MATERION Corp
Form 10-K
February 14, 2019

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

Form 10-K

(Mark One)
ý ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Fiscal Year Ended December 31, 2018
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	Name of Each Exchange on Which Registered
Common Stock, no par value	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 ý 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 ý
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 ý 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 and post such files). Yes ý No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant’s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form

10-K. ¨

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. (Check one):

Large accelerated filer	x	Accelerated filer	¨
Non-accelerated filer	¨	Smaller reporting company	¨
Emerging Growth Company	¨		

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

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

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 29, 2018 was $1,082,760,630.

As of February 1, 2019, there were 20,238,146 common shares, no par value, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for the 2019 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 2019;

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: consumer electronics, industrial components, medical, automotive electronics, defense, telecommunications infrastructure, energy, commercial aerospace, and science;

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 2018. The Company was incorporated in Ohio in 1931 and has approximately 2,700 employees. Our products are sold into numerous end markets, including consumer electronics, industrial components, defense, medical, automotive electronics, telecommunications infrastructure, energy, commercial aerospace, science, services, and appliance.

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) provides advanced engineered solutions comprised of beryllium and non-beryllium containing alloy systems and custom engineered parts in strip, bulk, rod, plate, bar, and other customized shapes at manufacturing facilities located throughout the United States and Europe. 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 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.

- Bulk products are made with copper and nickel (with or without beryllium) in plate, rod, bar, tube, and wire product forms and other customized shapes. Depending upon the application, they may provide superior strength, corrosion/wear resistance, thermal conductivity, or lubricity. Applications for bulk products include oil & gas drilling and production components, bearings, bushings, welding rods, plastic mold tooling, and undersea telecommunications housing equipment. Major end markets for bulk products include industrial components, commercial aerospace, energy, and telecommunications infrastructure. Bulk products 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 Industriel, KME AG & Co. KG, Aurubis AG, MKM Mansfelder Kupfer und Messing GmbH, AMPCO Metal, and Chuetsu Metal Works Ltd.
- Strip products include various thicknesses of precision strip. These beryllium and non-beryllium containing alloy products are made primarily with copper and nickel to provide unique combinations of high conductivity, high reliability, and formability for use as connectors, contacts, springs, switches, relays, shielding, and bearings. Major end markets for strip products include consumer electronics, telecommunications infrastructure, automotive electronics, aerospace, industrial components, appliance, and medical. Strip products compete with companies around the world that produce alloys with similar properties as beryllium and non-beryllium containing alloys. Key competitors include NGK Insulators, Global Brass and Copper, Inc., Wieland Electric, Inc., Aurubis Stolberg GmbH, Diehl Metall Stiftung & Co. KG, Nippon Mining, and PMX Industries, Inc.
- Technical Materials produces engineered strip metal products with 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 a precious metal or other base metal 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 are automotive electronics, consumer electronics, energy, and medical. Technical Materials' major competitors include

Heraeus Inc., AMI Doduco, Inc., and other North American continuous strip and plating companies.

- Beryllium Metals primarily manufactures beryllium-containing products in customized shapes and engineered forms. These materials are used in applications that require high stiffness and/or low density due to their unique combination of properties. Defense and science are the largest end markets for beryllium products, while other end markets served

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include industrial components, commercial aerospace, energy, and telecommunications infrastructure. Direct competitors include American Beryllia Inc., CBL Ceramics Limited, and CoorsTek, Inc.

- 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 strip and bulk products and, to a lesser extent, beryllium products.

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 semiconductor logic and memory, medical, energy, lighting, defense, optics, and wireless communications applications within the consumer electronics, industrial components, and telecommunications infrastructure 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, Sumitomo Metals Industries, Ltd., and Tanaka Holding Co., Ltd., as well as a number of smaller regional and national suppliers.

The majority of the sales into the consumer electronics end market from this segment are vapor deposition targets, lids, wire, other related precious and non-precious metal products, and advanced chemicals for semiconductors and other microelectronic applications. These materials are used in wireless, light-emitting diode (LED), handheld devices and other applications, as well as in a number of applications within the defense end market. Since we are an up-front material supplier, changes in our consumer electronics 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 reporting units:

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.

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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, from consumer electronics to medical devices to highly engineered bushings and bearings for heavy industrial equipment.

Approximately 800 customers purchase our products throughout the consumer electronics, industrial components, defense, medical, automotive electronics, telecommunications infrastructure, energy, commercial aerospace, science, services, and appliance end markets. No single customer accounted for more than 10% of our total net sales for 2018.

Availability of Raw Materials

The principal raw materials we use are aluminum, beryllium, 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, 2018, 2017, and 2016 was $266.0 million, $204.0 million, and $175.5 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, 2018 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, http://investor.shareholder.com/materion/index.cfm, 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 consumer electronics, industrial components, medical, automotive electronics, defense, telecommunications infrastructure, energy, commercial aerospace, and science markets. Each of these 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 consumer electronics, 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. For example, the Christmas season generates increased demand from our customers that manufacture consumer products. 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 2018, 10% of our value-added sales was derived from sales to customers in the 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 could 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 structured 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.

We provide defined benefit pension plans to eligible employees. 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 40% in 2018, 44% in 2017, and 34% in 2016 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; and
- fluctuations in currency exchange rates.

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

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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, 2018, 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 (CERCLA), 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, 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 2018, 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, 2018, 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/Leased	55,000/10,000
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 [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
Singapore [1]	Leased	2,500
Stuttgart, Germany [1]	Leased	24,800
Tokyo, Japan [1]	Leased	7,200
Warren, Michigan [1]	Leased	34,500

(1) Performance Alloys and Composites

(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, 2018, our subsidiary, Materion Brush Inc., was a defendant in one beryllium case (involving four plaintiffs). The case was originally filed and dismissed during 2015, but reversed and remanded in 2016 to the trial court. The Company does not expect the resolution of this matter to have a material impact on the consolidated financial statements.

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, has been continued to September 4, 2019.

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

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 1, 2019, there were 792 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, 2018.

Period	Total Number of Shares Purchased	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 29 through November 2, 2018[(1)]	2,666	$ 56.45	—	$ 15,703,744
November 3 through November 30, 2018	—	—	—	15,703,744
December 1 through December 31, 2018	9,500	44.47	9,500	15,281,289
Total	12,166	$ 47.09	9,500	$ 15,281,289

(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, 2018, we repurchased 9,500 shares at an average price of $44.47 per share, or $0.4 million in the aggregate.

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.

	2014	2015	2016	2017	2018
Materion Corporation	$150	$120	$172	$214	$199
Russell 2000	169	162	196	225	200
S&P SmallCap 600	174	170	215	244	223
S&P SmallCap 600 - Materials	171	127	196	216	168

The above graph assumes that the value of our common shares and each index was $100 on December 31, 2013 and that all applicable dividends were reinvested.

Item 6. SELECTED FINANCIAL DATA
Materion Corporation and Subsidiaries

(Thousands except per share data)	2018	2017	2016	2015	2014
For the year					
Net sales	$1,207,815	$1,139,447	$969,236	$1,025,272	$1,126,890
Income before income taxes(1)	16,342	36,396	25,315	42,818	54,801
Income tax (benefit) expense(2)	(4,504)	24,945	(425)	10,660	12,670
Net income	20,846	11,451	25,740	32,158	42,131
Earnings per share of common stock:					
Basic	1.03	0.57	1.29	1.60	2.06
Diluted	1.01	0.56	1.27	1.58	2.02
Dividends per share of common stock	0.415	0.395	0.375	0.355	0.335
Depreciation, depletion, and amortization	35,524	42,751	45,651	37,817	42,721
Capital expenditures	27,702	27,516	27,177	29,505	29,312
Mine development expenditures	6,558	1,560	9,861	22,585	1,247
Year-end position					
Net current assets	$299,573	$283,834	$254,907	$249,616	$282,628
Ratio of current assets to current liabilities	3.1 to 1	3.2 to 1	3.8 to 1	3.6 to 1	3.7 to 1
Property, plant, and equipment:					
At cost	898,251	891,789	861,267	833,834	800,671
Cost less depreciation, depletion, and amortization	251,018	255,578	252,631	263,629	247,588
Total assets	800,341	791,084	741,298	742,293	761,921
Long-term liabilities(3)	101,401	161,097	150,853	157,182	173,890
Long-term debt	2,066	2,827	3,605	4,276	23,196
Shareholders' equity	553,906	494,981	494,089	482,957	459,019

(1) Income before income taxes for 2018 includes pension settlement charges totaling $41.4 million. For additional information refer to Note O of the Consolidated Financial Statements.
(2) Income tax (benefit) expense 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 H of the Consolidated Financial Statements.
(3) Long-term liabilities include long-term obligations relating to Retirement and post-employment benefits, Unearned income, Capital lease obligations, 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 consumer electronics, industrial components, defense, medical, automotive electronics, telecommunications infrastructure, energy, commercial aerospace, science, services, and appliance.

RESULTS OF OPERATIONS

(Thousands except per share data)	2018	2017	2016
Net sales	$1,207,815	$1,139,447	$969,236
Value-added sales	738,958	677,697	599,910
Gross margin	251,105	212,829	184,528
Gross margin as a % of Value-added sales	34 %	31 %	31 %
Selling, general, and administrative (SG&A) expense	153,489	144,280	128,972
SG&A expense as a % of Value-added sales	21 %	21 %	21 %
Research and development (R&D) expense	15,187	13,981	12,802
R&D expense as a % of Value-added sales	2 %	2 %	2 %
Restructuring expense	5,599	644	2,586
Other — net	15,334	13,893	11,288
Operating profit	61,496	40,031	28,880
Interest expense — net	2,471	2,183	1,789
Other non-operating expense — net	42,683	1,452	1,776
Income before income taxes	16,342	36,396	25,315
Income tax (benefit) expense	(4,504)	24,945	(425)
Net income	20,846	11,451	25,740
Diluted earnings per share	1.01	0.56	1.27

2018 Compared to 2017

Net sales were $1,207.8 million in 2018, reflecting an increase of 6% from 2017. Net sales in the Performance Alloys and Composites segment increased $71.1 million due to higher sales volume and improved commercial execution. Net sales in the Precision Coatings and Advanced Materials segments were relatively flat compared to 2017. Changes in precious metal and copper prices unfavorably impacted net sales in 2018 by approximately $2.7 million when compared to 2017.

Value-added sales were $739.0 million in 2018, an increase of $61.3 million, or 9%, as compared to 2017 value-added sales of $677.7 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. Internally, we manage our business on this basis, and a reconciliation of net sales to value-added sales is included herein.

The increase in value-added sales was primarily driven by commercial excellence initiatives, new product introductions, and stronger demand in the energy, defense, and industrial components end markets. In addition, incremental value-added sales from the high-performance target materials business of the Heraeus Group (HTB) acquisition totaled approximately $9.4 million.

Gross margin was $251.1 million in 2018, or an 18% increase from the $212.8 million gross margin recorded in 2017. Gross margin expressed as a percentage of value-added sales increased to 34% in 2018 from 31% in 2017. The increase in gross margin was primarily due to a combination of higher sales volume and commercial and manufacturing performance improvements.

SG&A expenses totaled $153.5 million in 2018 as compared to $144.3 million in 2017. The increase in SG&A expenses was driven by investments to execute our strategic initiatives and variable costs associated with driving top-line and profit growth. Expressed as a percentage of value-added sales, SG&A expenses were 21% in both 2018 and 2017.

R&D expense consists primarily of direct personnel costs for pre-production evaluation and testing of new products, prototypes, and applications. R&D expense increased 9% to $15.2 million and remained flat as a percentage of value-added sales at approximately 2% in both 2018 and 2017.

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 2018, we recorded $5.6 million of expenses related to restructuring actions taken in our Advanced Materials segment. The Company anticipates that cost savings realized from the staff reduction measures taken during 2018 will increase 2019 operating profit by approximately $3.0 million.

In 2017, restructuring charges of $0.6 million were incurred primarily in our Precision Coatings and Other segments. Refer to Note E of the Consolidated Financial Statements for additional discussion.

Other-net totaled expense of $15.3 million and $13.9 million in 2018 and 2017, respectively. In 2018, metal consignment fees increased $2.2 million. In addition we recorded $1.5 million of foreign currency losses, compared to $0.7 million of foreign currency gains recognized in 2017. These increases were partially offset by a $2.4 million decrease in the amortization of intangible assets. Refer to Note F of the Consolidated Financial Statements for the major components of Other-net.

Interest expense - net was $2.5 million in 2018 and $2.2 million in 2017. The increase is primarily due to a capital lease entered into in 2017 in connection with the HTB acquisition.

Other non-operating expense-net includes components of pension and post-retirement expense other than service costs. The increase in other non-operating expense in 2018 compared to 2017 is due to $41.4 million in pension settlements recorded in 2018, primarily related to the purchase of a group annuity contract to relieve the Company of responsibility for certain pension benefit obligations. Refer to Note O of the Consolidated Financial Statements for details of the components of net periodic benefit costs.

Income tax (benefit) expense for 2018 was a benefit $4.5 million versus expense of $24.9 million in 2017. The effective tax rate for 2018 was negative 27.6% compared to an effective tax rate of 68.5% for 2017. The TCJA resulted in an expense of $17.1 million in 2017 and a benefit of $11.1 million in 2018. Refer to Note H to the Consolidated Financial Statements for further details on income taxes.

2017 Compared to 2016

Net sales were $1,139.4 million in 2017, reflecting an increase of 18% from 2016. Changes in precious metal and copper prices favorably impacted net sales in 2017 by approximately $13.1 million when compared to 2016. Net sales in the Performance Alloys and Composites segment increased $41.9 million due to higher sales volume, including shipments of raw material beryllium hydroxide. Net sales of $119.7 million during 2017 were attributable to the HTB acquisition. Excluding the HTB acquisition, net sales in the Advanced Materials segment increased $33.9 million due to higher sales volume in the consumer electronics and industrial components end markets. These favorable impacts were offset by lower sales volume in the medical end market in the Precision Coatings segment.

Value-added sales were $677.7 million in 2017, an increase of $77.8 million as compared to 2016 value-added sales of $599.9 million. Value-added sales from the HTB acquisition totaled approximately $36.5 million in 2017. Excluding the HTB acquisition, value-added sales to the consumer electronics end market, which accounted for 30% of our total value-added sales during 2017, increased $17.2 million from the prior year. Also, value-added sales in the industrial components end market increased $12.3 million from the prior year.

Gross margin was $212.8 million in 2017, or a 15% increase from the $184.5 million gross margin recorded in 2016. Gross margin expressed as a percentage of value-added sales was 31% in both 2017 and 2016. The increase in gross margin was primarily due to higher sales volume.

SG&A expenses totaled $144.3 million in 2017 as compared to $129.0 million in 2016. Expressed as a percentage of value-added sales, SG&A expenses were 21% in both 2017 and 2016. The increase is attributable to normal course of business expenses from the HTB acquisition of $5.9 million, $4.1 million of CEO transition costs, and higher variable compensation expense related to improved financial performance.

R&D expense was flat as a percentage of value-added sales at approximately 2% in both 2017 and 2016.

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 2017, restructuring charges of $0.6 million were incurred in our Precision Coatings and Other segments. In 2016, we incurred $2.6 million in restructuring expenses related to the closure of our service center in Fukaya, Japan. Refer to Note E of the Consolidated Financial Statements for additional discussion.

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Other-net totaled expense of $13.9 million and $11.3 million in 2017 and 2016, respectively. Refer to Note F of the Consolidated Financial Statements for the major components of Other-net.
Interest expense - net was $2.2 million in 2017 and $1.8 million in 2016. The lower expense in 2016 resulted from lower average outstanding debt levels.
Other non-operating expense-net includes components of pension and post-retirement expense other than service costs. Refer to Note O for details of the components of net periodic benefit costs.
Income tax (benefit) expense for 2017 was $24.9 million versus a benefit of $0.4 million in 2016. The effective tax rate for 2017 was 68.5% compared to a negative effective tax rate of 1.7% for 2016.
On December 22, 2017, the TCJA was signed into law, resulting in an expense of $17.1 million in 2017. The TCJA includes a number of provisions, including the lowering of the U.S. corporate tax rate from 35 percent to 21 percent, effective January 1, 2018. The TCJA also includes provisions that may partially offset the benefit of such rate reduction, including the repeal of the deduction for domestic production activities. The international provisions of the TCJA establish a territorial-style system for taxing foreign-source income of domestic multinational corporations. As a result of the TCJA, we recorded adjustments for the re-measurement of deferred tax assets (liabilities) and the deemed repatriation tax on unremitted foreign earnings and profits. Refer to Note H of the Consolidated Financial Statements for a discussion of the impact of compliance with the TCJA and a reconciliation of the statutory and effective tax rates.
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)	2018	2017	2016
Net sales	$500,590	$429,442	$387,539
Value-added sales	425,471	363,465	332,012
Operating profit	58,832	21,978	6,601

2018 Compared to 2017
Net sales from the Performance Alloys and Composites segment of $500.6 million in 2018 were 17% higher than net sales of $429.4 million in 2017 primarily due to higher sales volume principally in the energy, defense, and industrial components end markets, as well as improved commercial execution. In addition, the impact of higher pass-through metal prices favorably impacted net sales by approximately $3.9 million.
Value-added sales of $425.5 million in 2018 were 17% higher than value-added sales of $363.5 million in 2017. The increase in value-added sales was impacted by the same factors driving the net sales increase.
Performance Alloys and Composites generated operating profit of $58.8 million, or 14% of value-added sales, in 2018 as compared to $22.0 million, or 6% of value-added sales, in 2017. Operating profit in 2018 was favorably impacted by higher sales volume, favorable product mix, and improved manufacturing performance.
2017 Compared to 2016
Net sales from the Performance Alloys and Composites segment of $429.4 million in 2017 were 11% higher than net sales of $387.5 million in 2016 primarily due to higher sales volume primarily related to the industrial components, consumer electronics, and automotive electronics end markets and higher raw material sales of beryllium hydroxide. In addition, the impact of higher pass-through metal prices favorably impacted net sales by approximately $8.9 million.
Value-added sales of $363.5 million in 2017 were 9% higher than value-added sales of $332.0 million in 2016. Stronger demand in the consumer electronics and industrial components end markets increased value-added sales by $14.7 million compared to 2016. Also, the increase in value-added sales was driven by higher raw material sales of beryllium hydroxide of approximately $7.1 million.
Performance Alloys and Composites generated operating profit of $22.0 million, or 6% of value-added sales, in 2017 as compared to $6.6 million, or 2% of value-added sales, in 2016. Operating profit in 2017 was favorably impacted by

higher sales volume, favorable product mix, and productivity improvements. Additionally, a $1.4 million gain was realized on the sale of our service

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center located in Fukaya, Japan. Operating profit in 2016 was negatively impacted by unfavorable product mix and manufacturing yields, the negative impact of foreign exchange rate movements, and a $2.6 million impairment charge relating to the closure of our service center located in Fukaya, Japan.

Advanced Materials

(Thousands)	2018	2017	2016
Net sales	$586,643	$590,789	$437,249
Value-added sales	223,714	228,062	176,332
Operating profit	17,651	32,763	26,282

2018 Compared to 2017

Net sales from the Advanced Materials segment of $586.6 million in 2018 were 1% lower than net sales of $590.8 million in 2017, primarily due to the impact of unfavorable pass-through metal prices of $8.9 million.

Value-added sales of $223.7 million were 2% lower than value-added sales of $228.1 million in 2017. During 2018, the HTB acquisition contributed incremental value-added sales of $9.4 million. Excluding the HTB acquisition, value-added sales decreased $13.7 million, or 7%, driven by softer demand in the consumer electronics end market.

Advanced Materials generated operating profit of $17.7 million in 2018 as compared to $32.8 million in 2017. Operating profit in 2018 was impacted by unfavorable product mix, particularly within the consumer electronics end market, as well as integration and ramp up expenses related to the move of the HTB business in Germany to a new state-of-the-art facility.

2017 Compared to 2016

Net sales from the Advanced Materials segment of $590.8 million in 2017 were 35% higher than net sales of $437.2 million in 2016. Net sales of $119.7 million during 2017 were attributable to the HTB acquisition. Also, net sales increased due to a combination of new product sales growth and demand in the consumer electronics end market. In addition, the impact of higher pass-through metal prices favorably impacted net sales by approximately $1.9 million.

Value-added sales of $228.1 million were 29% higher than value-added sales of $176.3 million in 2016. This increase included value-added sales of $36.5 million attributable to our HTB acquisition. The increase in value-added sales was also driven by higher value-added sales to the consumer electronics end market. Value-added sales to the consumer electronics end market, which represents approximately 49% of total segment value-added sales in 2017, increased $11.0 million primarily due to higher demand, excluding the HTB acquisition.

Advanced Materials generated operating profit of $32.8 million in 2017 as compared to $26.3 million in 2016. Operating profit as a percentage of value-added sales was 14% in 2017 compared to 15% in 2016. The increase in operating profit in 2017 versus 2016 was primarily due to higher sales volume.

Precision Coatings

(Thousands)	2018	2017	2016
Net sales	$120,582	$119,216	$144,448
Value-added sales	94,231	90,678	97,700
Operating profit	11,468	8,445	11,635

2018 Compared to 2017

Net sales for the Precision Coatings segment were $120.6 million in 2018 as compared to $119.2 million in 2017, and value-added sales were $94.2 million in 2018 versus $90.7 million in 2017. The increase was primarily due to success in new product sales and improved end-market demand, principally in the defense end market.

The Precision Coatings segment reported an operating profit of $11.5 million, or 12% of value-added sales, in 2018 versus $8.4 million, or 9% of value-added sales, in 2017. The increase in operating profit was driven by a combination of sales growth, cost reduction actions, and improved manufacturing performance.

2017 Compared to 2016

Net sales for the Precision Coatings segment were $119.2 million in 2017 as compared to $144.4 million in 2016, and value-added sales were $90.7 million in 2017 versus $97.7 million in 2016. Higher sales from new imaging and sensing applications were more than offset by lower sales in the medical end market. Sales decreased $8.4 million primarily due to lower volume in the blood glucose test strip segment of the medical end market.

The Precision Coatings segment reported an operating profit of $8.4 million, or 9% of value-added sales, in 2017 versus $11.6 million, or 12% of value-added sales, in 2016. The decrease in operating profit in 2017 versus 2016 was due to lower sales volume and the absence of a gain on the sale of equipment of $0.7 million realized during 2016.

Other

(Thousands)	2018	2017	2016
Net sales	$ —	$ —	$ —
Value-added sales	(4,458)	(4,508)	(6,134)
Operating loss	(26,455)	(23,155)	(15,638)

2018 Compared to 2017

The Other reportable segment in total includes unallocated corporate costs.

Corporate costs of $26.5 million in 2018 increased $3.3 million as compared to $23.2 million in 2017. As a percent of total Company value-added sales, corporate costs increased to 4% in 2018 from 3% in 2017. The increase is reflective of investments to execute our strategic initiatives and variable costs associated with improved financial performance.

2017 Compared to 2016

Corporate costs of $23.2 million in 2017 increased $7.6 million as compared to $15.6 million in 2016. Corporate costs were 3% of total Company value-added sales in both 2017 and 2016. The increase in corporate costs in 2017 compared to 2016 was primarily due to costs associated with the CEO transition of $4.1 million and higher variable compensation expense relating to improved performance levels.

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 2018, 2017, and 2016 is as follows:

(Thousands)	2018	2017	2016
Net sales			
Performance Alloys and Composites	$500,590	$429,442	$387,539
Advanced Materials	586,643	590,789	437,249
Precision Coatings	120,582	119,216	144,448
Other	—	—	—
Total	$1,207,815	$1,139,447	$969,236
Less: pass-through metal costs			
Performance Alloys and Composites	$75,119	$65,977	$55,527
Advanced Materials	362,929	362,727	260,917
Precision Coatings	26,351	28,538	46,748
Other	4,458	4,508	6,134
Total	$468,857	$461,750	$369,326
Value-added sales			
Performance Alloys and Composites	$425,471	$363,465	$332,012
Advanced Materials	223,714	228,062	176,332
Precision Coatings	94,231	90,678	97,700
Other	(4,458)	(4,508)	(6,134)
Total	$738,958	$677,697	$599,910

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 from (used in) operating, investing, and financing activities is as follows:

(Thousands)	2018	2017	2016
Net cash provided by operating activities	$76,374	$67,795	$68,180
Net cash (used in) investing activities	(33,828)	(43,358)	(37,355)
Net cash (used in) financing activities	(13,605)	(15,445)	(23,118)
Effects of exchange rate changes	(140)	1,388	(479)
Net change in cash and cash equivalents	$28,801	$10,380	$7,228

Net cash provided by operating activities totaled $76.4 million in 2018 versus $67.8 million in 2017. Higher net income of $9.4 million was due to improved performance, specifically in the Performance Alloys and Composites segment. In conjunction with our pension annuitization transaction, we remeasured the periodic benefit obligation of our domestic pension plan and recorded settlement charges totaling $41.4 million during 2018. In addition, we contributed $42.0 million to our domestic pension plan during 2018.

Working capital requirements provided cash of $5.8 million during 2018 compared to providing $6.5 million in 2017. Cash flows provided by accounts receivable increased $11.3 million due to increased sales volumes and timing of collections. Three-month trailing days sales outstanding (DSO) was approximately 41 days at December 31, 2018 versus 37 days at December 31, 2017. Cash flows used by inventory decreased $13.7 million primarily within the Advanced Materials segment to respond to anticipated orders and demand. Cash flows from accounts payable and accrued expenses provided cash of approximately $8.8 million compared to $34.4 million in the prior year primarily resulting from a higher accounts payable balance, due to the timing of payments, and the HTB acquisition in prior year.

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 $33.8 million in 2018 compared to $43.4 million in 2017, reflecting the $16.5 million payment for the HTB acquisition in 2017 offset by higher payments for property, plant, and equipment and mine development of $5.2 million in 2018.

Net cash used in financing activities decreased $1.8 million from 2017 due to lower payments of withholding taxes for stock-based compensation awards and less repurchases of common stock.

Dividends per common share increased 5% to $0.415 per share in 2018. Total dividend payments to common shareholders were $8.4 million in 2018 and $7.9 million in 2017. In May 2018, the Board of Directors declared an increase in our quarterly dividend from $0.100 to $0.105 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, 2018, cash and cash equivalents held by our foreign operations totaled $14.1 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, 2018 and December 31, 2017 is as follows:

	December 31,	
(Thousands)	2018	2017
Cash	$70,645	$41,844
Total outstanding debt	3,041	3,818
Net cash	67,604	38,026

Available borrowing capacity	$275,488	$254,777

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.

The Company's revolving credit agreement (Credit Agreement) expires in 2020 and is 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 us 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, 2018 and December 31, 2017. 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. As a result we have negotiated increases in the available capacity under existing lines, added additional lines, and extended the maturity dates of existing lines in recent years. The most recent amendment, completed in the third quarter of 2016 with our largest precious metals consignment facility, extended the maturity date from September 30, 2016 to September 30, 2019 and provided for more favorable pricing for fixed rate consignments. The available and unused capacity under the metal financing lines totaled approximately $133.9 million as of December 31, 2018. 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)	2019	2020	2021	2022	2023	There-after	Total
Total debt (1)	$0.8	$0.9	$1.3	$—	$—	$—	$3.0
Capital lease payments (2)	2.2	2.2	2.2	2.2	1.4	21.0	31.2
Interest payments on total debt (3)	0.2	0.1	—	—	—	—	0.3
Non-cancelable lease payments (4)	7.3	6.5	5.0	3.8	3.5	4.3	30.4
Pension plan contribution (5)	6.0	—	—	—	—	—	6.0
Other long-term liabilities (6)	1.2	2.9	0.6	0.9	0.4	0.5	6.5
Purchase obligations	0.9	0.3	0.3	0.3	1.7	1.7	5.2
Total	$18.6	$12.9	$9.4	$7.2	$7.0	$27.5	$82.6

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

(2) The capital 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, 2018.

(5) Our domestic defined benefit pension plan is underfunded as of December 31, 2018. Contributions in future periods 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 2019 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 $6.5 million at both December 31, 2018 and December 31, 2017. Environmental projects tend to be long term, and the associated payments are typically made over a number of years. Refer to Note S of 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 $316.1 million as of December 31, 2018 versus $320.0 million as of December 31, 2017. We were in compliance with all of the covenants contained in the consignment agreements as of December 31, 2018 and December 31, 2017. Refer to Note J 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 88 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 and (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) for which are 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, 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
As of December 31, 2017			
Tonnage (in thousands)	8,119	945	9,064
Grade (% beryllium)	0.248%	0.257 %	0.249%
Beryllium pounds (in millions)	40.34	4.85	45.19

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

(Thousands of Pounds of Beryllium)	2018	2017	2016
Domestic ore	368	326	339
Non-domestic ore	—	12	23
Unyielded total	368	338	362
Annual yield	88 %	88 %	88 %
Beryllium produced	324	296	318
% of mill capacity	50 %	47 %	42 %

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

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customer. The core principle of 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 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 B 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 S 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 2018 and 2017, 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. Historically, the Company used a weighted-average approach to determine the service and interest components of its net periodic benefit costs. The change was accounted for as a change in estimate and, accordingly, has been accounted for prospectively starting in 2017.

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 6.75% at December 31, 2018 and 7.00% at December 31, 2017. 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 2019 projected pension expense approximately $0.7 million. A 0.25 percentage point decrease in the expected rate of return assumption would increase the 2019 projected pension expense by approximately $0.4 million.

Refer to Note O 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 $15.9 million associated with certain federal, state, and foreign deferred tax assets as of year-end 2018, primarily for net operating loss carryforwards.

Refer to Note H 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 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 $50.3 million as of December 31, 2018. Within the Precision Coatings segment, goodwill totaled $17.9 million and $20.6 million relating to the Precision Optics and Large Area Coatings reporting units, respectively, as of December 31, 2018. The remaining $1.9 million is related to the Beryllium reporting unit within 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. We opted to bypass step zero and proceeded to perform a "step one" quantitative assessment for each of our reporting units. The results of the step one indicated that no goodwill impairment existed.
In the step one, we estimated the fair value of each of our reporting units using a discounted cash flow (DCF) model. Each reporting unit prepared operating forecasts which include 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. These forecasts are reviewed and approved by management and serve as the basis for the assumptions used in the DCF. The DCF included three 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 estimates of future cash flows, other significant estimates involved in the determination of fair value of the reporting units were the discount rates and growth rates used in the DCF model. The discount rates used in the DCF model consider market and industry data as well as specific risk premiums for each reporting unit. The growth rate for each reporting unit, for the purpose of calculating cash flows through perpetuity, was set after the forecasted period.
Changes in market conditions could increase the discount rate in the future, thus decreasing the fair value of the reporting unit. A hypothetical 1% increase in the discount rate, holding all other assumptions constant, would not have decreased the fair value of any reporting unit below that of its carrying value.
The sales growth assumption for each reporting unit was based on future secured orders, as well as growth in certain markets due to the introduction of new products. The key uncertainty in the sales growth assumption, as discussed in Item 1A "Risk Factors," is our inability to accurately predict the timing and magnitude of sales of our products, especially newly introduced products. The assumed growth rate for cash flows beyond the forecast period was approximately 3%. A hypothetical 1% decrease in the growth rate, holding all other assumptions constant, would not have decreased the fair value of any reporting unit below that of its carrying value.
Precious metal prices, particularly palladium used by our Large Area Coatings reporting unit, have fluctuated significantly in recent years. The key risks with the precious metal pricing assumption, as discussed in Item 1A "Risk

Factors," is our inability to pass the higher raw material costs to the customer along with the possibility that rising prices could deter our customers from purchasing our products and adversely affect our net sales and operating profit. We also compared the market capitalization as of December 31, 2018 to the carrying value of our equity, noting no impairment indicators or triggering events.

We are unaware of any current market trends that are contrary to the assumptions made in the valuation of our reporting units. If actual results are not consistent with the assumptions made in the determination of the fair value of our reporting units, especially assumptions regarding future sales growth from new products and applications, it is possible that the estimated fair value of certain reporting units could fall below their carrying value and cause the reporting unit to fail step one of the goodwill impairment test.

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, 2018, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately $4.5 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, 2018, we had no 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, 2018, the additional pre-tax cost to us as a result of an increase in the consignment fee would be approximately $0.2 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 2018, 2017, or 2016 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, 2018. 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 $38.7 million as of December 31, 2018. If the dollar weakened 10% against the currencies we have hedged from the December 31, 2018 exchange rates, the reduced gain and/or increased loss on the outstanding contracts as of December 31, 2018 would reduce pre-tax profits by approximately $3.9 million in 2018. 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 year-end 2018. 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, 2018. 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, 2018, the Company’s internal control over financial reporting is effective.

The effectiveness of our internal control over financial reporting as of December 31, 2018 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 as of December 31, 2018 and 2017, and 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, 2018 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, 2018 and 2017, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018, 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, 2018, 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 14, 2019 expressed an unqualified opinion thereon.
Basis for Opinion
These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.
We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/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 14, 2019

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, 2018, 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, 2018, 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, 2018 and 2017, and 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, 2018 and the related notes and financial statement schedule listed in the Index at Item 15(a) (collectively referred to as the "consolidated financial statements") of the Company and our report dated February 14, 2019 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 14, 2019

Materion Corporation and Subsidiaries
Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Income

(Thousands except per share amounts)	2018	2017	2016
Net sales	$1,207,815	$1,139,447	$969,236
Cost of sales	956,710	926,618	784,708
Gross margin	251,105	212,829	184,528
Selling, general, and administrative expense	153,489	144,280	128,972
Research and development expense	15,187	13,981	12,802
Restructuring expense (Note E)	5,599	644	2,586
Other — net (Note F)	15,334	13,893	11,288
Operating profit	61,496	40,031	28,880
Interest expense — net (Note G)	2,471	2,183	1,789
Other non-operating expense — net (Note O)	42,683	1,452	1,776
Income before income taxes	16,342	36,396	25,315
Income tax (benefit) expense (Note H)	(4,504)	24,945	(425)
Net income	$20,846	$11,451	$25,740
Basic earnings per share:			
Net income per share of common stock	$1.03	$0.57	$1.29
Diluted earnings per share:			
Net income per share of common stock	$1.01	$0.56	$1.27
Cash dividends per share	$0.415	$0.395	$0.375
Weighted-average number of shares of common stock outstanding:			
Basic	20,212	20,027	19,983
Diluted	20,613	20,415	20,213

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

Materion Corporation and Subsidiaries
Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Comprehensive Income (Loss)

(Thousands)	2018	2017	2016
Net income	$20,846	$11,451	$25,740
Other comprehensive income:			
Foreign currency translation adjustment	(484)	1,552	(172)
Derivative and hedging activity, net of tax benefit (expense) of $672, ($271), and ($149)	138	(1,074)	258
Pension and post-employment benefit adjustment, net of tax (expense) benefit of ($13,300), ($13,820), and $4,555	45,049	(17,234)	(5,562)
Other comprehensive income (loss)	44,703	(16,756)	(5,476)
Comprehensive income (loss)	$65,549	$(5,305)	$20,264

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

Materion Corporation and Subsidiaries
Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Cash Flows

(Thousands)	2018	2017	2016
Cash flows from operating activities:			
Net income	$20,846	$11,451	$25,740
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation, depletion, and amortization	35,524	42,751	45,651
Amortization of deferred financing costs in interest expense	1,009	919	666
Stock-based compensation expense (non-cash)	5,313	4,957	3,174
Amortization of pension and post-retirement costs	5,551	4,865	4,060
Loss (gain) on sale of property, plant, and equipment	518	234	(648)
Deferred income tax (benefit) expense	(1,318)	20,256	(9,010)
Pension settlement charges	41,406	—	120
Changes in assets and liabilities net of acquired assets and liabilities:			
Decrease (increase) in accounts receivable	(7,219)	(18,484)	(4,096)
Decrease (increase) in inventory	4,234	(9,462)	10,791
Decrease (increase) in prepaid and other current assets	1,162	(11,606)	658
Increase (decrease) in accounts payable and accrued expenses	8,820	34,433	2,758
Increase (decrease) in unearned revenue	477	4,336	(2,590)
Increase (decrease) in interest and taxes payable	435	(514)	2,511
Domestic pension plan contributions	(42,000)	(16,000)	(16,000)
Other — net	1,616	(341)	4,395
Net cash provided by operating activities	76,374	67,795	68,180
Cash flows from investing activities:			
Payments for purchase of property, plant, and equipment	(27,702)	(27,516)	(27,177)
Payments for mine development	(6,558)	(1,560)	(9,861)
Payments for acquisition	—	(16,504)	(1,750)
Proceeds from sale of property, plant, and equipment	432	2,222	1,433
Net cash (used in) investing activities	(33,828)	(43,358)	(37,355)
Cash flows from financing activities:			
Repayment of short-term debt	—	—	(8,305)
Proceeds from issuance of long-term debt	—	55,000	10,000
Repayment of long-term debt	(777)	(55,797)	(10,694)
Principal payments under capital lease obligations	(861)	(843)	(736)
Cash dividends paid	(8,389)	(7,913)	(7,496)
Deferred financing costs	—	(300)	(1,000)
Repurchase of common stock	(422)	(1,086)	(3,798)
Payments of withholding taxes for stock-based compensation awards	(3,156)	(4,506)	(1,089)
Net cash (used in) financing activities	(13,605)	(15,445)	(23,118)
Effects of exchange rate changes	(140)	1,388	(479)
Net change in cash and cash equivalents	28,801	10,380	7,228
Cash and cash equivalents at beginning of period	41,844	31,464	24,236
Cash and cash equivalents at end of period	$70,645	$41,844	$31,464

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

Materion Corporation and Subsidiaries
December 31, 2018 and 2017
Consolidated Balance Sheets

(Thousands)	2018	2017
Assets		
Current assets		
Cash and cash equivalents (Note A)	$70,645	$41,844
Accounts receivable (Note A)	130,538	124,014
Inventories, net (Notes A and J)	214,871	220,352
Prepaid and other current assets	23,299	24,733
Total current assets	439,353	410,943
Deferred income taxes (Notes A and H)	5,616	17,047
Property, plant, and equipment (Notes A and K)	898,251	891,789
Less allowances for depreciation, depletion, and amortization	(647,233)	(636,211)
Property, plant, and equipment — net	251,018	255,578
Intangible assets (Notes A and L)	6,461	9,847
Other assets	7,236	6,992
Goodwill (Notes A and L)	90,657	90,677
Total Assets	$800,341	$791,084
Liabilities and Shareholders' Equity		
Current liabilities		
Short-term debt (Note M)	$823	$777
Accounts payable	49,622	49,059
Salaries and wages	47,501	42,694
Other liabilities and accrued items	33,301	28,044
Income taxes (Notes A and H)	2,615	1,084
Unearned revenue	5,918	5,451
Total current liabilities	139,780	127,109
Other long-term liabilities	14,764	14,895
Capital lease obligations	15,221	16,072
Retirement and post-employment benefits (Note O)	38,853	93,225
Unearned income (Note A)	32,563	36,905
Long-term income taxes (Notes A and H)	2,993	4,857
Deferred income taxes (Notes A and H)	195	213
Long-term debt (Note M)	2,066	2,827
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 2018 and 2017)	234,704	223,484
Retained earnings	548,374	536,116
Common stock in treasury (6,906 shares for 2018 and 7,042 shares for 2017)	(175,426)	(166,128)
Accumulated other comprehensive loss (Note P)	(58,234)	(102,937)
Other equity	4,488	4,446
Total shareholders' equity	553,906	494,981
Total Liabilities and Shareholders' Equity	$800,341	$791,084

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

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Materion Corporation and Subsidiaries
Years Ended December 31, 2018, 2017, and 2016
Consolidated Statements of Shareholders’ Equity

(Thousands)	Common Stock	Retained Earnings	Common Stock In Treasury	Accumulated Other Comprehensive Income (Loss)	Other Equity	Total
Balance at January 1, 2016	$208,967	$499,659	$(148,559)	$ (80,705)	$3,595	$482,957
Net income	—	25,740	—	—	—	25,740
Other comprehensive income (loss)	—	—	—	(5,476)	—	(5,476)
Cash dividends declared	—	(7,496)	—	—	—	(7,496)
Stock-based compensation activity	3,764	—	(1,762)	—	—	2,002
Repurchase of 147 shares	—	—	(3,798)	—	—	(3,798)
Directors' deferred compensation	(29)	—	(280)	—	469	160
Balance at December 31, 2016	$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	—	(7,913)	—	—	—	(7,913)
Stock-based compensation activity	10,750	—	(10,300)	—	—	450
Repurchase of 32 shares	—	—	(1,086)	—	—	(1,086)
Directors’ deferred compensation	32	—	(343)	—	382	71
Balance at December 31, 2017	$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
Pension settlement charges	—	—	—	41,406	—	41,406
Tax Cuts and Jobs Act Reclassification	—	(575)	—	575	—	—
Cumulative effect of accounting change	—	425	—	—	—	425
Cash dividends declared	—	(8,389)	—	—	—	(8,389)
Stock-based compensation activity	11,131	(49)	(8,924)	—	—	2,158
Repurchase of 10 shares	—	—	(422)	—	—	(422)
Directors’ deferred compensation	89	—	48	—	42	179
Balance at December 31, 2018	$234,704	$548,374	$(175,426)	$ (58,234)	$4,488	$553,906

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

Materion Corporation and Subsidiaries
Notes to 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 consumer electronics, industrial components, defense, medical, automotive electronics, telecommunications infrastructure, energy, commercial aerospace, science, services, and appliance. The Company has four reportable segments: Performance Alloys and Composites, Advanced Materials, Precision Coatings, and Other. Other includes unallocated corporate costs.

Refer to Note D 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.

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

The amounts reflected in Note C are the results of the final purchase price allocation.

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, 2018. 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, 2018, the Company had $50.3 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 $616 and $640 at December 31, 2018 and 2017, 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 57% of inventories, net in 2018, and 52% of inventories, net in 2017.

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 capital 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.

Asset Impairment: In the event that facts and circumstances indicate that the carrying value of long-lived assets may be impaired, an evaluation of recoverability is performed by comparing the carrying value of the assets to the associated estimated future undiscounted cash flow. If the carrying value exceeds that cash flow, then the assets are written down to their fair values.

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.

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 $1,196 in 2018, $1,252 in 2017, and $1,163 in 2016.

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 Q for additional information about stock-based compensation.

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

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

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

New Pronouncements Adopted: In March 2017, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2017-07, Improving the Presentation of Net Periodic Pension Cost and Net Periodic Post-retirement Benefit Cost, which requires an employer to report the service cost component of net benefit cost in the same line item as other compensation costs arising from services rendered by pertinent employees during the period. This ASU requires non-service cost components of net benefit cost to be presented in a caption below the Company's Operating profit and allows only the service cost component to be eligible for capitalization. This ASU is effective for fiscal years beginning after December 15, 2017, including interim periods within those periods, with early adoption permitted. The Company adopted the new standard as of January 1, 2018 and applied its amendments retrospectively for the presentation of service cost and other components of net benefit cost on the income statement and prospectively for the capitalization of service cost and net periodic post-retirement benefits in assets. The application of ASU 2017-07 resulted in an increase to Operating profit of $1.5 million and $1.8 million for 2017 and

2016, respectively, which was offset by a corresponding increase in Other non-operating expense, net. The adoption of this ASU did not have a material effect on the Company's financial condition or liquidity. The Company utilized this ASU's practical expedient, which permits the Company to use the amounts disclosed in its Pensions and Other Post-employment Benefits note for the prior comparative periods as the estimation basis for applying the retrospective presentation requirements.

In May 2014, the FASB issued ASU 2014-09, Revenue from Contracts with Customers (ASC 606), which supersedes previous revenue recognition guidance. The Company adopted the new standard using the modified retrospective method as of January 1, 2018. Prior periods were not retrospectively adjusted. This approach was applied to all contracts not completed as of January 1, 2018. The new standard primarily impacted the Company's timing of revenue recognition for certain contracts and subcontracts with the United States (U.S.) government that contain termination for convenience clauses, and due to the cumulative impact of adopting ASC 606, the Company recorded an increase to beginning retained earnings of $0.4 million, net of tax as summarized below:

(Thousands)	December 31, 2017	Adjustments due to ASC 606	January 1, 2018
Assets			
Unbilled receivables	$ —	$ 2,658	$ 2,658
Inventories	220,352	(2,059)	218,293
Liabilities and Shareholders' Equity			
Other liabilities and accrued items	$ 28,044	61	28,105
Deferred income taxes	213	113	326
Retained earnings	536,116	425	536,541

The adoption of the standard did not have a material impact to the Company's consolidated financial statements. Refer to Note B for additional disclosures relating to ASC 606.
New Pronouncements Issued: 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. This ASU is effective for fiscal years beginning after December 15, 2018, including interim periods within those periods, with early adoption permitted. The Company is currently evaluating the impact of adopting this new guidance on its consolidated financial statements.
In February 2016, the FASB issued ASU 2016-02, Leases, which eliminates the off-balance-sheet accounting for leases. The new guidance will require lessees to report their operating leases as both an asset and liability on the balance sheet and disclose key information about leasing arrangements. This ASU is required to be applied using a modified retrospective adoption method with the option of applying the guidance either retrospectively to each prior comparative reporting period presented or retrospectively at the beginning of the period of adoption. This ASU is effective for interim and annual periods on January 1, 2019, and the Company will apply 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 will not elect the hindsight transitional practical expedient. The Company also will apply the practical expedient to not separate lease and non-lease components to new leases as well as existing leases through transition. The Company will elect an accounting policy to not apply recognition requirements of the guidance to short-term leases.

The Company is nearing completion of its assessment process and its determination of the expanded disclosure regarding leases, as well as the impact to the consolidated financial statements. The Company is also concluding its testing of the functionality and related controls of a new third-party lease accounting system and implementing other new processes and controls to support recognition and disclosure under the new lease standard. The adoption of the new standard will result in the recording of lease assets and lease liabilities for operating leases in the range of approximately $26 million to $28 million as of January 1, 2019. 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 ASUs are expected to have a material effect on the Company's results of operations, financial condition, or liquidity.

Note B — 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, 2018. Remaining performance obligations include noncancelable 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, 2018, the aggregate amount of the transaction price allocated to remaining performance obligations was approximately $28.8 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, 2018	January 1, 2018	$ change	% change	
Accounts receivable, trade	$124,498	$122,393	$2,105	2	%
Unbilled receivables	4,619	2,658	1,961	74	%
Unearned revenue	5,918	5,451	467	9	%

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 2018.

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.

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 C — Acquisitions

On February 28, 2017, the Company acquired the high-performance target materials business of the Heraeus Group (HTB), of Hanau, Germany, for $16.5 million. This business manufactures precious and non-precious metal target materials for the architectural and automotive glass, electronic display, photovoltaic, and semiconductor markets at facilities in Germany, Taiwan, and the United States. This business operates within the Advanced Materials segment, and the results of operations are included as of the date of acquisition.

The final purchase price allocation for the acquisition is as follows:

(Thousands)	Amount
Assets:	
Inventories	$7,221
Prepaid and other current assets	2,270
Deferred income taxes	14
Property, plant, and equipment	6,501
Intangible assets	3,649
Goodwill	3,574
Total assets acquired	$23,229
Liabilities:	
Other liabilities and accrued items	$984
Other long-term liabilities	449
Retirement and post-employment benefits	5,292
Total liabilities assumed	$6,725
Total purchase price	$16,504

No material measurement period adjustments were recorded upon finalizing the purchase price allocation in the first quarter of 2018.

Note D — 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 produces strip and bulk form alloy products, strip metal products with clad inlay and overlay metals, beryllium-based metals, beryllium, and aluminum metal matrix composites, in rod, sheet, foil, and a variety of customized forms, beryllia ceramics, and bulk metallic glass materials.

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
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
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
Assets	418,798	202,389	97,504	72,393	791,084
2016					
Net sales	$ 387,539	$437,249	$144,448	$ —	$969,236
Intersegment sales	240	70,457	—	—	70,697
Operating profit (loss)	6,601	26,282	11,635	(15,638)	28,880
Depreciation, depletion, and amortization	27,059	6,644	9,945	2,003	45,651
Expenditures for long-lived assets	26,604	4,931	3,176	2,327	37,038
Assets	422,787	133,682	108,788	76,041	741,298

Intersegment sales are eliminated in consolidation.

The primary measures of evaluating segment performance is 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)	2018	2017	2016
Net sales			
United States	$726,881	$650,675	$639,675
Asia	270,672	265,991	193,739
Europe	186,081	205,118	121,648
All other	24,181	17,663	14,174
Total	$1,207,815	$1,139,447	$969,236
Long-lived assets by country deployed			
United States	$215,395	$227,412	$240,309
All other	35,623	28,166	12,322
Total	$251,018	$255,578	$252,631

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 2018:

(Thousands)	Performance Alloys and Composites	Advanced Materials	Precision Coatings	Other	Total
2018					
End Market					
Consumer Electronics	$ 103,339	$ 327,355	$ 18,886	$ —	$ 449,580
Industrial Components	101,646	46,988	11,139	—	159,773
Energy	41,474	77,248	12	—	118,734
Automotive Electronics	78,963	—	1,521	—	80,484
Defense	45,162	15,233	20,077	—	80,472
Medical	8,349	17,627	65,125	—	91,101
Telecom Infrastructure	38,526	28,437	59	—	67,022
Other	83,131	73,755	3,763	—	160,649
Total	$ 500,590	$ 586,643	$ 120,582	$ —	$ 1,207,815

Intersegment sales are eliminated in consolidation.

Note E — Restructuring

In both 2018 and 2017, 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 2018 were in the Advanced Materials segment and included severance associated with approximately forty employees and other related costs. Remaining severance payments related to these initiatives of $5.3 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 2019 and does not expect to incur additional costs related to these initiatives.

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

In 2016, the Company closed the Fukaya, Japan service center, which is a part of the Performance Alloys and Composites segment. Costs associated with the plan included severance associated with approximately thirteen employees and related facility exit costs. The severance payments were paid by the end of 2017.

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

(Thousands)	2018	2017	2016
Performance Alloys & Composites	$—	$(16)	$2,586
Advanced Materials	5,599	—	—
Precision Coatings	—	431	—
Other	—	229	—
Total	$5,599	$644	$2,586

Certain prior-year amounts relating to restructuring have been reclassified in the Consolidated Statements of Income to conform to 2018 presentation. For 2017, Cost of sales and Selling, general, and administrative expense were reduced by $0.5 million and $1.3 million, respectively, while Other-net was increased by $1.1 million, reflecting a $1.4 million gain realized on the sale of the Company's service center in Fukaya, Japan. For 2016, Other-net was reduced by $2.6 million.

Remaining severance payments related to these initiatives of $5.3 million are reflected within Other liabilities and accrued items in the Consolidated Balance Sheets. The Company does not expect to incur additional costs related to these initiatives.

Note F — Other-net

Other-net is summarized for 2018, 2017, and 2016 as follows:

	(Income) Expense		
(Thousands)	2018	2017	2016
Metal consignment fees	$10,999	$8,782	$6,409
Amortization of intangible assets	2,265	4,629	4,498
Foreign currency loss (gain)	1,487	(722)	1,525
Net loss (gain) on disposal of fixed assets	518	234	(648)
Rental income	(416)	(168)	(21)
Other items	481	1,138	(475)
Total other-net	$15,334	$13,893	$11,288

Note G — Interest

The following chart summarizes the interest incurred, capitalized, and paid for 2018, 2017, and 2016:

(Thousands)	2018	2017	2016
Interest incurred	$2,870	$2,608	$2,219
Less: Capitalized interest	399	425	430
Total net expense	$2,471	$2,183	$1,789
Interest paid	$1,436	$1,646	$1,611

The increase in interest expense for 2018 was primarily due to a capital lease entered into in 2017 in connection with the HTB acquisition. The higher expense in 2017 compared to 2016 was due to higher average debt levels outstanding. Amortization of deferred financing costs within interest expense was $1.0 million in 2018, $0.9 million in 2017, and $0.7 million in 2016.

Note H — 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 TCJA included a number of changes to the U.S. tax code including, but not limited to, (1) the reduction of the U.S. federal corporate tax rate from 35% to 21% effective January 1, 2018; (2) a one-time transition tax on certain unrepatriated earnings of foreign subsidiaries; (3) the addition of new taxes on certain foreign sourced earnings; (4) a deduction for foreign-derived intangible income; and (5) the repeal of corporate alternative minimum tax and the domestic production activity deduction.

SAB 118 Measurement Period

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) in deferred taxes. In the year ended December 31, 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.

At December 31, 2018, the Company had completed its accounting for all of the enactment-date income tax effects of the TCJA. 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 for the re-measurement of deferred tax assets and liabilities, the one-time transition tax on the mandatory deemed repatriation of foreign earnings, the generation of foreign tax credits, and the reversal of the valuation allowance related to foreign tax credits.

Deferred Remeasurement

As of December 31, 2017, the Company re-measured certain deferred tax assets and liabilities based on the rates at which they were expected to reverse in the future, which is generally 21%, and recorded a provisional tax expense of $5.0 million. Upon further analysis of certain aspects of the TCJA and refinement of our calculations during the twelve-month period ended December 31, 2018, we reduced our provisional tax expense by $2.8 million, which is included as a component of income tax expense from continuing operations.

Transition Tax

The transition tax is a one-time tax based on the Company's total post-1986 earnings and profits (E&P) that were previously deferred from U.S. income taxes. As of December 31, 2017, the Company recorded a provisional tax expense of $6.1 million for the one-time transition tax. Upon further analysis of the TCJA, as well as Notices and Regulations issued and proposed by the U.S. Department of Treasury and the Internal Revenue Service, the Company finalized the calculations of the transition tax liability in 2018. The Company reduced its provisional tax expense by $1.2 million, which is included as a component of income tax expense.

As of December 31, 2017, the Company recorded a valuation allowance of $9.5 million on foreign tax credits that were determined not to be realizable as a result of the TCJA. In 2018, the Company finalized its calculations and reduced the valuation allowance by $2.4 million due to the generation of less foreign tax credits. The Company released the remaining valuation allowance due to an updated foreign expense methodology and further assessment of Notices and Regulations issued. As of December 31, 2018, the Company has determined that the foreign tax credits can be realized in full and no valuation allowance is recorded, which resulted in a $7.1 million tax benefit during the year.

Consistent with December 31, 2017, 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, 2018.

GILTI

While the TCJA provides for a territorial tax system, beginning in 2018, it includes a new U.S. tax, GILTI. The GILTI provisions require the Company to include in its U.S. income tax return foreign subsidiary earnings in excess of an allowable return on the foreign subsidiary's tangible assets. Under U.S. GAAP, the Company is allowed to make an accounting policy choice of either (1) treating taxes due on future U.S. inclusions in taxable income related to GILTI as a current period expense when incurred (the period cost method), or (2) factoring such amounts into the Company’s measurement of its deferred taxes (the deferred method). After further analysis, the Company has determined that it has no incremental U.S. tax on GILTI for the year ended December 31, 2018. The Company has elected to use the current period method, and therefore has not provided any deferred tax impacts of GILTI in its consolidated financial statements for the year ended December 31, 2018.

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

(Thousands)	2018	2017	2016
Income before income taxes:			
Domestic	$20,272	$28,327	$13,934
Foreign	(3,930)	8,069	11,381
Total income before income taxes	$16,342	$36,396	$25,315
Income tax expense:			
Current income tax expense:			
Domestic	$(5,896)	$1,912	$6,505
Foreign	2,710	2,777	2,080
Total current	$(3,186)	$4,689	$8,585
Deferred income tax (benefit) expense:			
Domestic	$(4,083)	$19,935	$(8,842)
Foreign	2,765	321	(168)
Total deferred	$(1,318)	$20,256	$(9,010)
Total income tax (benefit) expense	$(4,504)	$24,945	$(425)

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

	2018		2017		2016	
U.S. federal statutory rate	21.0	%	35.0	%	35.0	%
State and local income taxes, net of federal tax effect	0.1		2.3		(0.4	)
Effect of excess of percentage depletion over cost depletion	(17.8	)	(10.0	)	(10.6	)
Manufacturing production deduction, including impact of NOL carryback	6.3		(0.8	)	(3.3	)
Foreign derived intangible income deduction	(2.9	)	—		—	
Tax Cuts and Jobs Act impact	(67.8	)	47.1		—	
Foreign rate differential	1.5		(3.4	)	(5.9	)
Research and development tax credit	(7.6	)	(2.6	)	(6.6	)
Foreign tax credit	(1.9	)	(1.1	)	(28.1	)
Foreign repatriation	2.0		1.3		13.7	
Incremental fixed asset basis	—		(3.4	)	—	
Adjustment to unrecognized tax benefits	2.7		2.8		3.2	
	(4.4	)	(1.9	)	—	

Stock compensation - excess tax benefits			
Valuation allowance	38.7	2.4	0.1
Other items	2.5	0.8	1.2
Effective tax rate	(27.6)%	68.5 %	(1.7)%

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:

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	December 31,	
(Thousands)	2018	2017
Asset (liability)		
Post-employment benefits other than pensions	$2,198	$2,787
Other reserves	693	1,371
Deferred compensation	3,539	5,054
Environmental reserves	1,463	1,452
Inventory	3,032	4,636
Pensions	8,105	14,307
Accrued compensation expense	6,215	2,852
Net operating loss and credit carryforwards	12,002	6,374
Research and development tax credit carryforward	744	2,466
Foreign tax credit carryforward	2,385	9,481
Subtotal	40,376	50,780
Valuation allowance	(15,917)	(16,246)
Total deferred tax assets	24,459	34,534
Depreciation	(10,280)	(10,250)
Amortization	(3,635)	(2,900)
Mine development	(5,123)	(3,621)
Capitalized interest expense	—	(112)
Derivative instruments and hedging activities	—	(817)
Total deferred tax liabilities	(19,038)	(17,700)
Net deferred tax asset	$5,421	$16,834

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, 2018, for income tax purposes, the Company had foreign net operating loss carryforwards of $22.7 million that do not expire, and $8.0 million that expire in calendar years 2019 through 2027, of which $0.1 million expires within the next twelve months. The Company also had state net operating loss carryforwards of $21.9 million that expire in calendar years 2019 through 2037 and state tax credits of $3.6 million that expire in calendar years 2019 through 2033. A valuation allowance of $9.5 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 has research and development tax credits of $0.7 million that expire in calendar year 2038 and foreign tax credits of $2.4 million which all expire in calendar year 2026.

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 2014, and foreign examinations for tax years before 2010.

A reconciliation of the Company’s unrecognized tax benefits for the year-to-date periods ended December 31, 2018 and 2017 is as follows:

(Thousands)	2018	2017
Balance at January 1	$2,944	$2,048
Additions to tax provisions related to the current year	443	163
Additions to tax positions related to prior years	4	1,210
Reduction to tax positions related to prior years	(508)	(121)
Lapses on statutes of limitations	—	(356)

Balance at December 31	$2,883	$2,944

At December 31, 2018, the Company had $2.9 million of unrecognized tax benefits, of which $2.2 million 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 2018, 2017, and 2016. As of December 31, 2018 and 2017, accrued interest and penalties, net of the related tax benefit, were immaterial.

Income taxes paid during 2018, 2017 and 2016, were approximately $2.6 million, $8.1 million, and $3.0 million, respectively.

Note I — Earnings Per Share

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

(Thousands except per share amounts)	2018	2017	2016
Numerator for basic and diluted EPS:			
Net income	$20,846	$11,451	$25,740
Denominator:			
Denominator for basic EPS:			
Weighted-average shares outstanding	20,212	20,027	19,983
Effect of dilutive securities:			
Stock appreciation rights	170	174	74
Restricted stock units	85	96	88
Performance-based restricted stock units	146	118	68
Diluted potential common shares	401	388	230
Denominator for diluted EPS:			
Adjusted weighted-average shares outstanding	20,613	20,415	20,213
Basic EPS	$1.03	$0.57	$1.29
Diluted EPS	$1.01	$0.56	$1.27

Equity awards covering shares of common stock totaling 65,112 in 2018, 124,319 in 2017, and 818,268 in 2016 were excluded from the diluted EPS calculation as their effect would have been anti-dilutive.

Note J — Inventories, net

Inventories in the Consolidated Balance Sheets are summarized as follows:

	December 31,	
(Thousands)	2018	2017
Raw materials and supplies	$33,182	$42,958
Work in process	195,879	187,719
Finished goods	30,643	34,418
Subtotal	259,704	265,095
Less: LIFO reserve balance	44,833	44,743
Inventories	$214,871	$220,352

The liquidation of LIFO inventory layers increased cost of sales by $1.2 million in 2018, and reduced cost of sales by $0.8 million in 2017 and $4.1 million in 2016.

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 $316.1 million as of December 31, 2018 versus $320.0 million as of December 31, 2017.

Note K — Property, Plant, and Equipment

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

	December 31,	
(Thousands)	2018	2017
Land	$4,874	$4,874
Buildings	149,701	137,196
Machinery and equipment	631,421	626,186
Software	42,678	40,575
Construction in progress	14,468	29,963
Allowances for depreciation	(642,365)	(615,134)
Subtotal	200,777	223,660
Capital leases	22,150	10,912
Allowances for depreciation	(2,412)	(2,741)
Subtotal	19,738	8,171
Mineral resources	4,980	4,979
Mine development	27,979	37,103
Allowances for amortization and depletion	(2,456)	(18,335)
Subtotal	30,503	23,747
Property, plant, and equipment — net	$251,018	$255,578

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 $4.3 million and $4.5 million in 2018 and 2017, 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 $33.3 million in 2018, $38.1 million in 2017, and $41.2 million in 2016. 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 2018, 2017, and 2016. The net book value of capitalized software was $8.0 million and $8.3 million at December 31, 2018 and December 31, 2017, respectively. Depreciation expense related to software was $2.6 million in 2018, compared to $2.4 million in both 2017 and 2016.

Note L — Intangible Assets and Goodwill

Intangible Assets

The cost and accumulated amortization of intangible assets subject to amortization as of December 31, 2018 and 2017, is as follows:

(Thousands)	2018 Gross Carrying Amount	2018 Accumulated Amortization	2017 Gross Carrying Amount	2017 Accumulated Amortization
Customer relationships	$39,601	$ (37,077)	$40,751	$ (36,949)
Technology	13,377	(12,238)	13,467	(11,495)
Licenses and other	4,257	(2,725)	4,519	(2,672)
Total	$57,235	$ (52,040)	$58,737	$ (51,116)

During 2017, the Company acquired $2.3 million in customer relationships and $1.4 million in technology intangible assets, with useful lives of fifteen and three years, respectively.

The aggregate amortization expense relating to intangible assets for the year ended December 31, 2018 and estimated amortization expense for each of the five succeeding years is as follows:

(Thousands)	Amortization Expense
2018	$ 2,265
2019	1,366
2020	603
2021	485
2022	485
2023	485

Intangible assets also includes deferred financing costs relating to the Company's revolving credit and consignments lines of $1.3 million and $2.2 million at December 31, 2018 and 2017, respectively.

Goodwill

Goodwill arises from the purchase price for acquired businesses exceeding the fair value of tangible and intangible assets acquired less assumed liabilities. In 2017, the Company acquired HTB for total consideration of $16.5 million and recorded goodwill of $3.6 million. HTB is included in the Advanced Materials segment.

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. 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 both December 31, 2018 and 2017 was $90.7 million and assigned to the following segments:

(Thousands)	2018	2017
Performance Alloys and Composites	$1,899	$1,899
Advanced Materials	50,276	50,296
Precision Coatings	38,482	38,482
Total	$90,657	$90,677

The results of the Company's 2018, 2017, and 2016 goodwill impairment assessments indicated that no goodwill impairment existed.

Note M — Debt

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

(Thousands)	December 31, 2018	2017
Fixed rate industrial development revenue bonds payable in annual installments through 2021	$3,041	$3,818
Total debt outstanding	3,041	3,818
Current portion of long-term debt	(823)	(777)
Gross long-term debt	2,218	3,041
Unamortized deferred financing fees	(152)	(214)
Long-term debt	$2,066	$2,827

Maturities on long-term debt instruments as of December 31, 2018 are as follows:

(Thousands)	
2019	$823
2020	868
2021	1,350
2022	—
2023	—
Thereafter	—
Total	$3,041

In 2015, the Company entered into an Amended and Restated Credit Agreement (Credit Agreement) that matures in 2020 and provides for a $375.0 million revolving credit facility comprised of sub-facilities for revolving loans, swing-line loans, letters of credit, and foreign borrowings. 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 $300.0 million. The Credit Agreement is 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 Credit 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, 2018 and December 31, 2017.

At December 31, 2018 and 2017, respectively, there was $27.2 million and $27.3 million outstanding against the letters of credit sub-facility. The Company pays a variable commitment fee that may reset quarterly (0.2% as of December 31, 2018) of the available and unborrowed amounts under the revolving credit line.

While the available borrowings under the individual existing credit lines total $355.4 million, the covenants in the Credit Agreement restrict the aggregate borrowings to $275.5 million as of December 31, 2018.

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 $3.0 million at December 31, 2018.

Note N — Leasing Arrangements

The Company leases warehouse and manufacturing real estate, and manufacturing and computer equipment under operating leases with terms ranging up to 25 years. Operating lease expense amounted to $11.6 million, $9.3 million, and $8.6 million during 2018, 2017, and 2016, respectively. The future estimated minimum payments under capital leases and non-cancelable operating leases with initial lease terms in excess of one year at December 31, 2018, are 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
Amounts representing interest	19,338	
Present value of net minimum lease payments	$11,869	

During 2017, in connection with the HTB acquisition, the Company entered into an agreement to relocate the German operations from Hanau, Germany to a new, leased facility in Alzenau, Germany. In order for this manufacturing facility to meet the Company's operating specifications, both the landlord and the Company are making structural improvements to the facility, and as a result, the Company has concluded that it is the deemed owner of the building for accounting purposes only during the construction period. At December 31, 2018, the Company recorded an asset of $12 million, which is reflected in Property, Plant, and Equipment and a corresponding liability, recorded as Capital lease obligations. The future estimated minimum payments related to this lease are included in the above table under the caption of Capital Leases.

Note O — Pensions and Other Post-Employment Benefits

The obligation and funded status of the Company’s pension and other post-employment benefit plans are shown below. The Pension Benefits column aggregates defined benefit pension plans in the U.S., Germany, 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)	2018	2017	2018	2017
Change in benefit obligation				
Benefit obligation at beginning of year	$313,728	$276,801	$14,166	$14,334
Service cost	6,953	7,587	111	91
Interest cost	9,554	9,949	396	398
Settlements	(112,644)	—	—	—
Acquisition	—	7,645	—	—
Plan amendments	—	3,804	—	—
Actuarial loss (gain)	(31,824)	18,549	(2,453)	444
Benefit payments	(13,700)	(13,459)	(876)	(1,107)
Foreign currency exchange rate changes and other	(1,931)	2,852	31	6
Benefit obligation at end of year	170,136	313,728	11,375	14,166
Change in plan assets				
Fair value of plan assets at beginning of year	234,976	199,992	—	—
Plan settlements	(111,542)	—	—	—
Acquisition	—	2,353	—	—
Actual return on plan assets	(8,570)	29,428	—	—
Employer contributions	42,227	16,338	—	—
Employee contributions	146	162	—	—
Benefit payments from fund	(10,826)	(13,072)	—	—
Expenses paid from assets	(890)	(1,133)	—	—
Foreign currency exchange rate changes and other	(475)	908	—	—
Fair value of plan assets at end of year	145,046	234,976	—	—
Funded status at end of year	$(25,090)	$(78,752)	$(11,375)	$(14,166)
Amounts recognized in the Consolidated Balance Sheets consist of:				
Other assets	$1,948	$1,797	$—	$—
Other liabilities and accrued items	(411)	(2,490)	(1,258)	(1,412)
Retirement and post-employment benefits	(26,627)	(78,059)	(10,117)	(12,754)
	$(25,090)	$(78,752)	$(11,375)	$(14,166)

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.

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The following amounts are included within accumulated other comprehensive loss at December 31, 2018 and are expected to be recognized as components of net periodic benefit cost during 2019:

	Pension Benefits		Other Benefits	
(Thousands)	2018	2017	2018	2017
Amounts recognized in other comprehensive income (before tax) consist of:				
Net actuarial loss (gain)	$61,599	$119,114	$(2,429)	$24
Net prior service cost (credit)	3,810	3,688	(6,546)	(8,044)
	$65,409	$122,802	$(8,975)	$(8,020)
Amortizations expected to be recognized during next fiscal year (before tax):				
Amortization of net loss	$3,769	$8,077	$—	$—
Net prior service cost (credit)	482	(123)	(1,497)	(1,497)
	$4,251	$7,954	$(1,497)	$(1,497)

The following table provides information regarding the accumulated benefit obligation:

	Pension Benefits		Other Benefits	
(Thousands)	2018	2017	2018	2017
Additional information				
Accumulated benefit obligation for all defined benefit pension plans	$161,169	$302,942	$ —	$ —
For defined benefit pension plans with benefit obligations in excess of plan assets:				
Aggregate benefit obligation	165,344	304,814	—	—
Aggregate fair value of plan assets	138,305	227,115	—	—
For defined benefit pension plans with accumulated benefit obligations in excess of plan assets:				
Aggregate accumulated benefit obligation	156,639	296,878	—	—
Aggregate fair value of plan assets	138,305	227,115	—	—

The following table summarizes components of net benefit cost:

	Pension Benefits			Other Benefits		
(Thousands)	2018	2017	2016	2018	2017	2016
Net benefit cost						
Service cost	$6,953	$7,587	$7,473	$111	$91	$105
Interest cost	9,554	9,949	10,820	396	398	562
Expected return on plan assets	(14,231)	(13,760)	(13,654)	—	—	—
Amortization of prior service credit	(123)	(274)	(460)	(1,497)	(1,497)	(1,497)
Recognized net actuarial loss	7,171	6,636	6,005	—	—	—
Net periodic cost	9,324	10,138	10,184	(990)	(1,008)	(830)
Settlements	41,406	—	120	—	—	—
Total net benefit cost	$50,730	$10,138	$10,304	$(990)	$(1,008)	$(830)

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.

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

	Pension Benefits			Other Benefits		
(Thousands)	2018	2017	2016	2018	2017	2016
Change in other comprehensive income						
OCI at beginning of year	$122,802	$121,329	$112,518	$(8,020)	$(9,961)	$(11,267)
Increase (decrease) in OCI:						
Recognized during year — prior service cost (credit)	123	274	460	1,497	1,497	1,497
Recognized during year — net actuarial (losses) gains	(7,171)	(6,636)	(6,005)	—	—	—
Occurring during year — prior service cost	—	3,804	—	—	—	—
Occurring during year — net actuarial losses (gains)	(8,997)	4,055	14,279	(2,453)	444	(191)
Other adjustments	(41,406)	—	120	—	—	—
Foreign currency exchange rate changes	58	(24)	(43)	—	—	—
OCI at end of year	$65,409	$122,802	$121,329	$(8,976)	$(8,020)	$(9,961)

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			Other Benefits		
	2018	2017	2016	2018	2017	2016
Weighted-average assumptions used to determine benefit obligations at fiscal year end						
Discount rate	4.07%	3.53%	4.02%	4.11%	3.43%	3.68%
Rate of compensation increase	3.87%	3.93%	4.04%	4.00%	4.00%	4.00%
Weighted-average assumptions used to determine net cost for the fiscal year						
Discount rate	3.63%	3.93%	4.22%	3.43%	3.68%	3.88%
Expected long-term return on plan assets	6.63%	6.89%	6.90%	N/A	N/A	N/A
Rate of compensation increase	3.98%	3.91%	3.93%	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.

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 for each projected benefit payment in the calculation. Historically, the Company used a weighted-average approach to determine the service and interest cost components. The change was accounted for as a change in estimate and, accordingly, was accounted for prospectively starting in 2017. The reductions in service and interest costs for 2017 associated with this change in estimate totaled approximately $1.0 million.

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 4.0% in both 2018 and 2017 for 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	2018	2017
Health care trend rate assumed for next year	6.50%	6.75%
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)	2018	2017	2018	2017
Effect on total of service and interest cost components	$ 6	$ 8	$ (6)	$ (8)
Effect on post-employment benefit obligation	163	212	(152)	(198)

Plan Assets

The following tables present the fair values of the Company’s defined benefit pension plan assets as of December 31, 2018 and 2017 by asset category. The Company has some investments that are valued using net asset value (NAV) as the practical expedient and have not been classified in the fair value hierarchy. Refer to Note R for definitions of the fair value hierarchy.

	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	—	—
Alternative strategies (d)	—	—	—	—
Accrued interest and dividends	—	—	—	—
Total	94,211	94,211	—	—
Investments measured at NAV: (e)				
Pooled investment fund (f)	24,947			
Multi-strategy hedge funds (g)	4,113			
Common/Collective trusts (h)	—			
Intermediate-term bonds (i)	21,678			
Private equity funds	97			
Total assets at fair value	$145,046			

	December 31, 2017			
(Thousands)	Total	Level 1	Level 2	Level 3
Cash	$10,604	$10,604	$ —	$ —
Equity securities (a)	109,229	104,261	4,968	—
Fixed-income securities (b)	42,291	30,639	11,652	—
Other types of investments:				
Real estate fund (c)	6,617	6,284	333	—
Alternative strategies (d)	9,948	9,893	55	—
Accrued interest and dividends	114	114	—	—
Total	178,803	161,795	17,008	—
Investments measured at NAV: (e)				
Pooled investment fund (f)	21,378			
Multi-strategy hedge funds (g)	3,970			
Common/Collective trusts (h)	8,942			
Intermediate-term bonds (i)	21,771			
Private equity funds	112			
Total assets at fair value	$234,976			

(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) Includes a mutual fund that tactically allocates assets to global equity, fixed income, and alternative strategies.

(e)

Certain assets that are measured at fair value using the net asset value (NAV) practical expedient have not been classified in the fair value hierarchy.

(f) 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.

(g) Includes a fund that invests in a broad portfolio of hedge funds.

(h) The common/collective trusts are comprised of a number of investment funds that invest in a diverse portfolio of assets including equity securities, corporate and governmental bonds, equity and credit indexes, and money markets. Trusts are valued at the NAV as determined by their custodian. NAV represents the accumulation of the unadjusted quoted close prices on the reporting date for the underlying investments divided by the total shares outstanding at the reporting dates.

(i) 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 20% to 50% in equity securities, 30% to 70% 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 expects to contribute $6.0 million to its domestic defined benefit pension plan and $1.3 million to its other benefit plans in 2019.

Effective in 2016, 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:

(Thousands)	Pension Benefits	Other Benefits Gross Benefit Payments	Other Benefits Net of Medicare Part D Subsidy
2019	$ 3,203	$1,258	$ 1,241
2020	3,619	1,367	1,352
2021	4,457	1,334	1,321
2022	6,051	1,203	1,192
2023	6,293	1,192	1,182
2024 through 2028	44,444	4,155	4,125

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 $1.6 million at December 31, 2018 and $2.1 million at December 31, 2017, 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 $5.2 million in 2018, $4.5 million in 2017, and $3.6 million in 2016.

Note P — Accumulated Other Comprehensive Income

Changes in the components of accumulated other comprehensive income, including amounts reclassified out, for 2018, 2017, and 2016, and the balances in accumulated other comprehensive income as of December 31, 2018, 2017, and 2016 are as follows:

(Thousands)	Gains and Losses On Cash Flow Hedges Foreign Currency	Precious Metals	Copper	Total	Pension and Post-Employment Benefits	Foreign Currency Translation	Total
Balance at December 31, 2015	$1,579	$—	$—	$1,579	$(76,796)	$(5,488)	$(80,705)
Other comprehensive income (loss) before reclassifications	(377)	—	—	(377)	(14,165)	(172)	(14,714)
Amounts reclassified from accumulated other comprehensive income	784	—	—	784	4,048	—	4,832
Other comprehensive income (loss) before tax	407	—	—	407	(10,117)	(172)	(9,882)
Deferred taxes on current period activity	149	—	—	149	(4,555)	—	(4,406)
Other comprehensive income (loss) after tax	258	—	—	258	(5,562)	(172)	(5,476)
Balance at December 31, 2016	$1,837	$—	$—	$1,837	$(82,358)	$(5,660)	$(86,181)
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)

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

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

Note Q — Stock-based Compensation

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, stock appreciation 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 expenses (SG&A) expenses, was $11.4 million, $7.7 million, and $6.7 million in 2018, 2017, and 2016, respectively. The Company derives a tax deduction measured by the excess of the market value over the grant price at the date stock-based awards vest or are exercised. The Company recognized $1.2 million and $2.0 million of tax benefits in 2018 and 2017, respectively, compared to less than $0.1 million of tax expense in 2016 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 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 2018:

(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, 2017	616	$ 30.97		
Granted	65	50.35		
Exercised	(277)	33.03		
Cancelled	(25)	27.58		
Outstanding at December 31, 2018	379	33.01	$ 4,894	4.5
Vested and expected to vest as of December 31, 2018	379	33.01	4,894	4.5
Exercisable at December 31, 2018	60	34.10	659	3.0

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, 2017	426	$ 10.54
Granted	65	15.73
Vested	(147)	13.11
Cancelled	(25)	8.73

Nonvested as of December 31, 2018	319	$ 10.33

As of December 31, 2018, $1.0 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 2018 was $1.9 million, compared to $1.7 million in both 2017 and 2016.

The weighted-average grant date fair value for 2018, 2017, and 2016 was $15.73, $10.89, and $8.07, respectively. The fair value will be amortized to compensation cost on a straight-line basis over the three-year vesting period, or earlier if the employee is

retirement eligible as defined in the Plan. Stock-based compensation expense relating to SARs was $0.7 million in 2018, $1.4 million in 2017, and $0.9 million in 2016.
The fair value of the SARs was estimated on the grant date using the Black-Scholes pricing model with the following assumptions:

	2018	2017	2016
Risk-free interest rate	2.58%	1.92%	1.25%
Dividend yield	0.8 %	1.1 %	1.4 %
Volatility	31.9%	34.0%	38.0%
Expected lives (in years)	5.5	5.6	5.7

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 2018, 2017, and 2016 was $50.35, $35.24, and $25.19, 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 RSUs was $1.2 million in 2018, $1.4 million in 2017, and $0.6 million in 2016. The unamortized compensation cost on the outstanding RSUs was $2.5 million as of December 31, 2018 and is expected to be amortized over a weighted-average period of 24 months. The total fair value of shares vested during 2018 was $1.4 million, compared to $1.2 million in both 2017 and 2016.
The following table summarizes the stock-settled restricted stock unit activity during 2018:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2017	119	$ 32.16
Granted	59	50.35
Vested	(38)	36.69
Forfeited	(10)	34.07
Outstanding at December 31, 2018	130	$ 38.99

RSUs - Non-Employee Directors. In 2018, 2017, and 2016, 14,728, 18,656, and 26,469 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 $51.60, $34.30, and $27.20 in 2018, 2017, and 2016, respectively. The Company recognized $0.7 million of expense with respect to these awards in each of the last three years. At December 31, 2018, $0.3 million of expense with respect to non-vested RSU awards granted to the Board of Directors has yet to be recognized and will be amortized into expense over a weighted-average period of approximately four months.
Long-term Incentive Plans. Under 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 2018, 2017, and 2016, 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 2018 will be settled in Materion common shares and are equity classified. For grants made to executive officers 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 restricted stock units during 2018:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2017	223	$ 28.49
Granted	55	62.44
Vested	(75)	33.31
Forfeited	(1)	62.44
Outstanding at December 31, 2018	202	$ 35.76

Compensation expense is based upon the performance projections for the three-year plan period, 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 $2.7 million for 2018, $1.5 million for 2017, and $1.0 million for 2016.
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 2018:

(Shares in thousands)	Number of Shares	Weighted-average Grant Date Fair Value
Outstanding at December 31, 2017	164	$ 25.96
Granted	12	53.11
Distributed	(24)	54.71
Outstanding at December 31, 2018	152	$ 23.55

During the years ended December 31, 2018, 2017, and 2016, the weighted-average grant date fair value was $53.11, $35.34, and $24.46, respectively.
Note R — Fair Value Information and Derivative Financial Instruments
The Company measures and records financial instruments at fair value. A hierarchy is used for those instruments measured at fair value that distinguishes between assumptions based upon market data (observable inputs) and the Company's assumptions (unobservable inputs). The hierarchy consists of three levels:
Level 1 — Quoted market prices in active markets for identical assets and liabilities;
Level 2 — Inputs other than Level 1 inputs that are either directly or indirectly observable; and
Level 3 — Unobservable inputs developed using estimates and assumptions developed by the Company, which reflect those that a market participant would use.

The following table summarizes the financial instruments measured at fair value in the Consolidated Balance Sheets at December 31, 2018 and 2017:

(Thousands)	Total	Fair Value Measurements Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Observable Inputs (Level 2)	Other Significant Unobservable Inputs (Level 3)
December 31, 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	$ —
December 31, 2017				
Financial Assets				
Deferred compensation investments	$2,310	$2,310	$ —	$ —
Foreign currency forward contracts	254	—	254	—
Precious metal swaps	14	—	14	—
Total	$2,578	$2,310	$ 268	$ —
Financial Liabilities				
Deferred compensation liability	$2,310	$2,310	$ —	$ —
Foreign currency forward contracts	201	—	201	—
Precious metal swaps	269	—	269	—
Total	$2,780	$2,310	$ 470	$ —

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, 2018 and 2017.

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 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 maintains a portion of its copper production requirements on consignment in order to reduce its working capital investment and the exposure to metal price movements. 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.

Swap contracts on copper are used to manage the price risk associated with forecasted purchases of materials used in the company's manufacturing process and better enable matching of expense and revenue amounts.

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 other comprehensive income (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.

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The following table summarizes the notional amount and the fair value of the Company’s outstanding derivatives not designated as hedging instruments and balance sheet classification as of December 31, 2018 and 2017:

(Thousands)	December 31, 2018		December 31, 2017	
	Notional Amount	Fair Value	Notional Amount	Fair Value
Foreign currency forward contracts- euro				
Prepaid expenses	$8,767	$244	$13,981	$127
Other liabilities and accrued items	8,771	249	—	—
Total	$17,538	$5	$13,981	$127

These outstanding foreign currency derivatives were related to intercompany loans. Other-net included foreign currency gains relating to these derivatives of $0.9 million in 2018 and $1.1 million of foreign currency losses in 2017.

The following table summarizes the notional amount and the fair value of the Company’s outstanding derivatives designated as cash flow hedges and balance sheet classification at December 31, 2018 and 2017:

(Thousands)	December 31, 2018		December 31, 2017	
	Notional Amount	Fair Value	Notional Amount	Fair Value
Prepaid expenses				
Foreign currency forward contracts - yen	$ —	$ —	$5,673	$ 91
Foreign currency forward contracts - euro	725	2	5,026	36
Precious metal swaps	4,533	237	—	—
	5,258	239	10,699	127
Other assets				
Precious metal swaps	—	—	880	14
Other liabilities and accrued items				
Foreign currency forward contracts - yen	1,264	17	—	—
Foreign currency forward contracts - euro	19,158	166	13,583	201
Precious metal swaps	2,864	135	10,067	255
Copper swaps	11,170	569	—	—
	34,456	887	23,650	456