287
2020	2,172	6,525
2021	2,172	4,966
2022	2,172	3,790
2023	1,463	3,532
2024 and thereafter	21,056	4,287
Total minimum lease payments	31,207	$ 30,387
Less amount of lease payment representing interest	19,338	
Total present value of net minimum lease payments	$ 11,869	

Supplemental cash flow information related to leases for the year ended December 31, 2019 was as follows:

(Thousands)	Dec. 31, 2019
Supplemental cash flow information	
Cash paid for amounts included in the measurement of lease liabilities:	
Operating cash flows from operating leases	**$ 15,841**
Operating cash flows from finance leases	**1,028**
Financing cash flows from finance leases	**1,200**

Note L — Intangible Assets and Goodwill

Intangible Assets

The cost and accumulated amortization of intangible assets subject to amortization as of December 31, 2019 and 2018, is as follows:

	2019			2018		
(Thousands)	Gross Carrying Amount	Accumulated Amortization	Net	Gross Carrying Amount	Accumulated Amortization	Net
Customer relationships	$ 39,601	$ (37,692)	$ 1,909	$ 39,601	$ (37,077)	$ 2,524
Technology	13,377	(12,816)	561	13,377	(12,238)	1,139
Licenses and other	4,257	(3,046)	1,211	4,257	(2,725)	1,532
Total	**$ 57,235**	**$ (53,554)**	**$ 3,681**	$ 57,235	$ (52,040)	$ 5,195

The aggregate amortization expense relating to intangible assets for the year ended December 31, 2019 and estimated amortization expense for each of the five succeeding years is as follows:

(Thousands)	Amortization Expense
2019	$ 1,400
2020	615
2021	523
2022	523
2023	513
2024	421

Intangible assets also includes deferred financing costs relating to the Company's revolving credit and consignments lines of $2.7 million and $1.3 million at December 31, 2019 and 2018, respectively.

Goodwill

Goodwill arises from the purchase price for acquired businesses exceeding the fair value of tangible and intangible assets acquired less assumed liabilities.

Goodwill is reviewed annually for impairment or more frequently if impairment indicators arise. The Company conducts its annual goodwill impairment assessment as of the first day of the fourth quarter, or more frequently under certain circumstances. For the purpose of the goodwill impairment assessment, the Company has the option to perform a qualitative assessment (commonly referred to as "step zero") to determine whether further quantitative analysis for impairment of goodwill or indefinite-lived intangible assets is necessary or a quantitative assessment ("step one") where the Company estimates the fair value of each reporting unit using a discounted cash flow method (income approach). Goodwill is assigned to the reporting unit, which is the operating segment level or one level below the operating segment. The balance of goodwill at December 31, 2019 and 2018 was $79.0 million and $90.7 million, respectively.

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

(Thousands)	Performance Alloys and Composites	Advanced Materials	Precision Coatings	Total
Balance at December 31, 2018	$ 1,899	$ 50,276	$ 38,482	$ 90,657
Impairment charge	—	—	(11,560)	(11,560)
Other	—	(86)	—	(86)
Balance at December 31, 2019	**$ 1,899**	**50,190**	**$ 26,922**	**$ 79,011**

During the third quarter of 2019, the LAC reporting unit began to experience a decline in sales volume from a significant customer. Based on an assessment that the decline in sales volume was expected to continue, the Company initiated a restructuring plan at the end of the third quarter to reduce the LAC reporting unit's cost structure. Refer to Note D for further details of the restructuring plan. The Company considered these factors to be impairment indicators. As a result, the Company performed an interim impairment analysis as of September 27, 2019 using a "step one" quantitative assessment for the LAC reporting unit. The LAC reporting unit prepared an operating forecast that included several assumptions including future sales growth from new products and applications, as well as assumptions regarding future industry-specific market conditions, capital expenditures, and working capital changes. In addition to the estimates of future cash flows, other significant estimates involved in the determination of fair value of the reporting unit were the weighted average cost of capital (discount rate), annual growth rate, and terminal growth rate used in the discounted cash flow (DCF) model. The discount rates used in the DCF model consider market and industry data as well as specific risk premiums for the LAC reporting unit. The Company first reviewed long-lived assets, which resulted in an impairment charge of $2.6 million in the third quarter of 2019. The Company then performed a goodwill impairment analysis which resulted in an $11.6 million charge in the third quarter of 2019, which represents the excess of the carrying value over the estimated fair value of LAC. The Company estimated fair value using a discounted cash flow analysis for goodwill and estimated market values for other assets. These non-cash charges relating to goodwill and other assets were recorded in Goodwill impairment charges and Asset impairment charges, respectively, in the Consolidated Statements of Income.

The results of the Company's 2019, 2018, and 2017 annual goodwill impairment assessments indicated that no other goodwill impairment existed.

Note M — Debt

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

	December 31,	
(Thousands)	**2019**	**2018**
Fixed rate industrial development revenue bonds payable in annual installments through 2021	**$ 2,218**	$ 3,041
Total debt outstanding	**2,218**	3,041
Current portion of long-term debt	**(868)**	(823)
Gross long-term debt	**1,350**	2,218
Unamortized deferred financing fees	**(90)**	(152)
Long-term debt	**$ 1,260**	$ 2,066

Maturities on long-term debt instruments as of December 31, 2019 are as follows:

(Thousands)	
2020	$ 868
2021	1,350
Thereafter	—
Total	$ 2,218

In September 2019, the Company amended and restated the agreement governing its $375.0 million revolving credit facility (Credit Agreement). The maturity date of the Credit Agreement was extended from 2020 to 2024, and the Credit Agreement provides more favorable interest rates under certain circumstances. In addition, the Credit Agreement provides the Company and its subsidiaries with additional capacity to enter into facilities for the consignment, borrowing, or leasing of precious metals and copper, and provides enhanced flexibility to finance acquisitions and other strategic initiatives. The Credit Agreement also provides for an uncommitted incremental facility whereby, under certain conditions, the Company may be able to borrow additional term loans in an aggregate amount not to exceed $200.0 million. Borrowings under the Credit Agreement are secured by substantially all of the assets of the Company and its direct subsidiaries, with the exception of non-mining real property and certain other assets. The Credit Agreement allows the Company to borrow money at a premium over LIBOR or prime rate and at varying maturities. The premium resets quarterly according to the terms and conditions available under the agreement.

The Credit Agreement includes restrictive covenants relating to restrictions on additional indebtedness, acquisitions, dividends, and stock repurchases. In addition, the Credit Agreement includes covenants subject to a maximum leverage ratio and a minimum fixed charge coverage ratio. The Company was in compliance with all of its debt covenants as of December 31, 2019 and December 31, 2018.

At December 31, 2019 and 2018 there was $41.8 million and $27.2 million outstanding against the letters of credit sub-facility, respectively. The Company pays a variable commitment fee that may reset quarterly (0.175% as of December 31, 2019) of the available and unborrowed amounts under the revolving credit line.

The available borrowings under the individual existing credit lines total $340.9 million as of December 31, 2019.

In April 2011, the Company entered into an agreement with the Toledo-Lucas County Port Authority and the Dayton–Montgomery County Port Authority in Ohio to co-issue $8.0 million in taxable development revenue bonds, with a fixed amortization term that will mature in 2021. The interest rate on these bonds was fixed at 4.90%, and the unamortized balance of the bonds was $2.2 million at December 31, 2019.

Note N — Pensions and Other Post-Employment Benefits

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

	Pension Benefits		Other Benefits	
(Thousands)	**2019**	**2018**	**2019**	**2018**
Change in benefit obligation				
Benefit obligation at beginning of year	**$ 170,136**	$ 313,728	**$ 11,375**	$ 14,166
Service cost	**5,918**	6,953	**67**	111
Interest cost	**6,292**	9,554	**399**	396
Net pension curtailments and settlements	**(12,212)**	(112,644)	**—**	—
Actuarial loss (gain)	**20,409**	(31,824)	**(2,192)**	(2,453)
Benefit payments	**(3,170)**	(13,700)	**(981)**	(876)
Foreign currency exchange rate changes and other	**(613)**	(1,931)	**13**	31
Benefit obligation at end of year	**186,760**	170,136	**8,681**	11,375
Change in plan assets				
Fair value of plan assets at beginning of year	**145,046**	234,976	**—**	—
Plan settlements	**—**	(111,542)	**—**	—
Actual return on plan assets	**27,264**	(8,570)	**—**	—
Employer contributions	**4,702**	42,227	**—**	—
Employee contributions	**124**	146	**—**	—
Benefit payments from fund	**(2,933)**	(10,826)	**—**	—
Expenses paid from assets	**(391)**	(890)	**—**	—
Foreign currency exchange rate changes and other	**234**	(475)	**—**	—
Fair value of plan assets at end of year	**174,046**	145,046	**—**	—
Funded status at end of year	**$ (12,714)**	$ (25,090)	**$ (8,681)**	$ (11,375)
Amounts recognized in the Consolidated Balance Sheets consist of:				
Other assets	**$ 11,298**	$ 1,948	**$ —**	$ —
Other liabilities and accrued items	**(997)**	(411)	**(1,012)**	(1,258)
Retirement and post-employment benefits	**(23,015)**	(26,627)	**(7,669)**	(10,117)
	$ (12,714)	$ (25,090)	**$ (8,681)**	$ (11,375)

In 2019, the Company's Board of Directors approved changes to the U.S. defined benefit pension plan. The Company froze the pay and service amounts used to calculate the pension benefits for active participants as of January 1, 2020. The Company recognized a non-cash pretax pension curtailment charge of $3.3 million associated with the plan amendment in 2019.

During 2018, the Company completed a partial plan settlement transaction relating to its U.S. pension plan wherein plan assets amounting to $111.5 million were used to purchase a group annuity contract from Mutual of America. This transaction relieved the Company of responsibility for the pension benefit obligation and consequently transferred the obligation and payment responsibility to Mutual of America for retirement benefits owed to approximately 1,150 retirees, beneficiaries, and other participants. The annuity contract covered retirees who commenced receiving benefits on or before June 1, 2018. The monthly retirement benefit payment amounts currently received by retirees and their beneficiaries did not change as a result of this transaction. Those plan participants not included in the transaction remain in the Plan, and responsibility for payment of the retirement benefits remains with the Company.

The following amounts are included within accumulated other comprehensive loss at December 31, 2019 and are expected to be recognized as components of net periodic benefit cost during 2020:

	Pension Benefits		Other Benefits	
(Thousands)	2019	2018	2019	2018
Amounts recognized in other comprehensive income (before tax) consist of:				
Net actuarial loss (gain)	**$ 48,073**	$ 61,599	**$ (4,529)**	$ (2,429)
Net prior service cost (credit)	**—**	3,810	**(5,049)**	(6,546)
	$ 48,073	$ 65,409	**$ (9,578)**	$ (8,975)
Amortizations expected to be recognized during next fiscal year (before tax):				
Amortization of net loss	**$ 1,707**	$ 3,769	**$ —**	$ —
Net prior service cost (credit)	**—**	482	**(1,497)**	(1,497)
	$ 1,707	$ 4,251	**$ (1,497)**	$ (1,497)

The following table provides information regarding the accumulated benefit obligation:

	Pension Benefits		Other Benefits	
(Thousands)	2019	2018	2019	2018
Additional information				
Accumulated benefit obligation for all defined benefit pension plans	**$ 185,402**	$ 161,169	**$ —**	$ —
For defined benefit pension plans with benefit obligations in excess of plan assets:				
Aggregate benefit obligation	**25,640**	165,344	**—**	—
Aggregate fair value of plan assets	**3,045**	138,305	**—**	—
For defined benefit pension plans with accumulated benefit obligations in excess of plan assets:				
Aggregate accumulated benefit obligation	**24,482**	156,639	**—**	—
Aggregate fair value of plan assets	**3,045**	138,305	**—**	—

The following table summarizes components of net benefit cost:

	Pension Benefits			Other Benefits		
(Thousands)	2019	2018	2017	2019	2018	2017
Net benefit cost						
Service cost	**$ 5,918**	$ 6,953	$ 7,587	**$ 67**	$ 111	$ 91
Interest cost	**6,292**	9,554	9,949	**399**	396	398
Expected return on plan assets	**(8,777)**	(14,231)	(13,760)	**—**	—	—
Amortization of prior service credit	**483**	(123)	(274)	**(1,497)**	(1,497)	(1,497)
Recognized net actuarial loss (gain)	**3,304**	7,171	6,636	**(93)**	—	—
Net periodic cost	**7,220**	9,324	10,138	**(1,124)**	(990)	(1,008)
Net pension curtailments and settlements	**3,328**	41,406	—	**—**	—	—
Total net benefit cost	**$ 10,548**	$ 50,730	$ 10,138	**$ (1,124)**	$ (990)	$ (1,008)

In 2019, net benefit cost includes a $3.3 million curtailment charge related to the freeze of our U.S. defined benefit plan effective January 1, 2020.

Beginning in 2018, the Company reports the service cost component of net benefit cost in the same line item as other compensation costs in operating expenses and the non-service cost components of net benefit cost in Other non-operating expenses. Additionally, Pension Benefit Guaranty Corporation premiums are reported within expected return on plan assets. In conjunction with the pension annuity and other lump-sum payments, the Company remeasured the periodic benefit obligation of its U.S. plans in the period payments were made and recorded settlement charges totaling $41.4 million during 2018.

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

(Thousands)	Pension Benefits 2019	Pension Benefits 2018	Pension Benefits 2017	Other Benefits 2019	Other Benefits 2018	Other Benefits 2017
Change in other comprehensive income						
OCI at beginning of year	**$ 65,409**	$ 122,802	$ 121,329	**$ (8,976)**	$ (8,020)	$ (9,961)
Increase (decrease) in OCI:						
Recognized during year — prior service cost (credit)	**(3,811)**	123	274	**1,497**	1,497	1,497
Recognized during year — net actuarial (losses) gains	**(3,304)**	(7,171)	(6,636)	**93**	—	—
Occurring during year — prior service cost	**—**	—	3,804	**—**	—	—
Occurring during year — net actuarial losses (gains)	**2,062**	(8,997)	4,055	**(2,192)**	(2,453)	444
Other adjustments	**(12,212)**	(41,406)	—	**—**	—	—
Foreign currency exchange rate changes	**(71)**	58	(24)	**—**	—	—
OCI at end of year	**$ 48,073**	$ 65,409	$ 122,802	**$ (9,578)**	$ (8,976)	$ (8,020)

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

	Pension Benefits 2019	Pension Benefits 2018	Pension Benefits 2017	Other Benefits 2019	Other Benefits 2018	Other Benefits 2017
Weighted-average assumptions used to determine benefit obligations at fiscal year end						
Discount rate	**3.12%**	4.07%	3.53%	**3.20%**	4.11%	3.43%
Rate of compensation increase	**3.00%**	3.87%	3.93%	**3.00%**	4.00%	4.00%
Weighted-average assumptions used to determine net cost for the fiscal year						
Discount rate	**4.16%**	3.63%	3.93%	**4.11%**	3.43%	3.68%
Expected long-term return on plan assets	**6.06%**	6.63%	6.89%	**N/A**	N/A	N/A
Rate of compensation increase	**2.99%**	3.98%	3.91%	**4.00%**	4.00%	4.00%

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

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

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

Rate of Compensation Increase. The rate of compensation increase assumption was not applicable for the domestic defined benefit plan in 2019 due to the Company freezing the plan effective January 1, 2020. The rate of compensation assumption for the domestic retiree medical plan was 4.0% in 2019 and 4.0% in 2018 for both the domestic defined benefit pension plan and the domestic retiree medical plan.

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

Assumed health care trend rates at fiscal year end	**2019**	**2018**
Health care trend rate assumed for next year	**6.25%**	6.50%
Rate that the trend rate gradually declines to (ultimate trend rate)	**5.00%**	5.00%
Year that the rate reaches the ultimate trend rate	**2025**	2025

Assumed health care cost trend rates can have an effect on the amounts reported for the health care plans. A one-percentage-point change in assumed health care cost trend rates would have the following effects:

	1-Percentage-Point Increase		**1-Percentage-Point Decrease**	
(Thousands)	**2019**	**2018**	**2019**	**2018**
Effect on total of service and interest cost components	**$ 6**	$ 6	**$ (6)**	$ (6)
Effect on post-employment benefit obligation	**149**	163	**(139)**	(152)

Plan Assets

The following tables present the fair values of the Company's defined benefit pension plan assets as of December 31, 2019 and 2018 by asset category. The Company has some investments that are valued using net asset value (NAV) as the practical expedient and have not been classified in the fair value hierarchy. Refer to Note Q for definitions of the fair value hierarchy.

	December 31, 2019			
(Thousands)	**Total**	**Level 1**	**Level 2**	**Level 3**
Cash	**$ 1,718**	**$ 1,718**	**$ —**	**$ —**
Equity securities (a)	**47,722**	**47,722**	**—**	**—**
Fixed-income securities (b)	**3,923**	**3,923**	**—**	**—**
Other types of investments:				
Real estate fund (c)	**3,121**	**3,121**	**—**	**—**
Total	**56,484**	**56,484**	**—**	**—**
Investments measured at NAV: (d)				
Pooled investment fund (e)	**113,187**			
Multi-strategy hedge funds (f)	**4,277**			
Intermediate-term bonds (g)	**—**			
Private equity funds	**98**			
Total assets at fair value	**$ 174,046**			

	December 31, 2018			
(Thousands)	**Total**	**Level 1**	**Level 2**	**Level 3**
Cash	$ 21,881	$ 21,881	$ —	$ —
Equity securities (a)	50,862	50,862	—	—
Fixed-income securities (b)	18,211	18,211	—	—
Other types of investments:				
Real estate fund (c)	3,257	3,257	—	—
Total	94,211	94,211	—	—
Investments measured at NAV: (d)				
Pooled investment fund (e)	24,947			
Multi-strategy hedge funds (f)	4,113			
Intermediate-term bonds (g)	21,678			
Private equity funds	97			
Total assets at fair value	$ 145,046			

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

The Company's domestic defined benefit pension plan investment strategy, as approved by the Governance and Organization Committee of the Board of Directors, is to employ an allocation of investments that will generate returns equal to or better than the projected long-term growth of pension liabilities so that the plan will be self-funding. The return objective is to maximize investment return to achieve and maintain a 100% funded status over time, taking into consideration required cash contributions. The allocation of investments is designed to maximize the advantages of diversification while mitigating the risk and overall portfolio volatility to achieve the return objective. Risk is defined as the annual variability in value and is measured in terms of the standard deviation of investment return. Under the Company's investment policies, allowable investments include domestic equities, international equities, fixed income securities, cash equivalents, and alternative securities (which include real estate, private venture capital investments, hedge funds, and tactical asset allocation). Ranges, in terms of a percentage of the total assets, are established for each allowable class of security. Derivatives may be used to hedge an existing security or as a risk reduction strategy. Current asset allocation guidelines are to invest 10% to 40% in equity securities, 60% to 90% in fixed income securities and cash, and up to 20% in alternative securities. Management reviews the asset allocation on a quarterly or more frequent basis and makes revisions as deemed necessary.

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

Cash Flows

Employer Contributions. The Company does not expect to contribute to its domestic defined benefit pension plan in 2020.

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

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

		Other Benefits	
(Thousands)	**Pension Benefits**	**Gross Benefit Payment**	**Net of Medicare Part D Subsidy**
2020	$ 3,752	$ 1,012	$ 997
2021	3,921	979	966
2022	4,799	884	872
2023	6,231	804	794
2024	6,410	722	713
2025 through 2029	42,020	2,544	2,518

Other Benefit Plans

In addition to the plans shown above, the Company also has certain foreign subsidiaries with accrued unfunded pension and other post-employment arrangements. The liability for these arrangements was $1.4 million at December 31, 2019 and $1.6 million at December 31, 2018, and was included in retirement and post-employment benefits in the Consolidated Balance Sheets.

The Company also sponsors defined contribution plans available to substantially all U.S. employees. The Company’s annual defined contribution expense, including the expense for the enhanced defined contribution plan, was $7.0 million in 2019, $5.2 million in 2018, and $4.5 million in 2017.

Note O — Accumulated Other Comprehensive Income

Changes in the components of accumulated other comprehensive income, including amounts reclassified out, for 2019, 2018, and 2017, and the balances in accumulated other comprehensive income as of December 31, 2019, 2018, and 2017 are as follows:

	Gains and Losses On Cash Flow Hedges						
(Thousands)	Foreign Currency	Precious Metals	Copper	Total	Pension and Post-Employment Benefits	Foreign Currency Translation	Total
Balance at December 31, 2016	$ 1,837	$ —	$ —	$ 1,837	$ (82,358)	$ (5,660)	$ (86,181)
Other comprehensive income (loss) before reclassifications	(1,180)	(463)	—	(1,643)	(8,279)	1,552	(8,370)
Amounts reclassified from accumulated other comprehensive income	632	208	—	840	4,865	—	5,705
Other comprehensive income (loss) before tax	(548)	(255)	—	(803)	(3,414)	1,552	(2,665)
Deferred taxes on current period activity	330	(59)	—	271	13,820	—	14,091
Other comprehensive income (loss) after tax	(878)	(196)	—	(1,074)	(17,234)	1,552	(16,756)
Balance at December 31, 2017	$ 959	$ (196)	$ —	$ 763	$ (99,592)	$ (4,108)	$ (102,937)
Balance at December 31, 2017	$ 959	$ (196)	$ —	$ 763	$ (99,592)	$ (4,108)	$ (102,937)
Other comprehensive income (loss) before reclassifications	(333)	467	(569)	(435)	11,396	(484)	10,477
Amounts reclassified from accumulated other comprehensive income	10	(109)	—	(99)	46,953	—	46,854
Other comprehensive income (loss) before tax	(323)	358	(569)	(534)	58,349	(484)	57,331
Deferred taxes on current period activity	(627)	83	(128)	(672)	13,300	—	12,628
Other comprehensive income (loss) after tax	304	275	(441)	138	45,049	(484)	44,703
Balance at December 31, 2018	$ 1,263	$ 79	$ (441)	$ 901	$ (54,543)	$ (4,592)	$ (58,234)
Balance at December 31, 2018	$ 1,263	$ 79	$ (441)	$ 901	$ (54,543)	$ (4,592)	$ (58,234)
Other comprehensive income (loss) before reclassifications	108	(1,285)	209	(968)	9,085	(421)	7,696
Amounts reclassified from accumulated other comprehensive income	(29)	595	393	959	8,853	—	9,812
Other comprehensive income (loss) before tax	79	(690)	602	(9)	17,938	(421)	17,508
Deferred taxes on current period activity	18	(159)	136	(5)	4,741	—	4,736
Other comprehensive income (loss) after tax	61	(531)	466	(4)	13,197	(421)	12,772
Balance at December 31, 2019	$ 1,324	$ (452)	$ 25	$ 897	$ (41,346)	$ (5,013)	$ (45,462)

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

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

Note P — Stock-based Compensation

Stock incentive plans (the 2006 Stock Incentive Plan and the 2006 Non-employee Director Equity Plan) were approved at the May 2006 annual meeting of shareholders. These plans authorize the granting of option rights, SARs, performance-restricted shares, performance shares, performance units, and restricted shares. The 2006 Stock Incentive Plan and the 2006 Non-employee Director Equity Plan were amended to, among other things, add additional shares to the plans. These amendments were last approved by shareholders at the May 2017 annual meeting.

Stock-based compensation expense, which includes awards settled in shares and in cash and is recognized as a component of selling, general, and administrative (SG&A) expenses, was $11.1 million, $11.4 million, and $7.7 million in 2019, 2018, and 2017, respectively. The Company derives a tax deduction measured by the excess of the market value over the grant price at the date stock-based awards vest or are exercised. The Company recognized $2.1 million, $1.2 million, and $2.0 million of tax benefits in 2019, 2018, and 2017, respectively, relating to the issuance of common stock for the exercise/vesting of equity awards.

The following sections provide information on awards settled in shares.

SARs. The Company grants SARs to certain employees. Upon exercise of vested SARs, the participant will receive a number of shares of common stock equal to the spread (the difference between the market price of the Company's common shares at the time of exercise and the strike price established on the grant date) divided by the common share price. The strike price of the SARs is equal to the market value of the Company's common shares on the day of the grant. The number of SARs available to be issued is established by plans approved by the shareholders. The vesting period and the life of the SARs are established at the time of grant. The exercise of the SARs is generally satisfied by the issuance of treasury shares. SARs granted in 2019 and 2018 vest in equal installments annually over three years, while SARs granted prior to 2018 generally vest three years from the date of grant. SARs granted prior to 2011 expire in ten years, while the SARs granted in 2011 and later expire in seven years.

The following table summarizes the Company's SARs activity during 2019:

(Shares in thousands)	Number of SARs	Weighted-average Exercise Price Per Share	Aggregate Intrinsic Value (thousands)	Weighted-average Remaining Term (Years)
Outstanding at December 31, 2018	379	$ 33.01		
Granted	73	58.30		
Exercised	(196)	26.71	$ 6,730	
Cancelled	(6)	49.93		
Outstanding at December 31, 2019	250	44.95	$ 3,631	4.8
Vested and expected to vest as of December 31, 2019	250	44.95	3,631	4.8
Exercisable at December 31, 2019	72	37.70	1,557	3.8

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

(Shares in thousands)	Number of SARs	Weighted-average Grant Date Fair Value
Nonvested as of December 31, 2018	319	$ 10.33
Granted	73	17.76
Vested	(208)	9.02
Cancelled	(6)	15.35
Nonvested as of December 31, 2019	178	$ 14.72

As of December 31, 2019, $1.3 million of expense with respect to non-vested SARs has yet to be recognized as expense over a weighted-average period of approximately 22 months. The total fair value of shares vested during both 2019 and 2018 was $1.9 million, compared to $1.7 million in 2017.

The weighted-average grant date fair value for 2019, 2018, and 2017 was $17.76, $15.73, and $10.89, respectively. The fair value will be amortized to compensation cost on a straight-line basis over the vesting period of three years, or earlier if the employee is retirement eligible as defined in the Plan. Stock-based compensation expense relating to SARs was $0.9 million in 2019, $0.7 million in 2018, and $1.4 million in 2017.

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

	2019	2018	2017
Risk-free interest rate	**2.47%**	2.58%	1.92%
Dividend yield	**0.7%**	0.8%	1.1%
Volatility	**31.7%**	31.9%	34.0%
Expected lives (in years)	**5.2**	5.5	5.6

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

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

The fair value of the RSUs settled in stock is based on the closing stock price on the date of grant. The weighted-average grant date fair value for 2019, 2018, and 2017 was $58.33, $50.35, and $35.24, respectively. Cash-settled RSUs are accounted for as liability-based compensation awards and adjusted based on the closing price of Materion's common stock over the vesting period of three years.

Stock-based compensation expense relating to stock-settled RSUs was $2.2 million in 2019, $1.2 million in 2018, and $1.4 million in 2017. The unamortized compensation cost on the outstanding RSUs was $3.8 million as of December 31, 2019 and is expected to be amortized over a weighted-average period of 23 months. The total fair value of shares vested during 2019, 2018, and 2017 was $1.2 million $1.4 million, and $1.2 million, respectively.

The following table summarizes the stock-settled RSU activity during 2019:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2018	130	$ 38.99
Granted	70	58.33
Vested	(44)	27.52
Forfeited	(11)	52.15
Outstanding at December 31, 2019	145	$ 50.79

RSUs - Non-Employee Directors. In 2019, 2018, and 2017, 11,048, 14,728, and 18,656 RSUs, with a one year vesting period, were granted to certain non-employee members of the Board of Directors. The weighted-average grant date fair value of these RSUs were $68.79, $51.60, and $34.30 in 2019, 2018, and 2017, respectively. The Company recognized $0.7 million of expense with respect to these awards in each of the last three years. At December 31, 2019, $0.2 million of expense with respect to non-vested RSU awards granted to the Board of Directors has yet to be recognized and will be amortized into expense over a weighted-average period of approximately four months.

Long-term Incentive Plans. Under long-term incentive compensation plans, executive officers and selected other employees receive restricted stock unit awards based upon the Company's performance over the defined period, typically three years. Total units earned for grants made in 2019, 2018, and 2017, may vary between 0% and 200% of the units granted based on the attainment of performance targets during the related three-year period. All grants made in 2019 and 2018 will be settled in Materion common shares and are equity classified. For grants made to certain executives prior to 2018, attainment up to 100% is paid in Materion common shares and equity classified, while the remainder are classified as liability awards and settled in cash. Grants made to all other employees prior to 2018 are settled in cash. Vesting of performance-based awards is contingent upon the attainment of threshold performance objectives.

The following table summarizes the activity related to equity-based, performance-based RSUs during 2019:

(Shares in thousands)	Number of Shares		Weighted-average Grant Date Fair Value
Outstanding at December 31, 2018	202	$	35.76
Granted	56		69.84
Vested	(83)		22.77
Forfeited	(6)		58.93
Outstanding at December 31, 2019	169	$	52.74

Compensation expense is based upon the performance projections for the plan period of three years, the percentage of requisite service rendered, and the fair market value of the Company’s common shares on the date of grant. The offset to the compensation expense for the portion of the award to be settled in shares is recorded within shareholders’ equity and was $3.3 million for 2019, $2.7 million for 2018, and $1.5 million for 2017.

Directors' Deferred Compensation. Non-employee directors may defer all or part of their compensation into the Company’s common stock. The fair value of the deferred shares is determined at the share acquisition date and is recorded within shareholders’ equity. Subsequent changes in the fair value of the Company’s common shares do not impact the recorded values of the shares.

The following table summarizes the stock activity for the directors' deferred compensation plan during 2019:

(Shares in thousands)	Number of Shares		Weighted-average Grant Date Fair Value
Outstanding at December 31, 2018	152	$	23.55
Granted	13		66.35
Distributed	(57)		63.81
Outstanding at December 31, 2019	108	$	56.02

During the years ended December 31, 2019, 2018, and 2017, the weighted-average grant date fair value was $66.35, $53.11, and $35.34, respectively.

Note Q — Fair Value Information and Derivative Financial Instruments

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

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

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

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

The following table summarizes the financial instruments measured at fair value in the Consolidated Balance Sheets at December 31, 2019 and 2018:

		Fair Value Measurements		
(Thousands)	Total	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Observable Inputs (Level 2)	Other Significant Unobservable Inputs (Level 3)
December 31, 2019				
Financial Assets				
Deferred compensation investments	**$ 3,391**	**$ 3,391**	**$ —**	**$ —**
Foreign currency forward contracts	**188**	**—**	**188**	**—**
Precious metal swaps	**35**	**—**	**35**	**—**
Copper swaps	**61**	**—**	**61**	**—**
Total	**$ 3,675**	**$ 3,391**	**$ 284**	**$ —**
Financial Liabilities				
Deferred compensation liability	**$ 3,391**	**$ 3,391**	**$ —**	**$ —**
Foreign currency forward contracts	**211**	**—**	**211**	**—**
Precious metal swaps	**623**	**—**	**623**	**—**
Copper swaps	**28**	**—**	**28**	**—**
Total	**$ 4,253**	**$ 3,391**	**$ 862**	**$ —**
December 31, 2018				
Financial Assets				
Deferred compensation investments	$ 2,156	$ 2,156	$ —	$ —
Foreign currency forward contracts	246	—	246	—
Precious metal swaps	237	—	237	—
Total	$ 2,639	$ 2,156	$ 483	$ —
Financial Liabilities				
Deferred compensation liability	$ 2,156	$ 2,156	$ —	$ —
Foreign currency forward contracts	432	—	432	—
Precious metal swaps	135	—	135	—
Copper swaps	569	—	569	—
Total	$ 3,292	$ 2,156	$ 1,136	$ —

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

The carrying values of the other working capital items and debt in the Consolidated Balance Sheets approximate fair values at December 31, 2019 and 2018.

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

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

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

Precious Metals. The Company maintains the majority of its precious metal production requirements on consignment in order to reduce its working capital investment and the exposure to metal price movements. When a precious metal product is fabricated and ready for shipment to the customer, the metal is purchased out of consignment at the current market price. The price paid by the Company forms the basis for the price charged to the customer. This methodology allows for changes in either direction in the market prices of the precious metals used by the Company to be passed through to the customer and reduces the impact changes in prices could have on the Company's margins and operating profit. The consigned metal is owned by financial institutions who charge the Company a financing fee based upon the current value of the metal on hand.

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

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

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

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

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

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

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

The following table summarizes the notional amount and the fair value of the Company’s outstanding derivatives not designated as hedging instruments (on a gross basis) and balance sheet classification as of December 31, 2019 and 2018:

	December 31, 2019		December 31, 2018	
(Thousands)	Notional Amount	Fair Value	Notional Amount	Fair Value
Foreign currency forward contracts				
Prepaid expenses	**$ 13,734**	**$ 95**	$ 8,767	$ 244
Other liabilities and accrued items	**5,757**	**16**	8,771	249

These outstanding foreign currency derivatives were related to balance sheet hedges and intercompany loans. Other-net included foreign currency losses relating to these derivatives of $0.1 million in 2019 and foreign currency gains of $0.9 million in 2018.

The following table summarizes the notional amount and the fair value of the Company’s outstanding derivatives designated as cash flow hedges (on a gross basis) and balance sheet classification at December 31, 2019 and 2018:

	December 31, 2019		December 31, 2018	
(Thousands)	Notional Amount	Fair Value	Notional Amount	Fair Value
Prepaid expenses				
Foreign currency forward contracts - yen	**$ 1,025**	**$ 10**	$ —	$ —
Foreign currency forward contracts - euro	**3,466**	**83**	725	2
Precious metal swaps	**1,116**	**34**	4,533	237
Copper swaps	**1,951**	**61**	—	—
	7,558	**188**	5,258	239
Other assets				
Precious metal swaps	**157**	**1**	—	—
Other liabilities and accrued items				
Foreign currency forward contracts - yen	**2,355**	**12**	1,264	17
Foreign currency forward contracts - euro	**15,686**	**183**	19,158	166
Precious metal swaps	**7,034**	**618**	2,864	135
Copper swaps	**1,266**	**28**	11,170	569
	26,341	**841**	34,456	887
Other long-term liabilities				
Precious metal swaps	**149**	**5**	—	—
Total	**$ 34,205**	**$ 657**	$ 39,714	**$ 648**

All of these contracts were designated and effective as cash flow hedges. No ineffectiveness expense was recorded in 2019, 2018, or 2017.

The fair value of derivative contracts recorded in accumulated other comprehensive loss totaled $0.7 million and $0.6 million as of December 31, 2019 and December 31, 2018, respectively. Deferred losses of $0.7 million at December 31, 2019 are expected to be reclassified to earnings within the next 18-month period.

The following table summarizes the amounts reclassified from accumulated OCI relating to the hedging relationship of the Company's outstanding derivatives designated as cash flow hedges and income statement classification for year ended December 31, 2019:

(Thousands)		2019
Hedging relationship	**Line item**	
Foreign currency forward contracts	Net sales	$ (29)
Precious metal swaps	Cost of sales	595
Copper swaps	Cost of sales	393
Total		$ 959

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

Note R — Contingencies and Commitments

Beryllium Cases

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

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

Non-employee beryllium cases are covered by insurance, subject to certain limitations. The insurance covers defense costs and indemnity payments (resulting from settlements or court verdicts) and is subject to various levels of deductibles. In 2019 and 2018, defense and indemnity costs were less than or equal to the deductible.

One beryllium case, originally filed and dismissed during 2015, but reversed and remanded in 2016 to the trial court, was outstanding as of December 31, 2018 but was settled for an immaterial amount and dismissed in 2019. One beryllium case was filed in 2019 and was outstanding as of December 31, 2019. The Company does not expect the resolution of this matter to have a material impact on the consolidated financial statements.

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

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

Environmental Proceedings

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

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

The undiscounted reserve balance at the beginning of the year, the amounts expensed and paid, and the balance at December 31, 2019 and 2018 are as follows:

(Thousands)	2019	2018
Reserve balance at beginning of year	**$ 6,521**	$ 6,499
Expensed	**482**	718
Paid	**(1,066)**	(696)
Reserve balance at end of year	**$ 5,937**	$ 6,521
Ending balance recorded in:		
Other liabilities and accrued items	**$ 982**	$ 1,168
Other long-term liabilities	**4,955**	5,353

The majority of spending in 2019 and 2018 was for various remediation projects at the Elmore, Ohio plant site.

Other

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

At December 31, 2019, the Company had outstanding letters of credit totaling $41.8 million related to workers’ compensation, consigned precious metal guarantees, environmental remediation issues, and other matters. The majority of the Company's outstanding letters of credit expire in 2020 and are expected to be renewed.

Note S — Quarterly Data (Unaudited)

The following tables summarize selected quarterly financial data for the years ended December 31, 2019 and 2018:

	2019				
(Thousands except per share amounts)	**First Quarter**	**Second Quarter**	**Third Quarter**	**Fourth Quarter**	**Total**
Net sales	**$ 301,441**	**$ 297,843**	**$ 305,979**	**$ 280,161**	**$ 1,185,424**
Gross margin	**69,312**	**69,594**	**65,231**	**55,007**	**259,144**
Percent of net sales	**23.0%**	**23.4%**	**21.3%**	**19.6%**	**21.9%**
Net income[(1)]	**$ 16,906**	**$ 15,540**	**$ 3,463**	**$ 14,751**	**$ 50,660**
Net income per share of common stock:					
Basic	**$ 0.83**	**$ 0.76**	**$ 0.17**	**$ 0.72**	**$ 2.49**
Diluted	**0.82**	**0.75**	**0.17**	**0.71**	**2.45**

	2018				
	First Quarter	**Second Quarter**	**Third Quarter**	**Fourth Quarter**	**Total**
Net sales	$ 303,467	$ 309,085	$ 297,193	$ 298,070	$ 1,207,815
Gross margin	58,280	61,838	64,935	66,052	251,105
Percent of net sales	19.2%	20.0%	21.8%	22.2%	20.8%
Net income (loss)	$ 10,564	$ 11,144	$ 19,966	$ (20,828)	$ 20,846
Net income (loss) per share of common stock:					
Basic[(2)]	$ 0.52	$ 0.55	$ 0.99	$ (1.03)	$ 1.03
Diluted[(2)(3)]	0.51	0.54	0.97	(1.03)	1.01

[(1)] Net income for the third quarter 2019 includes the impact of $14.1 million of non-cash impairment charges. For additional information refer to Note L.

[(2)] Net income (loss) per basic and diluted share for the fourth quarter 2018 includes the impact of $41.4 million in pension settlement charges. For additional information refer to Note N. In addition, net income (loss) per basic and diluted share for the fourth quarter of 2018 includes the impact of $11.1 million of income tax benefits as a result of the TCJA signed into law on December 22, 2017. For additional information refer to Note G.

[(3)] Since the Company reported a net loss for the fourth quarter of 2018, the effects of potential common shares were excluded from diluted earnings per share, as their inclusion would have been anti-dilutive.

The Company follows a 13-week quarterly accounting cycle pursuant to which the first three fiscal quarters end on a Friday and the fiscal year always ends on December 31.

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

None.

Item 9A. CONTROLS AND PROCEDURES

a) Evaluation of Disclosure Controls and Procedures

The Company carried out an evaluation under the supervision and with participation of the Company's management, including the chief executive officer and chief financial officer, of the effectiveness of the design and operation of disclosure controls and procedures as of December 31, 2019 pursuant to Rules 13a-15(b) and 15d-15(b) under the Securities Exchange Act of 1934, as amended (Exchange Act). Based on that evaluation, management, including the chief executive officer and chief financial officer, concluded that disclosure controls and procedures are effective as of December 31, 2019.

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

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

c) Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting identified in connection with the evaluation required by Rules 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the three months ended December 31, 2019 that has materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting.

The Company adopted the new lease guidance under ASC 842 on January 1, 2019. Although the adoption of ASC 842 did not have a material impact on the Company's financial results, changes to the Company's processes and controls related to leasing arrangements were implemented. These changes included creating new accounting policies, implementing a new software solution, and gathering information necessary for disclosures.

Item 9B. OTHER INFORMATION

None.

PART III

Item 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information under “Election of Directors” in Materion Corporation's Proxy Statement for the 2020 Annual Meeting of Shareholders (Proxy Statement), to be filed with the Securities and Exchange Commission pursuant to Regulation 14A, is incorporated herein by reference.

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

Name	Age	Positions and Offices Held
Jugal K. Vijayvargiya	51	President and Chief Executive Officer (March 2017-Present); President Delphi Electronics and Safety, a global technology solutions provider to the automotive and transportation sectors (prior to March 2017)
Joseph P. Kelley	47	Vice President, Finance and Chief Financial Officer
Gregory R. Chemnitz	62	Vice President, General Counsel and Secretary (January 2017-Present); Vice President, General Counsel (prior to January 2017)

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

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

Item 11. EXECUTIVE COMPENSATION

Incorporated by reference from the sections of the Proxy Statement entitled “Executive Compensation” and “2019 Compensation of Non-Employee Directors."

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

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

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

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

Item 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

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

PART IV

Item 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) 1. Financial Statements and Supplemental Information

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

(a) 2. Financial Statement Schedules

The following consolidated financial information for the years ended December 31, 2019, 2018, and 2017 is submitted herewith:

Schedule II — Valuation and qualifying accounts.

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

(a) 3. Exhibits

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

3.1	Amended and Restated Articles of Incorporation of Materion Corporation (filed as Exhibit 3.2 to the Company's Quarterly Report on Form 10-Q for the period ended on June 27, 2014), incorporated herein by reference.
3.2	Amended and Restated Code of Regulations (filed as Exhibit 3.1 to the Company's Quarterly Report on Form 10-Q for the period ended June 27, 2014), incorporated herein by reference.
4.1#	Description of Materion Corporation Common Stock
4.2	Third Amended and Restated Credit Agreement, dated September 24, 2019, by and among Materion Corporation, Materion Netherlands B.V., the other foreign borrowers from time to time party thereto, the financial institutions from time to time party thereto as lenders, JPMorgan Chase Bank, N.A. as administrative agent, Wells Fargo Bank, National Association and Bank of America, N.A., as co-syndication agents, and KeyBank National Association, as documentation agent (filed as Exhibit 10.1 to the Company's 8-K filed on September 30, 2019) incorporated herein by reference.
	Pursuant to Regulation S-K, Item 601(b)(4), the Company agrees to furnish to the Securities and Exchange Commission, upon its request, a copy of the instruments defining the rights of holders of long-term debt of the Company that are not being filed with this report.
10.1	Metals Consignment Agreement, dated as of August 27, 2019, among Materion Corporation, certain of its subsidiaries and Bank of Montreal (filed as Exhibit 10.1 to the Company's Form 8-K Filed on August 29, 2019), incorporated herein by reference.
10.2	The Bank of Nova Scotia Consignment Agreement with Materion Advanced Materials Germany GMBH dated as of February 28, 2017 (filed as Exhibit 99.1 to the Company's Form 8-K filed on March 1, 2017), incorporated herein by reference.
10.3	Form of Indemnification Agreement entered into by the Company and its executive officers (filed as Exhibit 10a to the Company's Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.
10.4	Form of Indemnification Agreement entered into by the Company and its directors (filed as Exhibit 10b to the Company's Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.
10.5*	Amended and Restated Form of Severance Agreement for Executive Officers (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended June 27, 2008), incorporated herein by reference.
10.6*	Amendment No. 1 to Amended and Restated Severance Agreement, dated May 4, 2011 (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended July 1, 2011), incorporated herein by reference.
10.7*	Amended and Restated Form of Severance Agreement for Key Employees (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended June 27, 2008), incorporated herein by reference.
10.8*	Form of Severance Agreement for Key Employees (filed as Exhibit 10f to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference.
10.9*	Severance Agreement for Jugal Vijayvargiya dated as of March 3, 2017 (filed as Exhibit 10.2 to the Company's Form 8-K filed on March 3, 2017), incorporated herein by reference.
10.10*	CEO Offer Letter for Jugal Vijayvargiya dated as of March 1, 2017 (filed as Exhibit 10.1 to the Company's Form 8-K filed on March 3, 2017), incorporated herein by reference.

10.11*	Form of Trust Agreement between the Company and Key Trust Company of Ohio, N.A. (formerly Ameritrust Company National Association) on behalf of the Company's executive officers (filed as Exhibit 10e to the Company's Annual Report on Form 10-K for the year ended December 31, 1994), incorporated herein by reference.
10.12#*	2019 Management Incentive Plan.
10.13*	Materion Corporation 2006 Stock Incentive Plan (as Amended and Restated as of May 3, 2017) (filed as Exhibit 4.3 to the Registration Statement on Form S-8 (Registration No. 333-217633), incorporated herein by reference.
10.14*	Form of 2016 Restricted Stock Units Agreement (Cash-settled) (filed as Exhibit 10t to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference.
10.15*	Form of 2016 Restricted Stock Units Agreement (Stock-settled) (filed as Exhibit 10u to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference. .
10.16*	Form of 2016 Performance-Based Restricted Stock Units (Cash-settled) (filed as Exhibit 10v to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference. .
10.17*	Form of 2016 Performance-Based Restricted Stock Units (Stock-settled) (filed as Exhibit 10w to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference. .
10.18*	Form of 2010 Stock Appreciation Rights Agreement (filed as Exhibit 10.34 to the Company's Annual Report on Form 10-K for the year ended December 31, 2009), incorporated herein by reference.
10.19*	Form of 2016 Stock Appreciation Rights Agreement (filed as Exhibit 10ad to the Company's Annual Report on Form 10-K for the year ended December 31, 2015), incorporated herein by reference. .
10.20*	Materion Corporation Supplemental Retirement Benefit Plan (filed as Exhibit 10.1 to the Company's Form 8-K filed on September 19, 2011), incorporated herein by reference.
10.21*	Amendment No. 1 to the Supplemental Retirement Benefit Plan (filed as Exhibit 10al to the Company's Annual Report on Form 10-K for the year ended December 31, 2012), incorporated herein by reference.
10.22*	Amendment No. 2 to the Supplemental Retirement Benefit Plan (filed as Exhibit 10ah to the Company's Annual Report on Form 10-K for the year ended December 31, 2013), incorporated herein by reference.
10.23*	Materion Corporation 2006 Non-employee Director Equity Plan (as Amended and Restated as of May 3, 2017) (filed as Exhibit 4.3 to the Registration Statement on Form S-8 (Registration No. 333-217618), incorporated herein by reference.
10.24*	Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended March 28, 2008), incorporated herein by reference.
10.25*	Amendment No. 1 to the Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10bf to the Company's Annual Report on Form 10-K for the year ended December 31, 2008), incorporated herein by reference.
10.26*	Amendment No. 2 to the Amended and Restated Executive Deferred Compensation Plan II (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended July 3, 2009), incorporated herein by reference.
10.27*	Amendment No. 3 to the Amended and Restated Executive Deferred Compensation Plan II, dated July 6, 2011 (filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the period ended July 1, 2011), incorporated herein by reference.
10.28*	Materion Corporation Restoration & Deferred Compensation Plan, dated March 4, 2015 (filed as Exhibit 10.1 to the Company's Form 8-K filed on March 10, 2015), incorporated herein by reference.
10.29*	Trust Agreement between the Company and Fidelity Investments dated September 26, 2006 for certain deferred compensation plans for Non-employee Directors of the Company (filed as Exhibit 99.4 to the Current Report on Form 8-K filed by the Company on September 29, 2006), incorporated herein by reference.
10.30*	Trust Agreement between the Company and Fidelity Management Trust Company, dated June 25, 2009 relating to the Executive Deferred Compensation Plan II (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended July 3, 2009), incorporated herein by reference.
10.31*	Form of 2018 Non-Employee Directors Restricted Stock Unit Agreement (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended June 29, 2018), incorporated herein by reference.
10.32*	Form of 2018 Restricted Stock Unit Agreement covering grants made in 2018 and 2019 (filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the period ended March 30, 2018), incorporated herein by reference.
10.33*	Form of 2018 Performance-Based Restricted Stock Unit Agreement covering grants made in 2018 and 2019 (filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the period ended March 30, 2018), incorporated herein by reference.
(21)#	Subsidiaries of the Registrant.
(23)#	Consent of Ernst & Young LLP.
(24)#	Powers of Attorney.

(31.1)#	Certification of Chief Executive Officer required by Rule 13a-14(a) or 15d-14(a).
(31.2)#	Certification of Chief Financial Officer required by Rule 13a-14(a) or 15d-14(a).
(32)#	Certifications of Chief Executive Officer and Chief Financial Officer required by 18 U.S.C. Section 1350.
(95)#	Mine Safety Disclosure Pursuant to Section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act for the Fiscal Year Ended December 31, 2019.
(101.INS)#	Inline XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.
(101.SCH)#	Inline XBRL Taxonomy Extension Schema Document.
(101.CAL)#	Inline XBRL Taxonomy Extension Calculation Linkbase Document.
(101.DEF)#	Inline XBRL Taxonomy Extension Definition Linkbase Document.
(101.LAB)#	Inline XBRL Taxonomy Extension Label Linkbase Document.
(101.PRE)#	Inline XBRL Taxonomy Extension Presentation Linkbase Document.
(104)#	Cover Page Interactive Data File (formatted in Inline XBRL and contained in the Exhibit 101 attachments)
*	Denotes a compensatory plan or arrangement.
#	Filed or furnished herewith.

Item 16. FORM 10-K SUMMARY

None.

SIGNATURES

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

MATERION CORPORATION

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

February 13, 2020

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

/s/ Jugal K. Vijayvargiya Jugal K. Vijayvargiya	President and Chief Executive Officer and Director (Principal Executive Officer)	February 13, 2020
/s/ Joseph P. Kelley Joseph P. Kelley	Vice President, Finance and Chief Financial Officer (Principal Financial and Accounting Officer)	February 13, 2020
* Vinod M. Khilnani	Director	February 13, 2020
* Emily M. Liggett	Director	February 13, 2020
* Robert J. Phillippy	Director	February 13, 2020
* Patrick Prevost	Director	February 13, 2020
* N. Mohan Reddy	Director	February 13, 2020
* Craig S. Shular	Director	February 13, 2020
* Darlene J. S. Solomon	Director	February 13, 2020
* Robert B. Toth	Director	February 13, 2020

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

By: /s/ Joseph P. Kelley
Joseph P. Kelley
Attorney-in-Fact

February 13, 2020

Materion Corporation and Subsidiaries

Schedule II—Valuation and Qualifying Accounts

Years Ended December 31, 2019, 2018, and 2017

Column A	Column B	Column C		Column D		Column E
		ADDITIONS				
(Thousands)	Balance at Beginning of Period	Charged to Costs and Expenses	Charged to Other Accounts	Deduction		Balance at End of Period
Year ended December 31, 2019						
Deducted from asset accounts:						
Allowance for doubtful accounts receivable	$ 616	$ (39)	$ —	$ 185	(A)	$ 392
Inventory reserves and obsolescence	12,026	2,238	—	735	(B)	13,529
Year ended December 31, 2018						
Deducted from asset accounts:						
Allowance for doubtful accounts receivable	$ 640	$ 271	$ —	$ 295	(A)	$ 616
Inventory reserves and obsolescence	13,176	3,341	—	4,491	(B)	12,026
Year ended December 31, 2017						
Deducted from asset accounts:						
Allowance for doubtful accounts receivable	$ 857	$ 84	$ —	$ 301	(A)	$ 640
Inventory reserves and obsolescence	14,407	3,521	—	4,752	(B)	13,176

Note (A) - Bad debts written-off, net of recoveries
Note (B) - Inventory write-offs

Exhibit 4.1

DESCRIPTION OF SECURITIES REGISTERED UNDER SECTION 12 OF THE SECURITIES EXCHANGE ACT OF 1934

The following description is a general summary of the terms of the common shares, no par value, of Materion Corporation, an Ohio corporation (the "Company"). The description below does not include all of the terms of the common shares and should be read together with the Company's articles of incorporation and code of regulations, copies of which have been filed previously with the Securities and Exchange Commission and are incorporated herein by reference, as well as applicable provisions of Ohio law.

The Company's authorized capital stock consists of 65,000,000 shares of stock, including:

- 60,000,000 common shares, no par value; and
- 5,000,000 preferred shares, no par value.

Voting Rights

Each outstanding common share is entitled to one vote on each matter submitted to a vote of shareholders. Except as outlined below or otherwise expressly required by the Company's articles of incorporation or by statute, the vote of the holders of shares entitling them to exercise a majority of the voting power of the Company is required to approve any matters submitted to a vote of the shareholders. At each annual meeting of shareholders, each director will be elected by a plurality vote of all votes cast at such meeting for a term expiring at the next annual meeting of shareholders and until the election of their successors. The Company's articles of incorporation prevent any shareholder from cumulating votes in the election of directors.

The Company's articles of incorporation provide that, in addition to any affirmative vote required by law or the Company's articles of incorporation, any related party transaction shall require the affirmative vote of not less than both a majority of the Company's outstanding voting stock and a majority of the portion of the Company's outstanding voting stock excluding the voting stock owned by the related party involved in the related party transaction, except with respect to related party transactions (i) in which (a) the aggregate amount of the cash and the fair market value of consideration other than cash received per share by holders of outstanding shares of voting stock in the related party transaction is not less than the highest per share price paid by the related party in acquiring any of its holdings of such voting stock and (b) the form of consideration received by holders of shares of voting stock is cash or the same form of consideration used by the related party to acquire the largest percentage of voting stock owned by the related party and (ii) expressly approved by a majority vote of the continuing directors of the Company.

For the purpose of the above voting requirements: (i) "related party transaction" shall mean (a) any merger or consolidation of the Company or any of its subsidiaries with a related party, (b) any sale, purchase, lease, exchange, transfer, or other transaction, other than in the ordinary course of business, between the Company or any of its subsidiaries and a related party

involving the acquisition or disposition of assets for consideration of $5,000,000 or more in value, (c) the issuance or transfer of any securities of the Company or any of its subsidiaries to a related party (other than an issuance or transfer which is effected on a pro rata basis to all shareholders of the Company), (d) any reclassification of securities of the Company (including any reverse stock split) or recapitalization or other transaction involving the Company or any of its subsidiaries that would have the effect of increasing the voting power of the related party, except for any mandatory redemption required by the terms of outstanding securities, and (e) the adoption of any plan or proposal for the liquidation or dissolution of the Company in favor of which a related party votes its voting stock; (ii) "related party" shall mean (a) any individual, corporation, partnership, or other person, group or entity which, together with its affiliates and associates, is the beneficial owner of 10% or more, but less than 90%, of the Company's voting stock or (b) any such affiliate or associate; (iii) "voting stock" shall mean all securities of the Company entitled to vote generally in the election of directors; and (iv) "continuing director" shall mean a director who either (a) was a member of the Company's board of directors (the "Board") immediately prior to the time that the related party involved in the related party transaction became a related party or (b) was designated (before his or her initial election as a director) as a continuing director by a majority of the then continuing directors.

Additionally, the affirmative vote of the holders of at least 66 2/3% of the Company's voting stock, voting as a single class, shall be required to alter, amend or adopt any provision inconsistent with or repeal the provisions of the Company's articles of incorporation relating to related party transactions described above.

Dividends

Subject to any superior rights of any holders of preferred shares, each outstanding common share will be entitled to such dividends as may be authorized and declared from time to time by the Board out of legally available funds. The amount of dividends that the Company may pay is restricted by the terms of the Company's credit facilities.

Liquidation Rights

In the event of the Company's liquidation, dissolution or winding up, holders of common shares will be entitled to their proportionate share of any assets remaining after payment of liabilities and any amounts due to the holders of preferred shares.

No Preemptive or Conversion Rights; No Redemption or Sinking Funds

Holders of common shares have no preemptive rights and no right to convert or exchange their common shares into any other securities. No redemption or sinking fund provisions apply to the Company's common shares.

Preferred Shares

The Board is authorized, without shareholder approval, to issue up to 5,000,000 preferred shares in one or more series and to fix the rights, preferences, privileges and restrictions granted

to or imposed upon the preferred shares, including voting rights, dividend rights, conversion rights, terms of redemption, liquidation preference, sinking fund terms and the number of shares constituting any series or the designation of a series. The Board can, without shareholder approval, issue preferred shares with voting and conversion rights that could adversely affect the voting power of the holders of common shares. Any preferred shares issued would also rank senior to common shares as to rights up on liquidation, winding-up or dissolution. The issuance of convertible preferred shares could have the effect of delaying, deferring or preventing a change in control of our company.

Business Combinations with Certain Persons

Chapter 1704 of the Ohio Revised Code prohibits certain business combinations and transactions between an "issuing public corporation" and an "Ohio law interested shareholder" for at least three years after the Ohio law interested shareholder attains 10% ownership, unless the board of directors of the issuing public corporation approves the transaction before the Ohio law interested shareholder attains 10% ownership. An "issuing public corporation" is an Ohio corporation with 50 or more shareholders that has its principal place of business, principal executive offices, or substantial assets within the State of Ohio, and as to which no close corporation agreement exists. An "Ohio law interested shareholder" is a beneficial owner of 10% or more of the shares of a corporation. Examples of transactions regulated by Chapter 1704 include the disposition of assets, mergers and consolidations, voluntary dissolutions and the transfer of shares.

Subsequent to the three-year period, a transaction subject to Chapter 1704 may take place provided that certain conditions are satisfied, including:

- prior to the interested shareholder's share acquisition date, the board of directors approved the purchase of shares by the interested shareholder;
- the transaction is approved by the holders of shares with at least 66 2/3% of the voting power of the corporation (or a different proportion set forth in the articles of incorporation), including at least a majority of the outstanding shares after excluding shares controlled by the Ohio law interested shareholder; or
- the business combination results in shareholders, other than the Ohio law interested shareholder, receiving a fair price plus interest for their shares.

Chapter 1704 is applicable to all issuing public corporations formed under Ohio law, unless a corporation's articles of incorporation specifically states that Chapter 1704 does not apply to the corporation. The Company's articles of incorporation do not contain a provision excluding it from the application of Chapter 1704.

MATERION

MATERION and SUBSIDIARIES
MANAGEMENT INCENTIVE PLAN FOR THE 2019 PLAN YEAR
Summary Plan Document

I. INTRODUCTION

The Materion and Subsidiaries Management Incentive Plan for the 2019 Plan Year (the "Plan"), has been established by the Compensation Committee (the "Compensation Committee"), of the Company's Board of Directors to provide incentive compensation to certain eligible employees based principally on annual financial performance. Plan awards have a significant portion based on Company performance and potentially Business Unit or Corporate Function Performance ("Financial Performance"), and a remaining component that recognizes individual and combined contributions toward personal/team objectives ("Personal/Team Performance").

II. DEFINITIONS

Base Salary:
The Participant's annual base salary as of September 30 of the Plan Year will be used to calculate any earned award.

Plan Year:
Calendar year 2019, which is the fiscal year for which Financial Performance and Personal/Team Performance, and any Plan awards, will be calculated.

Business Unit or Corporate Function Performance:
The Compensation Committee has delegated authority to the Company's executive staff to designate the Company's business units/subsidiaries and corporate functions (and their eligible employees) that are eligible for participation in the Plan for the Plan Year. Each business unit or corporate function has defined Financial Performance measures, which have in turn been approved by the Compensation Committee and/or the executive staff. For each of these Financial Performance measures, a minimum goal, target goal and maximum goal will be established. Plan awards include a Financial Performance component based on Company Performance alone, or Company Performance and/or Business Unit/Corporate Function Performance.

Company Performance:
The Company Performance portion of the Financial Performance component of Plan awards will consist of an Operating Profit measure (weighted at 70%), a Growth in Value-added Sales measure (weighted at 15%) and a Simple Free Cash Flow measure (weighted at 15%).

Operating Profit ("OP"):
Operating Profit is defined as profit or loss, before interest and taxes, and for domestic and international operations, OP will include accrued performance or incentive compensation. Any adjustment to exclude the effect of any extraordinary, unusual or non-reoccurring items will be subject to review and approval by the Compensation Committee.

Growth in Value-added Sales (**"VAS"):**
Growth in Value-added Sales is defined as the percent increase in VAS for the Plan Year over the prior year. VAS is the amount equal to (1) the Company's sales for the Plan Year minus (2) the aggregate cost to the Company for the Plan Year of gold, silver, platinum, palladium and copper.

Simplified **Free Cash Flow ("SFCF"):**
Simple Free Cash Flow is defined as the amount equal to (1) operating profit plus depreciation and amortization minus (2) the change in working capital (accounts receivable, accounts payable, and inventory) and capital investments.

Other Metrics:
From time to time, other metrics may be adopted that are aligned with a business unit's strategy and market challenges or a corporate function's strategic imperatives. These metrics will be defined and tracked by the corporate accounting department, subject to approval by the executive staff.

Personal/Team Performance:
An assessment is made of an individual's achievements and his/her contributions to work/project teams during the Plan Year. This assessment is expressed as a percentage of Base Salary. The Personal/Team Performance component is distinct from the Financial Performance component.

Performance Objectives:
Performance Objectives shall mean the measurable performance objective or objectives established for Participants under the Plan for the Plan Year. The Compensation Committee may provide for such adjustments in the Performance Objectives or their evaluation as it may deem necessary or appropriate for purposes of administering this Plan.

Target Annual Award Opportunity
Each Plan Year, MIP eligible participants will be assigned a Target Annual Award Opportunity, expressed as a percent of Base Salary.

III. PARTICIPATION

At the beginning of the Plan Year, the executive staff will, based on delegated authority from the Compensation Committee, identify exempt salaried employees whose responsibilities affect progress on critical issues facing the Company, and those employees will participate in the Plan for the Plan Year. Those individuals selected by the executive staff will be notified of their participation in the Plan, their Target Annual Award Opportunity and applicable business unit designation.

Following the beginning of the Plan Year, the executive staff may admit new hires or individuals who are promoted or assigned additional and significant responsibilities to also participate in the Plan for the Plan Year. The executive staff may also alter Target Annual Award Opportunities to reflect changed responsibilities of participants during the Plan Year.

An employee who replaces or otherwise assumes the job functions or role of another employee does not automatically assume the Plan participation characteristics that had applied to such other employee. Rather, participation by the new or replacing employee must be individually considered and approved by the executive staff.

Participants who are newly employed before April 1 of the Plan Year are eligible for full participation in the Plan for such Plan Year. Participants who are newly employed on or after April 1 of the Plan Year and before July 1 of the Plan Year (or comparable date for any Plan Year that does not mirror the calendar year), are eligible for half of any Plan award available based on Personal/Team Performance and Financial Performance for the Plan Year.

Plan awards for Participants who transfer from the Exempt Salaried Incentive Plan to the Plan for purposes of the Plan Year, will be prorated to the beginning of the month following the employee's transfer to the Plan. The transferred employee's eligibility under the Exempt Salaried Incentive Plan will cease for the Plan Year.

Changes in a Target Annual Award opportunity during a Plan Year will result in prorated participation for Plan awards.

The eligibility of employees hired or with changed job responsibilities after June 30 of the Plan Year (or comparable date for any Plan Year that does not mirror the calendar year) will not be considered for participation in the Plan until a possible, subsequent Plan Year.

Normally, employees who participate in any other annual incentive, commission or performance compensation plan of the Company or as a subsidiary are not eligible. The executive staff may consider prorated participation in the Plan for the Plan Year under special circumstances.

With two exceptions, Participants must be employed on the day award payments are issued in order to be eligible for any plan award. For a Participant who becomes eligible for and who elects a severance option under the Chronic Beryllium Disease Policy as amended, any award under the Plan will be prorated to the beginning of the month after the employee exercises the severance option. The second exception pertains to either the death of the participant or the retirement (at age 65, or at age 55 or older with 10 years of service), in which case, any Plan award will be prorated to the beginning of the month following the employee's death or the employee's retirement date, as applicable. In no event will a prorated Plan award be earned where the proration percent is less than one-third (1/3).

Participants who have been on a leave of absence in excess of 13 weeks during the Plan Year will have their Plan award reduced on a pro-rata basis to reflect their actual contribution.

IV. TARGET ANNUAL AWARD OPPORTUNITY

The Compensation Committee (or executive staff), along with a Participant's assigned salary grade level will determine the Target Annual Award Opportunity, as a percent of Base Salary, for participants in the MIP. The Target Annual Award Opportunity for participants in salary levels A, B, and C will be individualized as determined by the Compensation Committee or executive staff. The Target Annual Award Opportunity for participants in salary levels D, E, and EE will be determined by their salary grade level and executive staff.

Below is a summary of the Target Annual Award Opportunities at minimum, target, and maximum goal achievement, as a percent of Base Salary, for the 2019 Plan Year:

Level	Financial Performance			Personal /Team Performance [2]			Total Award Opportunity		
	Min.	Target	Max.	Min.	Target	Max.	Min.	Target	Max.
A – C		Individualized [1]					Individualized [1]		
D		20% or					5.00%	30.00%	60 %
	25% of Target	15%	200% of Target	0%	10%	20%	3.75%	25.00%	50 %
E		10% or					2.50%	20.00%	40 %
		5%					1.25%	15.00%	30 %
EE		5%		0%	5%	10%	1.25%	10.00%	20 %

[1] Determined by Compensation Committee or executive staff

[2] Excludes Named Executive Officers (NEOs)

V. PLAN AWARD OPPORTUNITY FOR FINANCIAL PERFORMANCE COMPONENT

The Compensation Committee (or the executive staff) will establish minimum, target and maximum goals for each Financial Performance component of a Plan award opportunity. The executive staff will assign Participants to a specific business unit/subsidiary or corporate function for the Financial Performance component of Plan awards.

Performance that reaches the minimum level of a Financial goal will result in an award of 25 percent of the target opportunity for that measure. Unless the minimum level goal for Operating Profit has been met, no other Financial Performance component of plan awards (business unit, company, function, sub-unit, and/or other measurement), will result in an award greater than 100 percent of the target opportunity for that measure.

Performance that reaches or exceeds the maximum goal of a measure will result in an award at 200 percent of target opportunity for that measure. Award amounts for levels of achievement between minimum and target

goals, at target goals, and between target and maximum goals will be prorated according to the level of achievement.

The Financial Performance portion of awards will be prorated for transfers between units (or between business unit and Corporate) according to the length of service by months in each unit during the Plan Year.

VI. PLAN AWARD OPPORTUNITY FOR PERSONAL/TEAM PERFORMANCE COMPONENT

The funding pool of the Personal/Team performance component will be determined by the financial results against the goals in the Financial Performance component of the Plan. For target levels of performance, the funding of the Personal/Team award pool will be 10 percent of base salary for Grades A through E, and 5 percent for Grade EE. The Personal/Team funding pool will be adjusted up or down based on the actual business financial performance. Performance that reaches the minimum level of a financial goal will result in funding of 25 percent, and Performance that reaches the maximum level of a financial goal will result in funding of 140 percent. The funding between minimum and target and target and maximum will be prorated according to the level of achievement.

The business unit executive and the executive staff will decide allocation of the pool among eligible participants based on their performance throughout the Plan year relative to achieving established goals and objectives. Personal/Team incentive awards may range from 0% to 200% of a participant's Personal/Team target incentive opportunity based on their individual performance. The aggregate total dollar amount of awards within each group may not exceed its total funded pool.

VII. PAYMENT

Distribution of any payouts for plan awards earned under the Plan to participants will be made in March of the year following the Plan Year.

VIII. GENERAL PROVISIONS

The executive staff has authority to make administrative decisions regarding the Plan.

The Company's Board of Directors, through the Compensation Committee, shall have final and conclusive authority for interpretation, application, and possible modification of this Plan or established targets. The Board of Directors, through the Compensation Committee, reserves the right to amend or terminate the Plan at any time. Subject to the preceding sentences, any determination by the Company's independent accountants shall be final and conclusive as it relates to the calculation of financial results.

This Plan is not a contract of employment.

Exhibit 21

Subsidiaries of Registrant

The Company has the following subsidiaries, all of which are wholly owned and included in the consolidated financial statements.

Name of Subsidiary	State or Country of Incorporation
Aerospace Metal Composites Limited	England
Egbert Corp.	Ohio
Materion Advanced Chemicals Inc.	Wisconsin
Materion Advanced Materials Technologies and Services Netherlands BV	Netherlands
Materion Advanced Materials Technologies and Services Suzhou Ltd.	China
Materion Advanced Materials Technologies and Services Corp.	New Mexico
Materion Singapore PTE. Ltd.	Singapore
Materion Advanced Materials Technologies and Services Inc.	New York
Materion Taiwan Co. Ltd.	Taiwan
Materion Advanced Materials Germany GmbH	Germany
Materion Japan Ltd.	Japan
Materion Brush (Singapore) PTE Ltd.	Singapore
Materion Brush GmbH	Germany
Materion Brush Inc.	Ohio
Materion Brush Singapore Shanghai	China
Materion Brush Singapore India SRO	India
Materion Brush Ltd.	England
Materion Czech S.R.O.	Czech Republic
Materion Ireland Holdings Ltd.	Ireland
Materion Ireland Ltd.	Ireland
Materion Large Area Coatings LLC	Delaware
Materion Natural Resources Inc.	Utah
Materion Korea Ltd.	Korea
Materion Precision Optics (Shanghai) Limited	China
Materion UK Limited	England
Materion Precision Optics and Thin Film Coatings Inc.	Massachusetts
Materion Services Inc.	Ohio
Materion Technical Materials Inc.	Ohio
Materion Advanced Materials Technologies and Services Far East Philippines PTD LTD.	Philippines
EIS Optics Limited Taiwan	Taiwan

Exhibit 23

Consent of Independent Registered Public Accounting Firm

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

(1) Registration Statement Number 333-88994 on Form S-8 dated May 24, 2002;
(2) Registration Statement Number 333-127130 on Form S-8 dated August 3, 2005;
(3) Registration Statement Number 333-133428 on Form S-8 dated April 20, 2006;
(4) Registration Statement Number 333-133429 on Form S-8 dated April 20, 2006;
(5) Registration Statement Number 333-145149 on Form S-8 dated August 6, 2007;
(6) Registration Statement Number 333-173915 on Form S-8 dated May 4, 2011;
(7) Registration Statement Number 333-173916 on Form S-8 dated May 4, 2011;
(8) Registration Statement Number 333-173917 on Form S-8 dated May 4, 2011;
(9) Registration Statement Number 333-195761 on Form S-8 dated May 7, 2014;
(10) Registration Statement Number 333-195762 on Form S-8 dated May 7, 2014;
(11) Registration Statement Number 333-217633 on Form S-8 dated May 3, 2017; and
(12) Registration Statement Number 333-217618 on Form S-8 dated May 3, 2017.

of our reports dated February 13, 2020, with respect to the consolidated financial statements and schedule of Materion Corporation and subsidiaries and the effectiveness of internal control over financial reporting of Materion Corporation and subsidiaries included in this Annual Report (Form 10-K) of Materion Corporation and subsidiaries for the year ended December 31, 2019.

/s/ Ernst & Young LLP
Cleveland, Ohio
February 13, 2020

Exhibit 24

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, that each of the undersigned directors and officers of MATERION CORPORATION, an Ohio corporation (the "Corporation"), hereby constitutes and appoints Jugal K. Vijayvargiya, Joseph P. Kelley, Gregory R. Chemnitz, and Michael J. Solecki, and each of them, their true and lawful attorney or attorneys-in-fact, with full power of substitution and revocation, for them and in their names, place and stead, to sign on their behalf as a director or officer, or both, as the case may be, of the Corporation, an Annual Report pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 on Form 10-K for the fiscal year ended December 31, 2019, and to sign any and all amendments to such Annual Report, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission granting unto said attorney or attorneys-in-fact, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully to all intents and purposes as they might or could do in person, hereby ratifying and confirming all that said attorney or attorneys-in-fact or any of them or their substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands as of the 13th day of February, 2020.

/s/ JUGAL K. VIJAYVARGIYA

Jugal K. Vijayvargiya, President,
Chief Executive Officer and Director
(Principal Executive Officer)

/s/ JOSEPH P. KELLEY

Joseph P. Kelley, Vice President, Finance
and Chief Financial Officer
(Principal Financial and Accounting Officer)

/s/ VINOD M. KHILNANI

Vinod M. Khilnani, Director

/s/ EMILY M. LIGGETT

Emily M. Liggett, Director

/s/ CRAIG S. SHULAR

Craig S. Shular, Director

/s/ ROBERT J. PHILLIPPY

Robert J. Phillippy, Director

/s/ DARLENE J. S. SOLOMON

Darlene J. S. Solomon, Director

/s/ PATRICK PREVOST

Patrick Prevost, Director

/s/ ROBERT B. TOTH

Robert B. Toth, Director

/s/ N. MOHAN REDDY

N. Mohan Reddy, Director

Exhibit 31.1

CERTIFICATIONS

I, Jugal K. Vijayvargiya, certify that:

1) I have reviewed this annual report on Form 10-K of Materion Corporation (the "registrant");

2) Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3) Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4) The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5) The registrant's other certifying officer 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.

/s/ Jugal K. Vijayvargiya

Dated: February 13, 2020

Jugal K. Vijayvargiya
President and Chief Executive Officer

Exhibit 31.2

CERTIFICATIONS

I, Joseph P. Kelley, certify that:

1) I have reviewed this annual report on Form 10-K of Materion Corporation (the "registrant");

2) Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3) Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4) The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   a) designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   b) designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   c) evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   d) disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5) The registrant's other certifying officer 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.

Dated: February 13, 2020

/s/ Joseph P. Kelley

Joseph P. Kelley

Vice President, Finance and
Chief Financial Officer

Exhibit 32

Certification Pursuant to
18 U.S.C. Section 1350,
As Adopted Pursuant to
Section 906 of the Sarbanes-Oxley Act of 2002

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 filing of the Annual Report on Form 10-K of Materion Corporation (the “Company”) for the year ended December 31, 2019, as filed with the Securities and Exchange Commission on the date hereof (the “Report”), each of the undersigned officers of the Company certifies, that, to such officer’s knowledge:

1. The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m or 78o(d)), and

2. The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company as of the dates and for the periods expressed in the Report.

Dated: February 13, 2020

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

/s/ Joseph P. Kelley
Joseph P. Kelley
Vice President, Finance and
Chief Financial Officer

Exhibit 95

Materion Corporation

Mine Safety Disclosure Pursuant to Section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act for the Year Ended December 31, 2019

Materion Natural Resources Inc., a wholly owned subsidiary, operates a beryllium mining complex in the State of Utah which is regulated by both the U.S. Mine Safety and Health Administration ("MSHA") and state regulatory agencies. We endeavor to conduct our mining and other operations in compliance with all applicable federal, state and local laws and regulations. We present information below regarding certain mining safety and health citations which MSHA has levied with respect to our mining operations.

Section 1503(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Section 1503(a)") requires the Company to present certain information regarding mining safety in its periodic reports filed with the Securities and Exchange Commission.

The following table reflects citations, orders and notices issued to Materion Natural Resources Inc. by MSHA during the year ended December 31, 2019 (the "Reporting Period") and contains certain additional information as required by Section 1503(a) and Item 104 of Regulation S-K, including information regarding mining-related fatalities, proposed assessments from MSHA and legal actions ("Legal Actions") before the Federal Mine Safety and Health Review Commission, an independent adjudicative agency that provides administrative trial and appellate review of legal disputes arising under the Mine Act.

Included below is the information required by Section 1503(a) with respect to the beryllium mining complex (MSHA Identification Number 4200706) for the Reporting Period:

(A)	Total number of alleged violations of mandatory health or safety standards that could significantly and substantially contribute to the cause and effect of a mine safety or health hazard under Section 104 of the Mine Act for which Materion Natural Resources Inc. received a citation from MSHA	0
(B)	Total number of orders issued under Section 104(b) of the Mine Act	0
(C)	Total number of citations and orders for alleged unwarrantable failure by Materion Natural Resources Inc. to comply with mandatory health or safety standards under Section 104(d) of the Mine Act	0
(D)	Total number of alleged flagrant violations under Section 110(b)(2) of the Mine Act	0
(E)	Total number of imminent danger orders issued under Section 107(a) of the Mine Act	0
(F)	Total dollar value of proposed assessments from MSHA under the Mine Act	$605
(G)	Total number of mining-related fatalities	0
(H)	Received notice from MSHA of a pattern of violations under Section 104(e) of the Mine Act	No
(I)	Received notice from MSHA of the potential to have a pattern of violations under Section 104(e) of the Mine Act	No
(J)	Total number of Legal Actions pending as of the last day of the Reporting Period	0
(K)	Total number of Legal Actions instituted during the Reporting Period	0
(L)	Total number of Legal Actions resolved during the Reporting Period	0