



innovation



optimization

innovation

is a growth driver for
Ferro Corporation.

We leverage our expertise in particle size management, surface modification and color science to develop functional coatings and color solutions that improve our customers' products.

Through innovation, we enhance current products and develop new products for adjacent markets and new applications.

Today, about 15 percent of our revenue comes from programs that are new-to-Ferro or new-to-the-world.

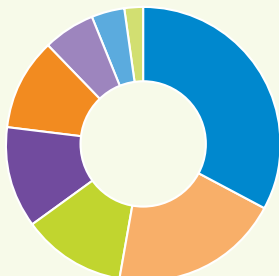
This annual report may contain "forward-looking statements" under the Private Securities Litigation Reform Act of 1995. Forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those expressed in or implied in this annual report. These statements speak only as of the date of this annual report. Further information concerning issues that could materially affect financial performance related to forward-looking statements can be found in Ferro's Annual Report on Form 10-K, a copy of which is included in this annual report, and the Company's periodic filings with the SEC. The Company undertakes no obligation to update any forward-looking statement.



Ferro Corporation

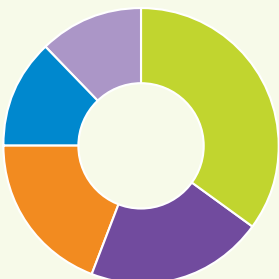
(NYSE: FOE) is a leading global supplier of technology-based functional coatings and color solutions. Ferro supplies functional coatings for glass, metal, ceramic and other substrates and color solutions in the form of specialty pigments and colorants for a broad range of industries and applications. Ferro products are sold into the building and construction, automotive, electronics, industrial products, household furnishings and appliance markets. The Company's reportable segments include: Performance Coatings (metal and ceramic coatings), Performance Colors and Glass (glass coatings), and Color Solutions. Headquartered in Mayfield Heights, Ohio, the Company has 5,682 associates globally and reported 2017 sales of \$1.4 billion.

Sales by End Market



- 33% Building/Renovation
- 20% Industrial
- 12% Electronics
- 12% Automotive/Transport
- 11% Appliances
- 6% Container
- 4% Household
- 2% Other

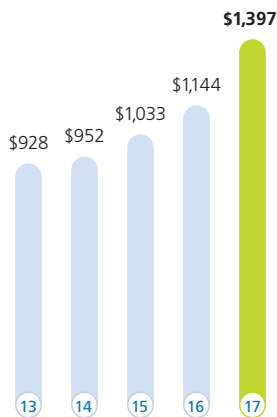
Ship to Sales by Geography



- 35% Europe
- 21% Asia/Pacific (APAC)
- 19% North America
- 13% Latin America
- 12% Middle East/North Africa (MENA)

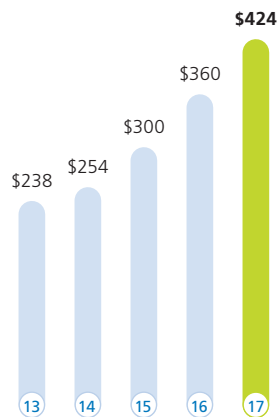
Net Sales

(in millions)

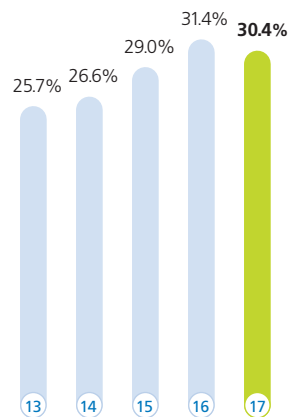


Adjusted Gross Profit

(in millions)

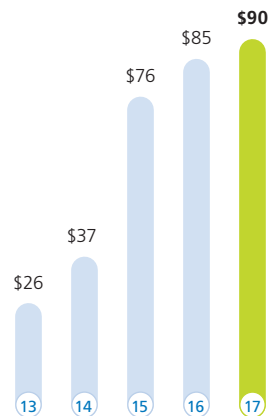


Adjusted Gross Profit Margin



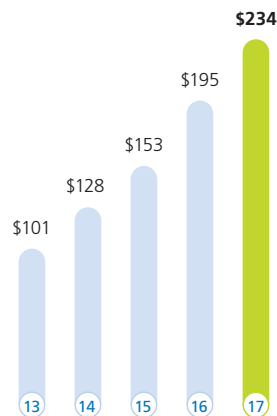
Adjusted Cash Flow From Operations

(in millions)

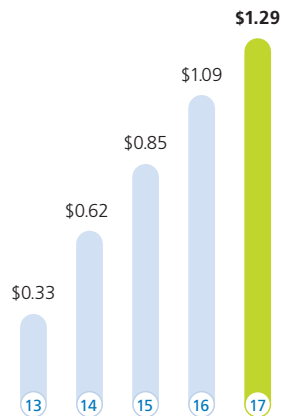


Adjusted EBITDA

(in millions)

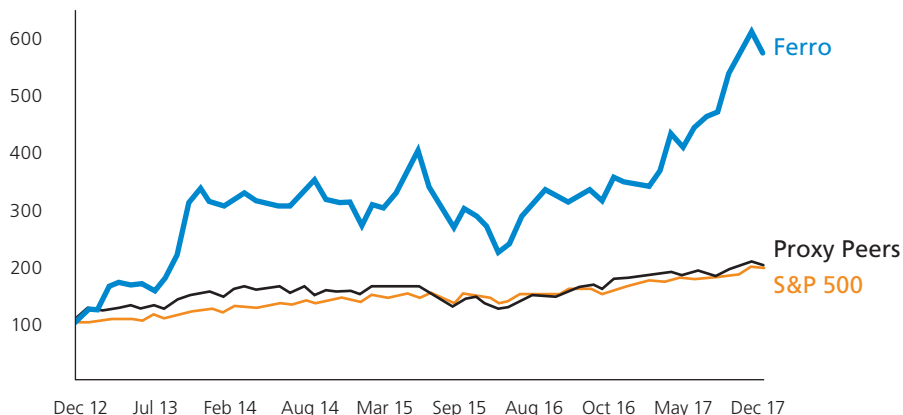


Adjusted Earnings Per Share



Non-GAAP Financial Information: Continuing Operations excluding Discontinued Operations and Other Divestitures; Adjusted Gross Profit Margin; Constant Currency Results; Adjusted Cash Flow From Operations; Adjusted Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA); Adjusted Earnings Per Share; are non-GAAP measures. These non-GAAP measures have been reconciled to the comparable GAAP measures within tables immediately following the Company's Annual Report on Form 10-K.

Total Shareholder Return



Note: Peer set based on companies disclosed in Ferro 2018 proxy statement, including Chemtura, Compass Minerals International, HB Fuller, Hexcel, Innophos, Innospec, Koppers Holding, Kraton Performance Polymers, Minerals Technology, Newmarket, OMNOVA, Quaker Chemical, Rayonier Advanced Materials, Sensient Technologies, Stepan and Tronox. Source: CapitalIQ

Fellow Shareholders:

Over the past five years, Ferro has transformed from a diversified specialty chemicals company to one of the world's leading technology-driven functional coatings and color solutions companies. We have upgraded our portfolio and expanded our addressable markets through strategic acquisitions, and we have developed a Company culture of innovation and optimization. As a result, we are consistently generating improved organic growth and profitability and, we believe, beginning to realize the accelerated growth and strong profitability that our business model is designed to produce.

This transformation would not have been possible without the extraordinary dedication and performance of thousands of Ferro associates around the world. I am proud of them, and I hope you are too.

Net sales improved to
\$1.4 billion
from \$1.1 billion,
an increase of
22 percent.

Improving Financial Results

Our financial results for 2017 were excellent. On a constant currency basis, our net sales improved to \$1.4 billion from \$1.1 billion, an increase of 22.0 percent over 2016. Adjusted gross profit rose to \$424.4 million from \$359.9 million, an increase of 17.9 percent.

Net income increased to \$57.1 million from a loss of \$20.8 million for 2016. Earnings per diluted share were \$0.67 compared to a loss of \$0.25 last year. On an adjusted basis, 2017 earnings per diluted share were \$1.29, an increase of 18.3 percent over adjusted earnings per share of \$1.09 for 2016.

Adjusted EBITDA grew 20.3 percent to \$234.2 million, or 16.8 percent of sales, compared to 17.0 percent of sales for 2016. Adjusted cash flow from operations improved to \$90.1 million, an increase of 5.6 percent.

Adjusted
gross profit rose to
\$424 million
from \$360 million,
an increase of
18 percent.

Net cash provided by operations improved to **\$84.8 million**, an increase of 35 percent.

Sustaining Our Momentum

In the current phase of our value creation strategy, we are focused on generating long-term organic and inorganic growth and increasing profitability through dynamic innovation and optimization.

We have built a scalable business model that leverages the linkages between our three operating segments, our technology capabilities and our shared manufacturing platforms. We operate growing businesses across diverse global markets. We are a market leader in 90 percent of our revenue base and our global business has a large and varied customer base.

Increasingly, innovation is driving our organic pipeline and playing a more significant role in driving our overall growth. Acquisitions have contributed to our capabilities in producing new products, but it is the spirit of innovation now embedded in our culture that energizes our product pipeline. Our Vitality Index is currently at 15 percent and we expect it to continue to improve as we launch new-to-Ferro and new-to-the-world products and services.

While we invest in growth initiatives, we also are redoubling our commitment to optimization. We are looking across our business to improve efficiency and effectiveness.

Looking Ahead: Vision 2020

At our investor day in November 2017, we described our Vision 2020 targets.

- We are targeting 3-to-4 percent annual organic growth and annual market expansion of 1-to-2 percent.
- We intend to continue to invest \$150 million per year in strategic acquisitions.
- We expect our optimization initiatives to help us generate gross margins of 33-to-34 percent per year, with EBITDA of 20 percent and free cash flow conversion of 50-to-60 percent.

Adjusted EBITDA grew 20.3 percent to **\$234.2 million**, or 17 percent of sales.

Vision 2020 — Performance Metrics

Three key levers, aligned with strategy

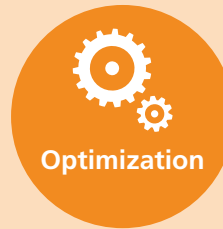


Organic Growth

~3%–~4% Annual Organic Growth

- New product pipeline (15%–20% vitality)
- Chief Technology Officer
- Expand our “market”

Market + 1%–2%



Optimization

Gross Margin

~33%–~34%

EBITDA ~20%+

FCF Conversion

~50%–~60%

- Lean and optimization initiatives

2% Annually



Inorganic Growth*

~\$100M Sales Annually

- Existing M&A pipeline
- Enhanced process

Strategic Acquisitions
\$150MM/Year

* Incomplete transactions not included in base model

We share these Vision 2020 targets so that you know where we intend to take our company. I am happy to say that we have a high-performance team in place that understands our goals and how we intend to achieve them.

Thank you for your continued confidence in Ferro. We look forward to continuing to earn your trust in the months and years to come.

Sincerely,



Peter T. Thomas
Chairman, President and Chief Executive Officer
March 22, 2018

UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2017

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 1-584

FERRO CORPORATION

(Exact name of registrant as specified in its charter)

Ohio

(State or Other Jurisdiction of Incorporation or Organization)

34-0217820

(IRS Employer Identification No.)

6060 Parkland Blvd.

Suite 250

Mayfield Heights, OH

(Address of Principal Executive Offices)

44124

(Zip Code)

Registrant's telephone number, including area code: 216-875-5600

Securities Registered Pursuant to section 12(b) of the Act:

<u>Title of Each Class</u>	<u>Name of Each Exchange on Which Registered</u>
Common Stock, par value \$1.00	New York Stock Exchange

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

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

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

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted 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 NO

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained here, 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, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer Accelerated filer Non-accelerated filer Smaller reporting company Emerging growth company
(Do not check if a smaller reporting company)

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

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

The aggregate market value of Ferro Corporation Common Stock, par value \$1.00, held by non-affiliates and based on the closing sale price as of June 30, 2017, was approximately \$1,510,002,000.

On January 31, 2018, there were 84,089,077 shares of Ferro Corporation Common Stock, par value \$1.00 outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for Ferro Corporation's 2018 Annual Meeting of Shareholders are incorporated into Part III of this Annual Report on Form 10-K.

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PART I

Item 1 — *Business*

History, Organization and Products

Ferro Corporation was incorporated in Ohio in 1919 as an enameling company and today is a leading producer of specialty materials that are sold to a broad range of manufacturers who, in turn, make products for many end-use markets. When we use the terms “Ferro,” “we,” “us” or “the Company,” we are referring to Ferro Corporation and its subsidiaries unless indicated otherwise.

Ferro’s products fall into two general categories: functional coatings, which perform specific functions in the manufacturing processes and end products of our customers; and color solutions, which provide aesthetic and performance characteristics to our customers’ products. Our products are manufactured in approximately 51 facilities around the world. They include frits, porcelain and other glass enamels, glazes, stains, decorating colors, pigments, inks, polishing materials, dielectrics, electronic glasses, and other specialty coatings.

Ferro develops and delivers innovative products to our customers based on our strengths in the following technologies:

- Particle Engineering — Our ability to design and produce very small particles made of a broad variety of materials, with precisely controlled characteristics of shape, size and particle distribution. We understand how to disperse these particles within liquid, paste and gel formulations.
- Color and Glass Science — Our understanding of the chemistry required to develop and produce pigments that provide color characteristics ideally suited to customers’ applications. We have a demonstrated ability to manufacture glass-based and certain other coatings with properties that precisely meet customers’ needs in a broad variety of applications.
- Surface Chemistry and Surface Application Technology — Our understanding of chemicals and materials used to develop products and processes that involve the interface between layers and the surface properties of materials.
- Formulation — Our ability to develop and manufacture combinations of materials that deliver specific performance characteristics designed to work within customers’ particular products and manufacturing processes.

We differentiate ourselves in our industry by innovation and new products and services and the consistent high quality of our products, combined with delivery of localized technical service and customized application technology support. Our value-added technology services assist customers in their material specification and evaluation, product design, and manufacturing process characterization in order to help them optimize the application of our products.

Ferro’s operations are divided into the four business units, which comprise three reportable segments, listed below:

- Tile Coating Systems⁽¹⁾
- Porcelain Enamel⁽¹⁾
- Performance Colors and Glass
- Color Solutions

(1) Tile Coating Systems and Porcelain Enamel are combined into one reportable segment, Performance Coatings, for financial reporting purposes.

Financial information about our segments is included herein in Note 20 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

Markets and Customers

Ferro's products are used in a variety of product application, including the following markets:

- Appliances
- Automobiles
- Building and renovation
- Electronics
- Household furnishings
- Industrial products
- Packaging
- Sanitary

Many of our products are used as functional or aesthetic coatings for a variety of different substrates on our customers' products, such as metals, ceramics, glass, plastic, wood, concrete and a variety of other surfaces. Other products are used to manufacture electronic components and other products. Still other products are added during our customers' manufacturing processes to provide desirable properties to their end product. Often, our products are a small portion of the total cost of our customers' products, but they can be critical to the appearance or functionality of those products.

Our customers include manufacturers of ceramic tile, major appliances, construction materials, automobile parts, automobiles, architectural and container glass, and electronic components and devices. Many of our customers, including makers of major appliances and automobile parts, purchase materials from more than one of our business units. Our customer base is well diversified both geographically and by end market.

We generally sell our products directly to our customers. However, a portion of our business uses indirect sales channels, such as agents and distributors, to deliver products to market. In 2017, no single customer or related group of customers represented more than 10% of net sales. In addition, none of our reportable segments is dependent on any single customer or related group of customers.

Backlog of Orders and Seasonality

Generally, there is no significant lead time between customer orders and delivery in any of our business segments. As a result, we do not consider that the dollar amount of backlogged orders believed to be firm is material information for an understanding of our business. Although not seasonal, in certain of our technology-driven markets, our customers' business is often characterized by product campaigns with specific life cycles, which can result in uneven demand as product ramp-up periods can be followed by down-cycle periods. As innovation activity increases in line with our value creation strategy, we expect this type of business to also increase. This type of market operates on a different cycle from the majority of our business. We also do not regard any material part of our business to be seasonal. However, customer demand has historically been higher in the second quarter when building and renovation markets are particularly active, and the second quarter is also normally the strongest for sales and operating profit.

Competition

In most of our markets, we have a substantial number of competitors, none of which is dominant. Due to the diverse nature of our product lines, no single competitor directly matches all of our product offerings. Our competition varies by product and by region, and is based primarily on product quality, performance and functionality, as well as on pricing, customer service, technical support, and the ability to develop custom products to meet specific customer applications.

We are a worldwide leader in the production of glass enamels, porcelain enamel, and ceramic tile coatings. There is strong competition in our markets, ranging from large multinational corporations to local producers. While many of our customers purchase customized products and formulations from us, our customers could generally buy from other sources, if necessary.

Raw Materials and Supplier Relations

Raw materials widely used in our operations include:

Metal Oxides:

- Aluminum oxide⁽¹⁾
- Chrome^{(1) (2)}
- Cobalt oxide⁽¹⁾⁽²⁾
- Iron Oxide⁽¹⁾
- Lead Oxide⁽¹⁾
- Nickel oxide⁽¹⁾⁽²⁾
- Titanium dioxide⁽¹⁾⁽²⁾
- Zinc oxide⁽²⁾
- Zirconium dioxide⁽²⁾

Other Inorganic Materials:

- Boron⁽²⁾
- Clay⁽²⁾
- Feldspar⁽²⁾
- Lithium⁽²⁾
- Silica⁽²⁾
- Soda Ash⁽¹⁾
- Zircon⁽²⁾

Precious and Non-precious Metals:

- Bismuth⁽¹⁾
- Chrome⁽¹⁾⁽²⁾
- Copper⁽¹⁾
- Gold⁽¹⁾
- Molybdenum⁽¹⁾
- Silver⁽¹⁾
- Vandaium⁽¹⁾

Energy:

- Electricity
- Natural gas

(1) Primarily used by the Performance Colors and Glass and the Color Solutions segments.

(2) Primarily used by the Performance Coatings segment.

These raw materials make up a large portion of our product costs in certain of our product lines, and fluctuations in the cost of raw materials can have a significant impact on the financial performance of the related businesses. We attempt to pass through to our customers raw material cost increases.

We have a broad supplier base and, in many instances, multiple sources of essential raw materials are available worldwide if problems arise with a particular supplier. We maintain many comprehensive supplier agreements for strategic and critical raw materials. We did not encounter raw material shortages in 2017 that significantly affected our manufacturing operations, but we are subject to volatile raw material costs that can affect our results of operations.

Environmental Matters

As part of the production of some of our products, we handle, process, use and store hazardous materials. As a result, we operate manufacturing facilities that are subject to a broad array of environmental laws and regulations in the countries in which we operate, particularly for plant wastes and emissions. In addition, some of our products are subject to restrictions under laws or regulations such as California's Proposition 65 or the European Union's ("EU") chemical substances directive. The costs to comply with complex environmental laws and regulations are significant and will continue for the industry and us for the foreseeable future. These routine costs are expensed as they are incurred. While these costs may increase in the future, they are not expected to have a material impact on our financial position, liquidity or results of operations. We believe that we are in substantial compliance with the environmental regulations to which our operations are subject and that, to the extent we may not be in compliance with such regulations, non-compliance will not have a materially adverse effect on our financial position, liquidity or results of operations.

Our policy is to operate our plants and facilities in a manner that protects the environment and the health and safety of our employees and the public. We intend to continue to make expenditures for environmental protection and improvements in a timely manner consistent with available technology. Although we cannot precisely predict future environmental spending, we do not expect the costs to have a material impact on our financial position, liquidity or results of operations. Capital expenditures for environmental protection were \$6.2 million in 2017, \$1.4 million in 2016, and \$5.5 million in 2015. We also accrue for environmental remediation costs when it is probable that a liability has been incurred and we can reasonably estimate the amount. We determine the timing and amount of any liability based upon assumptions regarding future events, and inherent uncertainties exist in such evaluations primarily due to unknown conditions, changing governmental regulations and legal standards regarding liability, and evolving technologies. We adjust these liabilities periodically as remediation efforts progress, the nature and extent of contamination becomes more certain, or as additional technical or legal information becomes available.

Research and Development

We are involved worldwide in research and development activities relating to new and existing products, services and technologies required by our customers' continually changing markets. Our research and development resources are organized into centers of excellence that support our regional and worldwide major business units. These centers are augmented by local laboratories that provide technical service and support to meet customer and market needs in various geographic areas.

Total expenditures for product and application technology, including research and development, customer technical support and other related activities, were \$36.4 million in 2017, \$27.3 million in 2016, and \$25.6 million in 2015.

Patents, Trademarks and Licenses

We own a substantial number of patents and patent applications relating to our various products and their uses. While these patents are of importance to us and we exercise diligence to ensure that they are valid, we do not believe that the invalidity or expiration of any single patent or group of patents would have a material adverse effect on our businesses. Our patents will expire at various dates through the year 2036. We also use a number of trademarks that are important to our businesses as a whole or to particular segments of our business. We believe that these trademarks are adequately protected.

Employees

At December 31, 2017, we employed 5,682 full-time employees, including 4,901 employees in our foreign consolidated subsidiaries and 781 in the United States ("U.S."). Total employment increased by 575 in our foreign subsidiaries and decreased by 18 in the U.S. from the prior year end due to the additions related to acquisitions and new business opportunities net of cost reduction initiatives.

Collective bargaining agreements cover 11.8% of our U.S. workforce. No U.S. labor agreements expire in 2018. We expect to complete renewals of agreements that would expire in the future with no significant disruption to the related businesses. We consider our relations with our employees, including those covered by collective bargaining agreements, to be good.

Our employees in Europe have protections afforded them by local laws and regulations through unions and works councils. Some of these laws and regulations may affect the timing, amount and nature of restructuring and cost reduction programs in that region.

Domestic and Foreign Operations

We began international operations in 1927. Our products are manufactured and/or distributed through our consolidated subsidiaries and unconsolidated affiliates in the following countries:

Consolidated Subsidiaries:

- | | | | |
|-------------|-------------|---------------|------------------|
| • Argentina | • Egypt | • Japan | • Russia |
| • Australia | • France | • Luxembourg | • Spain |
| • Belgium | • Germany | • Malaysia | • Taiwan |
| • Brazil | • India | • Mexico | • Thailand |
| • Bulgaria | • Indonesia | • Netherlands | • Turkey |
| • Canada | • Ireland | • Poland | • United Kingdom |
| • China | • Israel | • Portugal | • United States |
| • Colombia | • Italy | • Romania | • Vietnam |

Unconsolidated Affiliates:

- | | | |
|-----------|-------------|---------------|
| • China | • Egypt | • Spain |
| • Ecuador | • Indonesia | • South Korea |

Financial information for geographic areas is included in Note 20 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K. More than 74% of our net sales are outside of the U.S. Our customers represent more than 30 industries and operate in approximately 100 countries.

Our U.S. parent company receives technical service fees and/or royalties from many of its foreign subsidiaries. As a matter of corporate policy, the foreign subsidiaries have historically been expected to remit a portion of their annual earnings to the U.S. parent company as dividends. To the extent earnings of foreign subsidiaries are not remitted to the U.S. parent company, those earnings are indefinitely re-invested in those subsidiaries.

Available Information

Our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, and Current Reports on Form 8-K, including any amendments, will be made available free of charge on our website, www.ferro.com, as soon as reasonably practical, following the filing of the reports with the U.S. Securities and Exchange Commission (“SEC”). Our Corporate Governance Principles, Code of Business Conduct, Guidelines for Determining Director Independence, and charters for our Audit Committee, Compensation Committee and Governance and Nomination Committee are available free of charge either on our website or to any shareholder who requests them from the Ferro Corporation Investor Relations Department located at 6060 Parkland Blvd., Suite 250, Mayfield Heights, Ohio, 44124.

Forward-looking Statements

Certain statements contained here and in future filings with the SEC reflect our expectations with respect to future performance and constitute “forward-looking statements” within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. These statements are subject to a variety of uncertainties, unknown risks and other factors concerning our operations and the business environment, which are difficult to predict and are beyond our control.

Item 1A — Risk Factors

Many factors could cause our actual results to differ materially from those suggested by statements contained in this filing and could adversely affect our future financial performance. Such factors include the following:

We sell our products into industries where demand has been unpredictable, cyclical or heavily influenced by consumer spending, and such demand and our results of operations may be further impacted by macro-economic circumstances.

We sell our products to a wide variety of customers who supply many different market segments. Many of these market segments, including building and renovation, major appliances, transportation, and electronics, are cyclical or closely tied to consumer demand. Consumer demand is difficult to accurately forecast and incorrect forecasts of demand or unforeseen reductions in demand can adversely affect costs and profitability due to factors such as underused manufacturing capacity, excess inventory, or working capital needs. Our forecasting systems and modeling tools may not accurately predict changes in demand for our products or other market conditions.

Our results of operations are materially affected by conditions in capital markets and economies in the U.S. and elsewhere around the world. Concerns over fluctuating prices, energy costs, geopolitical issues, government deficits and debt loads, and the availability and cost of credit have contributed to economic uncertainty around the world. Our customers may be impacted by these conditions and may modify, delay, or cancel plans to purchase our products. Additionally, if customers are not successful in generating sufficient revenue or are precluded from securing financing, they may not be able to pay, or may delay payment of, accounts receivable that are owed to us. A reduction in demand or inability of customers to pay us for our products may adversely affect our earnings and cash flow.

We strive to improve operating margins through sales growth, price increases, productivity gains, optimization initiatives, and improved purchasing techniques, but we may not achieve the desired improvements.

We work to improve operating profit margins through activities such as growing sales to achieve increased economies of scale, increasing prices, improving manufacturing processes, and adopting purchasing techniques that lower costs or provide increased cost predictability to realize cost savings. However, these activities depend on a combination of improved product design and engineering, effective manufacturing process control initiatives, cost-effective redistribution of production, and other efforts that may not be as successful as anticipated. The success of sales growth and price increases depends not only on our actions but also on the strength of customer demand and competitors' pricing responses, which are not fully predictable. Failure to successfully implement actions to improve operating margins could adversely affect our financial performance.

The global scope of our operations exposes us to risks related to currency conversion rates, new and different regulatory schemes and changing economic, regulatory, social and political conditions around the world.

More than 74% of our net sales during 2017 were outside of the U.S. In order to support our customers, access regional markets and compete effectively, our operations are located around the world. Our operations are subject to economic, regulatory, social and political conditions in multiple locations and we are subject to risks relating to currency conversion rates. We also may encounter difficulties expanding into additional growth markets around the world. Other risks inherent in our operations include the following:

- New, different and unpredictable legal and regulatory requirements and enforcement mechanisms in the U.S. and other countries;

- Export licenses may be difficult to obtain and we may be subject to import or export duties or import quotas or other trade restrictions or barriers;
- Increased costs, and decreased availability, of transportation or shipping;
- Credit risk and financial conditions of local customers and distributors;
- Risk of nationalization of private enterprises governments, or restrictions on investments;
- Potentially adverse tax consequences, including imposition or increase of withholding and other taxes on remittances and other payments by subsidiaries; and
- Political, economic and social conditions, including the possibility of hyperinflationary conditions, deflation, and political instability in certain countries.

We have subsidiaries in Egypt, Israel and Turkey that are located near politically volatile regions. Such conditions could potentially impact our ability to recover both the cost of our investments and earnings from those investments. While we attempt to anticipate these changes and manage our business appropriately in each location where we do business, these changes are often beyond our control and difficult to forecast.

The consequences of these risks may have significant adverse effects on our results of operations or financial position, and if we fail to comply with applicable laws and regulations, we could be exposed to civil and criminal penalties, reputational harm, and restrictions on our operations.

We operate in regions of the world where it can be difficult for a multi-national company such as Ferro to compete lawfully with local competitors, which may cause us to lose business opportunities.

We pursue business opportunities around the world and many of our most promising growth opportunities are in developing markets and the Asia Pacific region, including the People’s Republic of China, Latin America, and the Middle East. Although we have been able to compete successfully in those markets to date, local laws and customs can make it difficult for a multi-national company such as Ferro to compete on a “level playing field” with local competitors without engaging in conduct that would be illegal under U.S. or other countries’ anti-bribery laws. Our strict policy of observing the highest standards of legal and ethical conduct may cause us to lose some otherwise attractive business opportunities to competitors in these regions.

We have undertaken and continue to undertake optimization initiatives, to rationalize our operations and improve our operating performance, but we may not be able to implement and/or administer these initiatives in the manner contemplated and these initiatives may not produce the desired results.

We have undertaken, and intend to continue undertaking, optimization initiatives to rationalize our operations to improve our operational performance. These initiatives may involve, among other things, changes to the operations of recently acquired business, the transfer of manufacturing to new or existing facilities and restructuring programs that involve plant closures and staff reductions, which could be material in their nature with respect to the investments, costs and potential benefits. These initiatives also may involve changes in the management and delivery of functional services. Although we expect these initiatives to help us achieve operational efficiencies and cost savings, we may not be able to implement and/or administer these initiatives in the manner contemplated, which could cause the initiatives to fail to achieve the desired results. In addition, transfer and consolidation of manufacturing operations may involve substantial capital expenses and the transfer of manufacturing processes and personnel from one site to another, with resultant inefficiencies and other issues at the receiving site as it starts up, the need for re-qualification of our products and for ISO or other certifications of our products. We may experience shortages of affected products, delays and higher than expected expenses. Changes in functional services may prove ineffective, inefficient and disruptive. Accordingly, the initiatives that we have implemented and those that we may implement in the future may not improve our operating performance and may not help us achieve cost savings. Failure to successfully implement and/or administer these initiatives could have an adverse effect on our financial performance.

Our businesses depend on a continuous stream of new products and services, and failure to introduce new products and services could affect our sales, profitability and liquidity.

We strive to remain competitive through innovation, including by developing and introducing new and improved products and services on an ongoing basis. Customers continually evaluate our products and services in comparison to those offered by our competitors. A failure to introduce new products and services at the right time that are price competitive and that meet the needs of our customers could adversely affect our sales, or could require us to compensate by lowering prices. In addition, when we invest in new product development, we face risks related to production delays, cost over-runs and unanticipated technical difficulties, which could impact sales, profitability and/or liquidity.

Our strategy includes seeking opportunities in new growth markets, and failure to identify or successfully enter such markets could affect our ability to grow our revenues and earnings.

Certain of our products are sold into mature markets and part of our strategy is to identify and enter into markets growing more rapidly. These growth opportunities may involve new geographies, new product lines, new technologies, or new customers. We may not successfully exploit such opportunities and our ability to increase our revenue and earnings could be impacted as a result.

We may not be able to complete or successfully integrate future acquisitions into our business, which could adversely affect our business or results of operations.

We have pursued and we intend to continue to pursue acquisitions. Our success in accomplishing growth through acquisitions may be limited by the availability and suitability of acquisition candidates and by our financial resources, including available cash and borrowing capacity. Acquisitions involve numerous risks, including difficulty determining appropriate valuation, integrating operations, technologies, services and products of the acquired product lines or business, personnel turnover, and the diversion of management's attention from other business matters. In addition, we may be unable to achieve anticipated benefits from these acquisitions in the timeframe that we anticipate, or at all, which could adversely affect our business or result of operations.

We rely on information systems to conduct our business and interruption, or damage to, or failure or compromise of, these systems may adversely affect our business and results of operations.

We rely on information systems to obtain, process, analyze and manage data to forecast and facilitate the purchase of raw materials and the distribution of our products; to receive, process, and ship orders on a timely basis; to run and operate our facilities; to account for our product and service transactions with customers; to manage the accurate billing and collections for thousands of customers; to process payments to suppliers; and to manage data and records relating to our employees, contractors, and other individuals. Our business and results of operations may be adversely affected if these systems are interrupted, damaged, or compromised or if they fail for any extended period of time, due to events including but not limited to programming errors, aging and required maintenance or replacement, computer viruses and security breaches. Information privacy and cyber security risks have generally increased in recent years because of the proliferation of new technologies and the increased sophistication and activities of perpetrators of cyber-attacks. Prevention of privacy or security breaches cannot be assured. In addition, third-party service providers are responsible for managing a significant portion of our information systems, and we are subject to risk as a result of possible information privacy and security breaches of those third parties. The consequences of these risks could adversely impact our results of operations, financial condition, and cash flows.

Our implementation and operation of business information systems and processes could adversely affect our results of operations and cash flow.

We have been implementing and operating information systems and related business processes for our business operations. Implementation and operation of information systems and related processes involves risk, including risks related to programming and data transfer. Costs of implementation also could be greater than anticipated. In addition, we may be unable or decide not to implement such systems and processes in certain locations. Inherent risks, decisions and constraints related to implementation and operation of information systems could result in operating inefficiencies and could impact our ability to perform business transactions. These risks could adversely impact our results of operations, financial condition, and cash flows.

Our business is subject to a variety of domestic and international laws, rules, policies and other obligations regarding data protection.

The processing and storage of certain information is increasingly subject to privacy and data security regulations and many such regulations are country-specific. The interpretation and application of data protection laws in the U.S, Europe, including but not limited to the General Data Protection Regulation (the “GDPR”), and elsewhere are uncertain, evolving and may be inconsistent among jurisdictions. Complying with these various laws is difficult and could cause us to incur substantial costs or require us to change our business practices in a manner adverse to our business. We may be required to expend additional resources to continue to enhance our information privacy and security measures, investigate and remediate any information security vulnerabilities and/or comply with regulatory requirements.

We are subject to a number of restrictive covenants under our revolving credit facility, which could affect our flexibility to fund ongoing operations and strategic initiatives, and, if we are unable to maintain compliance with such covenants, could lead to significant challenges in meeting our liquidity requirements.

Our Credit Facility, entered into on February 14, 2017, contains a number of restrictive covenants, including those described in more detail in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K. These covenants include limitations on use of loan proceeds, limitations on the Company’s ability to pay dividends and repurchase stock, limitations on acquisitions and dispositions and limitations on certain types of investments. The Credit Facility also contains standard provisions relating to conditions of borrowing and customary events of default, including the non-payment of obligations by the Company and the bankruptcy of the Company. Specific to the revolving credit facility, the Company is subject to a financial covenant regarding the Company’s maximum leverage ratio. If an event of default occurs, all amounts outstanding under the Credit Facility may be accelerated and become immediately due and payable. The Credit Facility is described in more detail in “Capital Resources and Liquidity” under Item 7 and in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

We depend on external financial resources, and the economic environment and credit market uncertainty could interrupt our access to capital markets, borrowings, or financial transactions to hedge certain risks, which could adversely affect our financial condition.

At December 31, 2017, we had approximately \$751.6 million of short-term and long-term debt with varying maturities and approximately \$45.4 million of off balance sheet arrangements, including consignment arrangements for precious metals, bank guarantees, and standby letters of credit. These arrangements have allowed us to make investments in growth opportunities and fund working capital requirements. In addition, we may enter into financial transactions to hedge certain risks, including foreign exchange, commodity pricing, and sourcing of certain raw materials. Our continued access to capital markets and, the stability of our lenders, customers and financial partners, and their willingness to support our needs, are essential to our liquidity and our ability to meet our current obligations and to fund operations and our strategic initiatives. An interruption in our access to external financing or financial transactions to hedge risk could adversely affect our business prospects and financial condition. See further information regarding our liquidity in “Capital Resources and Liquidity” under Item 7 and in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

We depend on reliable sources of energy and raw materials, minerals and other supplies, at a reasonable cost, but the availability of these materials and supplies could be interrupted and/or their prices could change and adversely affect our sales and profitability.

We purchase energy and many raw materials to manufacture our products. Changes in their availability or price could affect our ability to manufacture enough products to meet customers' demands or to manufacture products profitably. We try to maintain multiple sources of raw materials and supplies where practical, but this may not prevent unanticipated changes in their availability or cost and, for certain raw materials, there may not be alternative sources. We may not be able to pass cost increases through to our customers. Significant disruptions in availability or cost increases could adversely affect our manufacturing volume or costs, which could negatively affect product sales or profitability of our operations.

Regulatory authorities in the U.S., European Union and elsewhere are taking a much more aggressive approach to regulating hazardous materials and other substances, and those regulations could affect sales of our products.

Legislation and regulations concerning hazardous materials and other substances can restrict the sale of products and/or increase the cost of producing them. Some of our products are subject to restrictions under laws or regulations such as California's Proposition 65 or the EU's chemical substances directive. The EU "REACH" registration system requires us to perform studies of some of our products or components of our products and to register the information in a central database, increasing the cost of these products. As a result of such regulations, our ability to sell certain products may be curtailed and customers may avoid purchasing some products in favor of less regulated, less hazardous or less costly alternatives. It may be impractical for us to continue manufacturing heavily regulated products, and we may incur costs to shut down or transition such operations to alternative products. These circumstances could adversely affect our business, including our sales and operating profits.

Sales of our products to certain customers or into certain industries may expose us to different and complex regulatory regimes.

We seek to expand our customer base and the industries into which we sell. Selling products to certain customers or into certain industries, such as governments or the defense industry, requires compliance with regulatory regimes that do not apply to sales involving other customers or industries and that can be complex and difficult to navigate. Our failure to comply with these regulations could result in liabilities or damage to our reputation, which could negatively impact our business, financial condition, or results of operations.

Our business could be adversely affected by safety, environmental and product stewardship issues.

We may be impacted by and may not be able to adequately address safety, human health, product liability and environmental risks associated with our current and historical products, product life cycles, and production processes and the obligations that follow from them. This could adversely impact employees, communities, stakeholders, the environment, our reputation and our business, financial condition, and the results of our operations. Public perception of the risks associated with our products, their respective life cycles, and production processes could impact product acceptance and influence the regulatory environment in which we operate.

Certain of the markets for our products and services are highly competitive and subject to intense price competition, which could adversely affect our sales and earnings performance.

Our customers typically have multiple suppliers from which to choose. If we are unwilling or unable to provide products and services at competitive prices, and if other factors, such as product performance and value-added services do not provide an offsetting competitive advantage, customers may reduce, discontinue, or decide not to purchase our products. If we could not secure alternate customers for lost business, our sales and earnings performance could be adversely affected.

If we are unable to protect our intellectual property rights, including trade secrets, or to successfully resolve claims of infringement brought against us, our product sales and financial performance could be adversely affected.

Our performance may depend in part on our ability to establish, protect and enforce intellectual property rights with respect to our products, technologies and proprietary rights and to defend against any claims of infringement, which involves complex legal, scientific and factual questions and uncertainties. We may have to rely on litigation to enforce our intellectual property rights. The intellectual property laws of some countries may not protect our rights to the same extent as the laws of the U.S. In addition, we may face claims of infringement that could interfere with our ability to use technology or other intellectual property rights that are material to our business operations. If litigation that we initiate is unsuccessful, we may not be able to protect the value of some of our intellectual property. In the event a claim of infringement against us is successful, we may be required to pay royalties or license fees to continue to use technology or other intellectual property rights that we have been using or we may be unable to obtain necessary licenses from third parties at a reasonable cost or within a reasonable time.

Our operations are subject to operating hazards and to stringent environmental, health and safety regulations, and compliance with those regulations could require us to make significant investments.

Our production facilities are subject to hazards associated with the manufacture, handling, storage, and transportation of chemical materials and products. These hazards can cause personal injury and loss of life, severe damage to, or destruction of, property and equipment and environmental contamination and other environmental damage and could have an adverse effect on our business, financial condition or results of operations.

We strive to maintain our production facilities and conduct our manufacturing operations in a manner that is safe and in compliance with all applicable environmental, health and safety regulations. Compliance with changing regulations, or other circumstances, may require us to make significant capital investments, incur training costs, make changes in manufacturing processes or product formulations, or incur costs that could adversely affect our profitability, and violations of these laws could lead to substantial fines and penalties. These costs may not affect competitors in the same way due to differences in product formulations, manufacturing locations or other factors, and we could be at a competitive disadvantage, which might adversely affect financial performance.

We have limited or no redundancy for certain of our manufacturing operations, and damage to our facilities or interference with our operations could interrupt our business, increase our costs of doing business and impair our ability to deliver our products on a timely basis.

If certain of our existing production facilities become incapable of manufacturing products for any reason, including through interruption of our supply chain, we may be unable to meet production requirements, we may lose revenue and we may not be able to maintain our relationships with our customers. Without operation of certain existing production facilities, we may be unable or limited in our ability to deliver products until we restore the manufacturing capability at the particular facility, find an alternative manufacturing facility or arrange an alternative source of supply. Although we carry business interruption insurance to cover lost revenue and profits in an amount we consider adequate, this insurance does not cover all possible situations or expenses. We may not be able to recover from or be compensated for the loss of opportunity and potential adverse impact on relations with our existing customers resulting from our inability to produce and deliver products for them.

If we are unable to manage our general and administrative expenses, our business, financial condition or results of operations could be negatively impacted.

We may not be able to effectively manage our administrative expense in all circumstances. While we attempt to effectively manage such expenses, including through projects designed to create administrative

efficiencies, increases in staff-related and other administrative expenses may occur from time to time. We have made significant efforts to achieve general and administrative cost savings and improve our operational performance. As a part of these initiatives, we have and will continue to consolidate business and management operations and enter into arrangements with third parties offering cost savings. It cannot be assured that our strategies to reduce our general and administrative costs and improve our operating performance will be successful or achieve the anticipated savings.

Our multi-jurisdictional tax structure may not provide favorable tax efficiencies.

We conduct our business operations in a number of countries and are subject to taxation in those jurisdictions. While we seek to minimize our worldwide effective tax rate, our corporate structure may not optimize tax efficiency opportunities. We develop our tax position based upon the anticipated nature and structure of our business and the tax laws, administrative practices and judicial decisions now in effect in the countries in which we have assets or conduct business, which are subject to change or differing interpretations. In addition, our effective tax rate could be adversely affected by several other factors, including: increases in expenses that are not deductible for tax purposes, the tax effects of restructuring charges or purchase accounting for acquisitions, changes related to our ability to ultimately realize future benefits attributed to our deferred tax assets, including those related to other-than-temporary impairment, and a change in our decision to indefinitely reinvest foreign earnings. Further, we are subject to review and audit by both domestic and foreign tax authorities, which may result in adverse decisions. Increased tax expense could have a negative effect on our operating results and financial condition.

We have significant deferred tax assets, and if we are unable to utilize these assets, our results of operations may be adversely affected.

To fully realize the carrying value of our net deferred tax assets, we will have to generate adequate taxable profits in various tax jurisdictions. At December 31, 2017, we had \$74.7 million of net deferred tax assets, after valuation allowances. If we do not generate adequate profits within the time periods required by applicable tax statutes, the carrying value of the tax assets will not be realized. If it becomes unlikely that the carrying value of our net deferred tax assets will be realized, the valuation allowances may need to be increased in our consolidated financial statements, adversely affecting results of operations. Further information on our deferred tax assets is presented in Note 10 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

U.S. federal income tax reform could adversely affect us.

On December 22, 2017, U.S. federal tax legislation, commonly referred to as the Tax Cuts and Jobs Act (the “Tax Act”), was signed into law, significantly reforming the U.S. Internal Revenue Code. The Tax Act, among other things, includes changes to U.S. federal tax rates, imposes significant additional limitations on the deductibility of interest, allows for the expensing of capital expenditures, puts into effect the migration from a “worldwide” system of taxation to a territorial system and modifies or repeals many business deductions and credits. We continue to examine the impact the Tax Act may have on our business.

We may not be successful in implementing our strategies to increase our return on invested capital.

We are taking steps to generate a higher return on invested capital. There are risks associated with the implementation of these steps, which may be complicated and may involve substantial capital investment. To the extent we fail to achieve these strategies, our results of operations may be adversely affected.

We are subject to stringent labor and employment laws in certain jurisdictions in which we operate, we are party to various collective bargaining arrangements, and our relationship with our employees could deteriorate, which could adversely impact our operations.

A majority of our full-time employees are employed outside the U.S. In certain jurisdictions where we operate, labor and employment laws are relatively stringent and, in many cases, grant significant job protection to certain employees, including rights on termination of employment. In addition, in certain countries where we operate, our employees are members of unions or are represented by works councils. We are often required to consult with and seek the consent or advice of these unions and/or works councils. These regulations and laws, coupled with the requirement to seek consent or consult with the relevant unions or works councils, could have a significant impact on our flexibility in managing costs and responding to market changes.

Furthermore, approximately 11.8% of our U.S. employees as of December 31, 2017, are subject to collective bargaining arrangements or similar arrangements, none of which expire in 2018. While we expect to be able to renew these agreements without significant disruption to our business when they are scheduled to expire, there can be no assurance that we will be able to negotiate labor agreements on satisfactory terms or that actions by our employees will not be disruptive to our business. If these workers were to engage in a strike, work stoppage or other slowdown or if other employees were to become unionized, we could experience a significant disruption of our operations and/or higher ongoing labor costs, which could adversely affect our business, financial condition and results of operations.

Employee benefit costs, especially postretirement costs, constitute a significant element of our annual expenses, and funding these costs could adversely affect our financial condition.

Employee benefit costs are a significant element of our cost structure. Certain expenses, particularly postretirement costs under defined benefit pension plans and healthcare costs for employees and retirees, may increase significantly at a rate that is difficult to forecast and may adversely affect our financial results, financial condition or cash flows. Changes in the applicable discount rate can affect our postretirement obligation. Declines in global capital markets may cause reductions in the value of our pension plan assets. Such circumstances could have an adverse effect on future pension expense and funding requirements. Further information regarding our retirement benefits is presented in Note 12 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

We are subject to risks associated with outsourcing functions to third parties.

We have entered into outsourcing agreements with third parties, and rely on such parties, to provide certain services in support of our business. One such vendor provides a number of business services related to our information systems and finance and accounting activity. Arrangements with third-party service providers may make our operations vulnerable if vendors fail to provide the expected service or there are changes in their own operations, financial condition, or other matters outside of our control. If these service providers are unable to perform to our requirements or to provide the level of service expected, our operating results and financial condition may suffer and we may be forced to pursue alternatives to provide these services, which could result in delays, business disruptions and additional expenses.

There are risks associated with the manufacture and sale of our materials into industries that make products for sensitive applications.

We manufacture and sell materials to parties that make products for sensitive applications, such as medical devices. The supply of materials that enter the human body involves the risk of illness or injury to consumers, as well as commercial risks. Injury to consumers could result from, among other things, improper use, tampering by unauthorized third parties, or the introduction into the material of foreign objects, substances, chemicals and other agents during the manufacturing, packaging, storage, handling or transportation phases. Shipment of adulterated materials may be a violation of law and may lead to an increased risk of exposure to product liability

or other claims, product recalls and increased scrutiny by federal and state regulatory agencies. Such claims or liabilities may not be covered by our insurance or by any rights of indemnity or contribution that we may have against third parties. In addition, the negative publicity surrounding any assertion that our materials caused illness or injury could have a material adverse effect on our reputation with existing and potential customers, which could negatively impact our business, operating results or financial condition.

We are exposed to lawsuits, governmental investigations and proceeding relating to current and historical operations and products, which could harm our business.

We are from time to time exposed to certain lawsuits, governmental investigations and proceedings relating to current and historical operations and products, which may include claims involving product liability, infringement of intellectual property rights of third parties, environmental compliance, hazardous materials, work place safety, employment contract and other claims. Due to the uncertainties of litigation, we can give no assurance that we will prevail on claims made against us in the lawsuits that we currently face or that additional claims will not be made against us in the future. We do not believe that lawsuits we currently face are likely to have a material adverse effect on our business, operating results or financial condition. Lawsuits or claims, if they were to result in a ruling adverse to us or otherwise result in an obligation on the part of the Company, could give rise to substantial liability, which could have a material adverse effect on our business, operating results or financial condition.

We are exposed to intangible asset risk, and a write down of our intangible assets could have an adverse impact to our operating results and financial position.

We have recorded intangible assets, including goodwill, in connection with business acquisitions. We are required to perform goodwill impairment tests on at least an annual basis and whenever events or circumstances indicate that the carrying value may not be recoverable from estimated future cash flows. As a result of our annual and other periodic evaluations, we may determine that the intangible asset values need to be written down to their fair values, which could result in material charges that could be adverse to our operating results and financial position. See further information regarding our goodwill and other intangible assets in “Critical Accounting Policies” under Item 7 and in Note 7 to the consolidated financial statements under Item 8 of this Form 10-K.

Interest rates on some of our borrowings are variable, and our borrowing costs could be adversely affected by interest rate increases.

Portions of our debt obligations have variable interest rates. Generally, when interest rates rise, our cost of borrowings increases. We estimate, based on the debt obligations outstanding at December 31, 2017, that a one percent increase in interest rates would cause interest expense to increase by \$4.9 million annually. Although interest rates have remained relatively stable over the past few years, future increases could raise our cost of borrowings and adversely affect our financial performance. See further information regarding our interest rates on our debt obligations in “Quantitative and Qualitative Disclosures about Market Risk” under Item 7A and in Note 8 to the consolidated financial statements under Item 8 of this Form 10-K.

Many of our assets are encumbered by liens that have been granted to lenders, and those liens affect our flexibility to dispose of property and businesses.

Certain of our debt obligations are secured by substantially all of our assets. These liens could reduce our ability and/or extend the time to dispose of property and businesses, as these liens must be cleared or waived by the lenders prior to any disposition. These security interests are described in more detail in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

We are exposed to risks associated with acts of God, terrorists and others, as well as fires, explosions, wars, riots, accidents, embargoes, natural disasters, strikes and other work stoppages, quarantines and other governmental actions, and other events or circumstances that are beyond our control.

Ferro is exposed to risks from various events that are beyond our control, which may have significant effects on our results of operations. While we attempt to mitigate these risks through appropriate loss prevention measures, insurance, contingency planning and other means, we may not be able to anticipate all risks or to reasonably or cost-effectively manage those risks that we do anticipate. As a result, our operations could be adversely affected by circumstances or events in ways that are significant and/or long lasting.

The risks and uncertainties identified above are not the only risks that we face. Additional risks and uncertainties not presently known to us or that we currently believe to be immaterial also may adversely affect us. If any known or unknown risks and uncertainties develop into actual events, these developments could have material adverse effects on our financial position, results of operations, and cash flows.

Item 1B — Unresolved Staff Comments

None.

Item 2 — Properties

We lease our corporate headquarters offices, which are located at 6060 Parkland Blvd., Mayfield Heights, Ohio. The Company owns other corporate facilities worldwide. We own principal manufacturing plants that range in size from 21,000 sq. ft. to over 1,500,000 sq. ft. Plants we own with more than 250,000 sq. ft. are located in Spain; Germany; Belgium; Colombia; Mexico; Cleveland, Ohio; and Penn Yan, New York. The locations of these principal manufacturing plants by reportable segment are as follows:

Color Solutions-U.S.: Penn Yan, New York and Norcross, Georgia. Outside the U.S.: Colombia, China, India, Belgium, France, Romania, Spain and Brazil.

Performance Colors and Glass-U.S.: Washington, Pennsylvania; King of Prussia, Pennsylvania and Orrville, Ohio. Outside the U.S.: Brazil, China, France, Germany, Mexico, Spain, and the United Kingdom.

Performance Coatings-U.S.: Cleveland, Ohio. Outside the U.S.: Argentina, Brazil, China, Egypt, France, Indonesia, Italy, Mexico, Spain, Poland, Portugal, Thailand and the United Kingdom.

In addition, we lease manufacturing facilities for the Performance Colors and Glass segment in the United Kingdom; Germany; Japan; Israel; Turkey; and Vista, California. We also lease manufacturing facilities for the Performance Coatings segment in Italy and Poland. In some instances, the manufacturing facilities are used for two or more segments. Leased facilities range in size from 12,000 sq. ft. to over 100,000 sq. ft.

Item 3 — Legal Proceedings

There are various lawsuits and claims pending against the Company and its consolidated subsidiaries. We do not currently expect the resolution of such matters to materially affect the consolidated financial position, results of operations, or cash flows of the Company.

Item 4 — Mine Safety Disclosures

Not applicable.

Executive Officers of the Registrant

The executive officers of the Company as of February 28, 2018, are listed below, along with their ages and business experience during the past five years. The year indicates when the individual was named to the indicated position with Ferro, unless otherwise indicated.

Peter T. Thomas — 62

Chairman of the Board of Directors, 2014

President and Chief Executive Officer, 2013

Mark H. Duesenberg — 56

Vice President, General Counsel and Secretary, 2008

Benjamin J. Schlater — 42

Vice President and Chief Financial Officer, 2016

Vice President, Corporate Development and Strategy, 2015

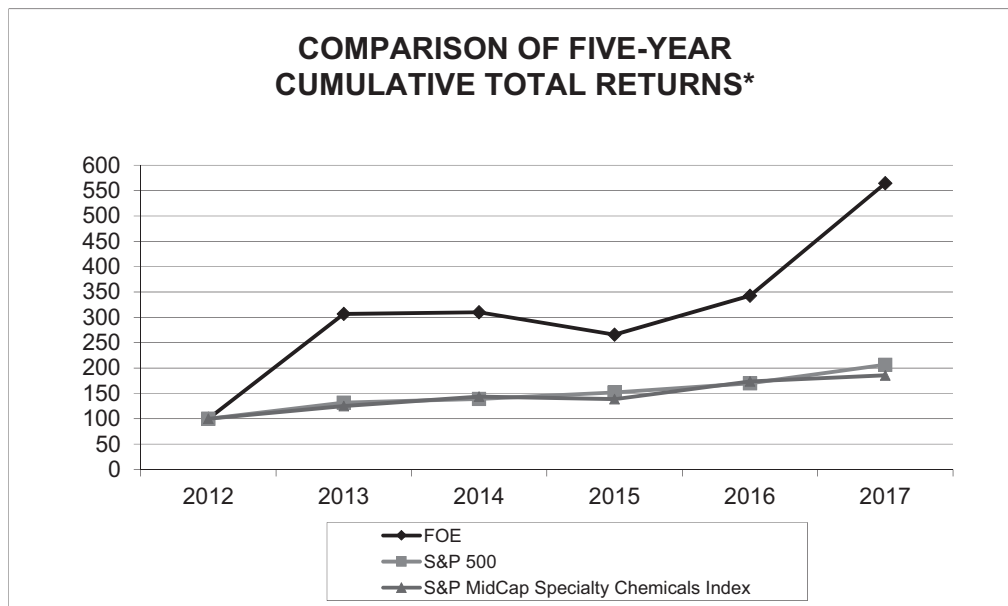
Treasurer and head of corporate development, strategic and financial planning and risk management, Veyance Technologies, a global manufacturing company, 2007

PART II

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

Our common stock is listed on the New York Stock Exchange under the ticker symbol FOE. On January 31, 2018, we had 869 shareholders of record for our common stock, and the closing price of the common stock was \$23.52 per share.

The chart below compares Ferro’s cumulative total shareholder return for the five years ended December 31, 2017, to that of the Standard & Poor’s 500 Index and the Standard & Poor’s MidCap Specialty Chemicals Index. In all cases, the information is presented on a dividend-reinvested basis and assumes investment of \$100.00 on December 31, 2012. At December 31, 2017, the closing price of our common stock was \$23.59 per share.



The quarterly high and low intra-day sales prices and dividends declared per share for our common stock during 2017 and 2016 were as follows:

	2017			2016		
	High	Low	Dividends	High	Low	Dividends
First Quarter	\$15.28	\$13.55	\$—	\$12.76	\$ 8.47	\$—
Second Quarter	19.37	14.79	—	14.88	11.42	—
Third Quarter	22.30	17.78	—	14.70	11.80	—
Fourth Quarter	25.50	21.64	—	16.17	12.46	—

The restrictive covenants contained in our Credit Facility limit the amount of dividends we can pay on our common stock. For further discussion, see Management’s Discussion and Analysis of Financial Condition and Results of Operations under Item 7 of this Annual Report on Form 10-K.

The Company's Board of Directors approved share repurchase programs, under which the Company is authorized to repurchase up to \$100 million of the Company's outstanding shares of common stock on the open market, including through a Rule 10b5-1 plan, or in privately negotiated transactions.

The Company repurchased 1,175,437 shares of common stock at an average price of \$9.72 per share for a total cost of \$11.4 million during 2016. No repurchases were made during 2017. Under the share repurchase programs, the Company has repurchased an aggregate of 4,458,345 shares of common stock, at an average price of \$11.21 per share, for a total cost of \$50.0 million. As of December 31, 2017, \$50.0 million may still be purchased under the programs.

The following table summarizes purchases of our common stock by the Company and affiliated purchasers during the three months ended December 31, 2017:

	Total Number of Shares Purchased	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	Maximum Dollar Amount that May Yet Be Purchased Under the Plans or Programs
	(Dollars in thousands, except for per share amounts)			
October 1, 2017 to October 31, 2017	—	\$—	—	\$50,000,000
November 1, 2017 to November 30, 2017	—	\$—	—	\$50,000,000
December 1, 2017 to December 31, 2017	—	\$—	—	\$50,000,000
Total	—		—	

Item 6 — Selected Financial Data

The following table presents selected financial data for the last five years ended December 31st:

	2017	2016	2015	2014	2013
	(Dollars in thousands, except for per share data)				
Net sales	\$ 1,396,742	\$ 1,145,292	\$ 1,075,341	\$ 1,111,626	\$ 1,188,582
Income (loss) from continuing operations	57,768	44,577	99,883	(8,609)	63,905
Basic earnings (loss) per share from continuing operations attributable to Ferro Corporation common shareholders	0.68	0.52	1.16	(0.10)	0.73
Diluted earnings (loss) per share from continuing operations attributable to Ferro Corporation common shareholders	0.67	0.51	1.14	(0.10)	0.72
Cash dividends declared per common shares	—	—	—	—	—
Total assets	1,682,202	1,283,769	1,225,351	1,091,554	1,004,781
Long-term debt, including current portion	735,267	563,033	470,805	302,383	265,226

In 2015, we adopted the provisions of ASU 2015-03. The ASU requires debt issuance costs for term loans to be presented in the balance sheet as a reduction of the related debt liability rather than an asset. The adoption resulted in the reclassification of \$5.3 million and \$3.4 million of unamortized debt issuance costs related to the term loan from Total assets to a reduction in Long-term debt, including current portion within the financial data above as of December 31, 2014 and 2013, respectively.

In 2014, we commenced a process to market for sale all of the assets in our Polymer Additives reportable segment. During 2014, we sold substantially all of the assets related to our North America-based Polymer Additives business, which is presented as discontinued operations in 2014 and 2013. In 2016, we completed the disposition of the Europe-based Polymer Additives business, which is presented as discontinued operations in 2016 through 2013.

In 2014, we sold substantially all of the assets in our Specialty Plastics business, which is presented as discontinued operations in 2014 and 2013.

In 2013, we sold our Pharmaceuticals business, which is presented as discontinued operations in 2013.

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

Overview

During the year ended December 31, 2017, net sales increased \$251.5 million, or 22.0%, compared with 2016. The increase was driven by higher sales in Color Solutions, Performance Colors and Glass and Performance Coatings of \$111.2 million, \$73.2 million and \$67.0 million, respectively. Gross profit increased \$65.0 million compared with 2016. The increase in gross profit was attributable to increases across all of our segments, with increases in Color Solutions, Performance Colors and Glass and Performance Coatings of \$29.4 million, \$23.8 million and \$6.3 million, respectively. As a percentage of net sales, gross profit rate decreased approximately 90 basis points to 29.8%, from 30.7% in the prior year.

For the year ended December 31, 2017, selling, general and administrative (“SG&A”) expenses increased \$16.9 million, or 7.0%, compared with 2016. As a percentage of net sales, SG&A expenses decreased 260 basis points from 21.1% in 2016 to 18.5% in 2017.

For the year ended December 31, 2017, net income was \$57.8 million, compared with net loss of \$19.9 million in 2016, and net income attributable to common shareholders was \$57.1 million, compared with net loss attributable to common shareholders of \$20.8 million in 2016. Income from continuing operations was \$57.8 million for the year ended December 31, 2017, compared with income from continuing operations of \$44.6 million in 2016.

2017 Transactional Activity

Business Acquisitions

Acquisition of Endeka Group (“Endeka”): As discussed in Note 4, in the fourth quarter of 2017, the Company acquired 100% of the equity interests of Endeka, a global producer of high-value coatings and key raw materials for the ceramic tile market, for €72.7 million (approximately \$84.6 million).

Acquisition of Gardenia Quimica S.A. (“Gardenia”): As discussed in Note 4, in the third quarter of 2017, the Company acquired a majority interest in Gardenia for \$3.0 million.

Acquisition of Dip Tech Ltd. (“Dip-Tech”): As discussed in Note 4, in the third quarter of 2017, the Company acquired 100% of the equity interests of Dip-Tech, a leading provider of digital printing solutions for glass, for \$76.0 million.

Acquisition of S.P.C. Group s.r.l. and Smalti per Ceramiche, s.r.l (together “SPC”): As discussed in Note 4, in the second quarter of 2017, the Company acquired 100% of the equity interests of SPC, for €18.7 million (approximately \$20.3 million).

Outlook

The Company delivered strong performance throughout 2017, with notable sales and gross profit improvements, primarily due to increases in organic growth, contributions from businesses acquired within the past 12 months and optimization programs throughout the footprint. For 2018, we will continue to execute our value creation strategy, which includes organic and inorganic growth, and optimization. We expect organic growth through new products and repositioning of our portfolio to continue transitioning to the higher end of our target markets. We expect to continue investing at a level of approximately \$100 to \$150 million per year in strategic acquisitions. We are implementing optimization programs to improve efficiency and upgrade operations throughout our business.

Raw materials costs increased during 2017, putting pressure on gross margin. Over the long term, we are confident in our ability to mitigate raw material inflation, with a lag, due to our technological advances in reformulating compounds, pricing initiatives and optimization initiatives. For 2017, organic growth, new

products and pricing initiatives completely offset raw material price increases. We expect price increases for some raw materials to continue in 2018. We expect to offset the cost increases with pricing actions, product reformulations and optimization actions.

We expect foreign currency rates to continue to be volatile in 2018, and changes in interest rates could adversely impact reported results.

We remain focused on the integration of recent acquisitions and continue to work toward achieving the identified synergies. We will concurrently focus on opportunities to optimize our cost structure and make our business processes and systems more efficient. We continue to expect cash flow from operating activities to be positive for 2018, providing additional liquidity

Results of Operations — Consolidated

Comparison of the years ended December 31, 2017 and 2016

For the year ended December 31, 2017, income from continuing operations was \$57.8 million, compared with income from continuing operations of \$44.6 million in 2016. For the year ended December 31, 2017, net income was \$57.8 million, compared with net loss of \$19.9 million in 2016. For the year ended December 31, 2017, net income attributable to common shareholders was \$57.1 million, or \$0.68 earnings per share, compared with net loss attributable to common shareholders of \$20.8 million, or \$0.25 loss per share in 2016.

Net Sales

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Net sales	\$ 1,396,742	\$ 1,145,292	\$ 251,450	22.0%
Cost of sales	980,521	794,075	186,446	23.5%
Gross profit	\$ 416,221	\$ 351,217	\$ 65,004	18.5%
Gross profit as a % of net sales	29.8%	30.7%		

Net sales increased by \$251.5 million, or 22.0%, in the year ended December 31, 2017, compared with the prior year, with increased sales in Color Solutions, Performance Colors and Glass and Performance Coatings of \$111.2 million, \$73.2 million and \$67.0 million, respectively. The increase in net sales was driven by both acquisitions and organic growth. Organically, Color Solutions grew \$39.6 million, Performance Coatings grew \$24.1 million and Performance Colors and Glass grew \$11.8 million.

Gross Profit

Gross profit increased \$65.0 million, or 18.5%, in 2017 to \$416.2 million, compared with \$351.2 million in 2016 and, as a percentage of net sales, it decreased 90 basis points to 29.8%. The increase in gross profit was attributable to increases across all of our segments, with increases in Color Solutions, Performance Colors and Glass and Performance Coatings of \$29.4 million, \$23.8 million and \$6.3 million, respectively. The increase in gross profit was primarily attributable to acquisitions of \$46.9 million, lower manufacturing and product costs of \$28.8 million, driven by higher volume and mix, as well as strategic purchasing actions, favorable product pricing of \$12.9 million, higher sales volumes and mix of \$9.9 million, favorable foreign currency impacts of \$0.3 million, partially offset by higher raw material costs of \$39.3 million.

Geographic Revenues

The following table presents our sales on the basis of where sales originated.

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Geographic Revenues on a sales origination basis				
Europe	\$ 683,601	\$ 515,055	\$ 168,546	32.7%
United States	356,482	300,187	56,295	18.8%
Asia Pacific	195,918	179,464	16,454	9.2%
Latin America	160,741	150,586	10,155	6.7%
Net sales	\$ 1,396,742	\$ 1,145,292	\$ 251,450	22.0%

The increase in net sales of \$251.5 million, compared with 2016, was driven by higher sales from all regions. The increase in sales from Europe was attributable to higher sales in Color Solutions, Performance Coatings and Performance Colors and Glass of \$69.3 million, \$56.4 million and \$42.8 million, respectively. The increase in sales from the United States was primarily attributable to higher sales in Color Solutions and Performance Colors and Glass of \$33.0 million and \$22.9 million, respectively. The increase in sales from Latin America and Asia Pacific was attributable to higher sales across all segments.

The following table presents our sales on the basis of where sold products were shipped.

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Geographic Revenues on a shipped-to basis				
Europe	\$ 649,423	\$ 501,231	\$ 148,192	29.6%
Asia Pacific	300,594	244,057	56,537	23.2%
United States	263,236	239,771	23,465	9.8%
Latin America	183,489	160,233	23,256	14.5%
Net sales	\$ 1,396,742	\$ 1,145,292	\$ 251,450	22.0%

Selling, General and Administrative Expense

The following table includes SG&A components with significant changes between 2017 and 2016.

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Personnel expenses	\$ 147,598	\$ 119,785	\$ 27,813	23.2%
Business development	16,481	12,890	3,591	27.9%
Stock-based compensation	11,770	7,245	4,525	62.5%
Incentive compensation	12,581	10,852	1,729	15.9%
Pension and other postretirement benefits	(5,624)	16,417	(22,041)	(134.3)%
Bad debt	44	1,383	(1,339)	(96.8)%
Intangible asset amortization	10,289	6,199	4,090	66.0%
Research and development expenses	36,359	27,327	9,032	33.1%
All other expenses	29,106	39,604	(10,498)	(26.5)%
Selling, general and administrative expenses	\$ 258,604	\$ 241,702	\$ 16,902	7.0%

SG&A expenses were \$16.9 million higher in 2017 compared with the prior year. As a percentage of net sales, SG&A expenses decreased 260 basis points from 21.1% in 2016 to 18.5% in 2017. The most significant driver in SG&A expenses in 2017 was the change in the mark-to-market loss and curtailment and settlement effects on our defined benefit pension plans and postretirement health care and life insurance benefit plans of \$18.8 million, which is included within Pension and other postretirement benefits. The expense in 2017 was lower than the prior year primarily due to the gain from actual returns exceeding expected returns on plan assets on the U.S. pension plans. Excluding the impacts of the pension and other postretirement benefits expense, SG&A expenses decreased 80 basis points from 19.7% in 2016 to 18.9% in 2017. The higher SG&A expenses compared with the prior year are primarily driven by businesses acquired within the last year. The acquisitions were the primary driver of the increase in personnel expenses, research and development expenses and accounted for the entire increase in intangible asset amortization. The increase in business development expense is due to higher professional fees. The increase in stock-based compensation expense of \$4.5 million is the result of the Company's performance relative to targets for certain awards compared with the prior year, as well as increases in the Company's stock price.

The following table presents SG&A expenses attributable to sales, research and development, and operations costs as strategic services and presents other SG&A costs as functional services.

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Strategic services	\$ 138,551	\$ 116,807	\$ 21,744	18.6%
Functional services	95,702	106,798	(11,096)	(10.4)%
Incentive compensation	12,581	10,852	1,729	15.9%
Stock-based compensation	11,770	7,245	4,525	62.5%
Selling, general and administrative expenses	\$ 258,604	\$ 241,702	\$ 16,902	7.0%

Restructuring and Impairment Charges

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Employee severance	\$ 5,167	\$ 1,353	\$ 3,814	281.9%
Equity method investment impairment	1,566	—	1,566	NM%
Asset impairment	1,176	—	1,176	NM%
Goodwill impairment	—	13,198	(13,198)	100.0%
Other restructuring costs	3,500	1,356	2,144	158.1%
Restructuring and impairment charges	\$ 11,409	\$ 15,907	\$ (4,498)	(28.3)%

Restructuring and impairment charges decreased by \$4.5 million in 2017, compared with 2016. The decrease was primarily attributable to an impairment charge in 2016 within our Tile Coating Systems reporting unit, a component of the Performance Coatings operating segment of \$13.2 million. The decrease was partially offset by an increase due to an "other than temporary impairment" charge on an equity method investment of \$1.6 million and costs associated with a restructuring plan in Italy, which includes \$1.2 million of asset impairment associated with assets that have been taken out of service, as well as actions taken in connection with recent acquisitions designed to achieve our targeted synergies.

Interest Expense

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Interest expense	\$ 24,337	\$ 20,246	\$ 4,091	20.2%
Amortization of bank fees	3,496	1,353	2,143	158.4%
Interest capitalization	(79)	(52)	(27)	51.9%
Interest expense	\$ 27,754	\$ 21,547	\$ 6,207	28.8%

Interest expense in 2017 increased \$6.2 million compared with 2016. The increase in interest expense was due to an increase in the average long-term debt balance during 2017, compared with 2016 and an increase of the amortization of debt issuance costs associated with the 2017 Credit Facility, partially offset by a favorable average borrowing rate as a result of the refinancing completed in the first quarter of 2017.

Income Tax Expense

On December 22, 2017, U.S. federal tax legislation, commonly referred to as the Tax Cut and Jobs Act (the “Tax Act”), was signed into law, significantly changing the U.S. corporate income tax system. These changes include a federal statutory rate reduction from 35% to 21% effective January 1, 2018. Changes in tax rates and tax law are accounted for in the period of enactment. Accordingly, the Company’s net deferred tax assets were re-measured to reflect the reduction in the federal statutory rate, resulting in a \$21.5 million increase in income tax expense for the year ended December 31, 2017. The Tax Act also changed the U.S. taxation of worldwide income. Accordingly, we have assessed the one-time mandatory deemed repatriation tax on accumulated foreign subsidiaries’ previously untaxed foreign earnings and profits and have preliminarily determined no tax is due.

Additional provisions of the Tax Act which may have an impact to the Company include, but are not limited to, the repeal of the domestic production deduction, limitations on interest expense, accelerated depreciation that will allow for full expensing of qualified property, provisions related to performance-based executive compensation and international provisions, which generally establish a territorial-style system for taxing foreign-source income of domestic multinational corporations.

We have recognized the provisional tax impacts related to the Tax Act under the guidance of SEC Staff Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act (“SAB 118”). The ultimate impact may differ from these provisional amounts due to additional analysis, changes in interpretations and assumptions, additional regulatory guidance that may be issued, and actions we may take as a result of the Tax Act. Pursuant to SAB 118, adjustments to the provisional amounts recorded by the Company as of December 31, 2017, that are identified within a subsequent measurement period of up to one year from the enactment date will be included as an adjustment to income tax expense in the period the amounts are determined.

In 2017, we recorded an income tax expense of \$52.8 million, or 47.7% of income before income taxes, compared to an income tax expense of \$17.9 million, or 28.6% of income before income taxes in 2016. The 2017 effective tax rate is greater than the statutory income tax rate of 35% primarily as a result of a net effect of a \$21.5 million expense related to re-measuring the U.S. deferred tax assets as a result of the Tax Act, \$5.6 million net expense related to uncertain tax positions and \$8.0 million benefit related to foreign tax rate differences. The 2016 effective tax rate is less than the statutory income tax rate of 35%, primarily as a result of a \$5.5 million net benefit related to greater levels of income earned in lower tax jurisdictions, \$4.8 million net benefit for the release of valuation allowances related to deferred tax assets that were utilized in the current year, \$2.0 million in net benefit for the release of valuation allowance, which are deemed no longer necessary based upon changes in the current and expected future years operating profits, \$1.8 million benefit related to notional interest deductions, \$2.8 million benefit for the generation of tax credits offset by a \$4.1 expense related to the impairment of book basis goodwill and a \$2.1 million expense related to non-deductible expenses.

Comparison of the years ended December 31, 2016 and 2015

For the year ended December 31, 2016, income from continuing operations was \$44.6 million, compared with income from continuing operations of \$99.9 million in 2015. For the year ended December 31, 2016, net loss was \$19.9 million, compared with net income of \$63.1 million in 2015. For the year ended December 31, 2016, net loss attributable to common shareholders was \$20.8 million, or \$0.25 loss per share, compared with net income attributable to common shareholders of \$64.1 million, or \$0.74 earnings per share in 2015.

Net Sales

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Net sales	\$ 1,145,292	\$ 1,075,341	\$ 69,951	6.5%
Cost of sales	794,075	773,661	20,414	2.6%
Gross profit	\$ 351,217	\$ 301,680	\$ 49,537	16.4%
Gross profit as a % of net sales	30.7%	28.1%		

Net sales increased by \$70.0 million, or 6.5%, in the year ended December 31, 2016, compared with the prior year. The net sales increase was driven by higher sales in Color Solutions of \$81.6 million, partially offset by a decrease in sales in Performance Colors and Glass of \$5.3 million and Performance Coatings of \$6.4 million. The increase in net sales was primarily driven by the sales from Nubiola of \$66.3 million and sales from Al Salomi of \$22.1 million, partially offset by a decrease in sales of frits and glazes from Latin America of \$23.9 million.

Gross Profit

Gross profit increased \$49.5 million, or 16.4%, in 2016 to \$351.2 million, compared with \$301.7 million in 2015 and as a percentage of net sales, it increased 260 basis points to 30.7%. The significant driver of the increased gross profit was strong performance in our Color Solutions segment which exceeded prior year gross profit by \$38.6 million, primarily driven by sales from Nubiola. The increase in gross profit was driven by acquisitions of \$40.4 million, decreases in raw material costs of \$21.0 million, decreases in manufacturing and product costs of \$11.1 million and increases in sales volumes and mix of \$8.2 million, partially offset by unfavorable product pricing of \$15.0 million and unfavorable foreign currency impacts of \$9.1 million.

Geographic Revenues

The following table presents our sales on the basis of where sales originated.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Geographic Revenues on a sales origination basis				
Europe	\$ 515,055	\$ 474,400	\$ 40,655	8.6%
United States	300,187	281,976	18,211	6.5%
Asia Pacific	179,464	161,027	18,437	11.4%
Latin America	150,586	157,938	(7,352)	(4.7)%
Net sales	\$ 1,145,292	\$ 1,075,341	\$ 69,951	6.5%

The increase in net sales of \$70.0 million, compared with 2015, was driven by increased sales from Europe, Asia Pacific and the United States, partially mitigated by a decrease in sales from Latin America. The increase

from Europe was primarily attributable to Nubiola sales of \$24.6 million and an increase in Performance Coatings sales of \$11.2 million and the increase from Asia Pacific was attributable to an increase in sales in all segments. The increase from the United States was attributable to an increase in sales in Color Solutions of \$29.4 million, partially offset by lower sales in Performance Colors and Glass of \$11.5 million. The decrease in sales from Latin America was attributable to the sale of our interest in an operating affiliate in Venezuela in 2015 which contributed \$8.4 million in net sales

The following table presents our sales on the basis of where sold products were shipped.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Geographic Revenues on a shipped-to basis				
Europe	\$ 501,231	\$ 466,861	\$ 34,370	7.4%
Asia Pacific	244,057	220,806	23,251	10.5%
United States	239,771	213,531	26,240	12.3%
Latin America	160,233	174,143	(13,910)	(8.0)%
Net sales	\$ 1,145,292	\$ 1,075,341	\$ 69,951	6.5%

Selling, General and Administrative Expense

The following table includes SG&A components with significant changes between 2016 and 2015.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Personnel expenses	\$ 119,785	\$ 114,386	\$ 5,399	4.7%
Business development	12,890	13,527	(637)	(4.7)%
Stock-based compensation	7,245	8,868	(1,623)	(18.3)%
Incentive compensation	10,852	4,982	5,870	117.8%
Pension and other postretirement benefits	16,417	1,494	14,923	998.9%
Bad debt	1,383	667	716	107.3%
Research and development expenses	27,327	25,572	1,755	6.9%
Intangible asset amortization	6,199	4,445	1,754	39.5%
All other expenses	39,604	42,958	(3,354)	(7.8)%
Selling, general and administrative expenses	\$ 241,702	\$ 216,899	\$ 24,803	11.4%

SG&A expenses were \$24.8 million higher in 2016 compared with the prior year. As a percentage of net sales, SG&A expenses increased 90 basis points from 20.2% in 2015 to 21.1% in 2016. The most significant driver of the increase in SG&A expenses in 2016 was the change in the mark-to-market loss and curtailment and settlement effects on our defined benefit pension plans and postretirement health care and life insurance benefit plans of \$8.1 million, which is included within the pension and other postretirement benefits line above. The expense in 2016 was higher than the prior year due to the loss from expected returns on plan assets exceeding actual returns and a decrease in the discount rate compared with the prior year. Excluding the impacts of the pension and other postretirement benefits expense, SG&A expenses decreased 30 basis points from 20.0% in 2015 to 19.7% in 2016. The increase in personnel expenses was attributable to the acquisitions acquired which contributed \$5.5 million and the increase in incentive compensation was a result of the Company's performance relative to targets for certain awards compared with the prior year.

The following table presents SG&A expenses attributable to sales, research and development and operations costs as strategic services and other SG&A costs as functional services.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Strategic services	\$ 116,807	\$ 107,729	\$ 9,078	8.4%
Functional services	106,798	95,320	11,478	12.0%
Incentive compensation	10,852	4,982	5,870	117.8%
Stock-based compensation	7,245	8,868	(1,623)	(18.3)%
Selling, general and administrative expenses	\$ 241,702	\$ 216,899	\$ 24,803	11.4%

Restructuring and Impairment Charges

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Employee severance	\$ 1,353	\$ 4,015	\$ (2,662)	(66.3)%
Goodwill impairment	13,198	—	13,198	100.0%
Other restructuring costs	1,356	5,640	(4,284)	(76.0)%
Restructuring and impairment charges	\$ 15,907	\$ 9,655	\$ 6,252	64.8%

Restructuring and impairment charges increased by \$6.3 million in 2016, compared with 2015. The increase was driven by an impairment charge within our Tile Coating Systems reporting unit, a component of our Performance Coatings operating segment in 2016 of \$13.2 million. This increase was partially mitigated by a decrease in employee severance cost of \$2.7 million in 2016, compared with 2015 and the early termination cost of a contract associated with restructuring a corporate function of \$2.8 million in 2015.

Interest Expense

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Interest expense	\$ 20,246	\$ 15,464	\$ 4,782	30.9%
Amortization of bank fees	1,353	1,125	228	20.3%
Interest capitalization	(52)	(1,426)	1,374	(96.4)%
Interest expense	\$ 21,547	\$ 15,163	\$ 6,384	42.1%

Interest expense in 2016 increased \$6.4 million compared with 2015, primarily due to an increase in the average long-term debt balance for the 2016 period compared with 2015, as well as less interest capitalization associated with long-term capital projects, which was driven by the substantial completion of the Antwerp, Belgium facility in the fourth quarter of 2015.

Income Tax Expense

In 2016, we recorded an income tax expense of \$17.9 million, or 28.6% of income before income taxes, compared to an income tax benefit of \$45.1 million, or (82.3%) of income before income taxes in 2015. The 2016 effective tax rate is less than the statutory income tax rate of 35%, primarily as a result of a \$5.5 million benefit related to greater levels of income earned in lower tax jurisdictions, \$4.8 million net benefit for the release of valuation allowances related to deferred tax assets that were utilized in the current year, \$2.0 million in

net benefit for the release of valuation allowances, which are deemed no longer necessary based upon changes in the current and expected future years operating profits, \$1.8 million benefit related to notional interest deductions, \$2.8 million benefit for the generation of tax credits offset by a \$4.1 million expense related to the impairment of book basis goodwill and a \$2.1 million expense related to non-deductible expenses. The 2015 effective tax rate was less than the statutory income tax rate of 35% primarily as a result of a \$3.8 million benefit related to greater levels of income earned in lower tax jurisdictions, \$3.1 million benefit for the release of the valuation allowances related to deferred tax assets that were utilized in the current year and \$63.3 million benefit for the release of valuation allowances in certain jurisdictions, which are deemed no longer necessary based upon a change from a cumulative three-year loss to income and our expectation of sufficient future taxable income to be able to realize the respective benefits, offset by \$2.4 million expense related to new uncertain tax positions and \$1.7 million expense related to non-deductible expenses.

Results of Operations — Segment Information

Comparison of the years ended December 31, 2017 and 2016

Performance Coatings

	2017	2016	\$ Change	% Change	Change due to					
					Price	Volume / Mix	Currency	Acquisitions	Other	
	(Dollars in thousands)									
Segment net sales	\$ 594,029	\$ 526,981	\$ 67,048	12.7%	\$ 4,319	\$ 24,437	\$ (4,657)	\$ 42,949	\$ —	
Segment gross profit	145,797	139,454	6,343	4.5%	4,319	6,550	(572)	9,512	(13,466)	
Gross profit as a % of segment net sales	24.5%	26.5%								

Net sales increased in Performance Coatings by \$67.0 million compared with the prior year, primarily driven by sales from SPC of \$22.6 million, sales from Endeka of \$18.3 million, and by organic growth across all product lines. The increase in net sales included higher sales volume and mix of \$24.4 million, sales from acquisitions of \$42.9 million and higher product pricing of \$4.3 million, partially offset by unfavorable foreign currency impacts of \$4.7 million. Gross profit increased \$6.3 million from the prior year, primarily driven by gross profit from acquisitions of \$9.5 million, lower manufacturing and product costs of \$13.0 million, higher sales volumes and mix of \$6.6 million and favorable product pricing impacts of \$4.3 million, partially offset by higher raw material costs of \$26.5 million, and unfavorable foreign currency impacts of \$0.6 million.

	2017	2016	\$ Change	% Change
	(Dollars in thousands)			
Segment net sales by Region				
Europe	\$ 346,199	\$ 289,780	\$ 56,419	19.5%
Latin America	106,640	101,565	5,075	5.0%
Asia Pacific	94,722	89,573	5,149	5.7%
United States	46,468	46,063	405	0.9%
Net sales	\$ 594,029	\$ 526,981	\$ 67,048	12.7%

Net sales increased by \$67.0 million with increases in sales from all regions. The increase in sales from Europe was primarily driven by sales from SPC of \$22.6 million, sales from Endeka of \$16.8 million, and an increase in sales of porcelain enamel and colors of \$5.7 million and \$5.5 million, respectively. The sales increase from Latin America was primarily driven by higher sales of frits and glazes and porcelain enamel of \$3.4 million and \$1.4 million, respectively. The sales increase from Asia Pacific was primarily driven by higher sales of digital inks, sales from Endeka and higher sales of porcelain enamel of \$4.4 million, \$1.6 million and \$1.2 million, respectively, partially offset by a decrease of frits and glazes sales of \$1.8 million. The increase in sales from the United States was attributable to higher sales of porcelain enamel.

Performance Colors and Glass

	2017	2016	\$ Change	% Change	Change due to					
					Price	Volume / Mix	Currency	Acquisitions	Other	
(Dollars in thousands)										
Segment net sales	\$ 444,653	\$ 371,464	\$ 73,189	19.7%	\$ 2,557	\$ 6,794	\$ 2,472	\$ 61,366	\$ —	
Segment gross profit	157,544	133,716	23,828	17.8%	2,557	(1,665)	685	21,198	1,053	
Gross profit as a % of segment net sales	35.4%	36.0%								

The net sales increase of \$73.2 million was primarily attributable to sales from ESL of \$38.2 million and Dip-Tech of \$18.2 million and organic growth in decoration products of \$12.5 million. The increase in net sales included sales from acquisitions of \$61.4 million, favorable volume and mix of \$6.8 million, higher product pricing of \$2.6 million and favorable foreign currency impacts of \$2.5 million. Gross profit increased from the prior year, primarily due to gross profit from acquisitions of \$21.2 million, favorable manufacturing and product costs of \$4.8 million, higher product pricing of \$2.6 million and favorable foreign currency impacts of \$0.7 million, partially offset by unfavorable raw material costs of \$3.8 million and lower sales volumes and mix of \$1.7 million.

	2017	2016	\$ Change	% Change						
					Price	Volume / Mix	Currency	Acquisitions	Other	
(Dollars in thousands)										
Segment net sales by Region										
Europe	\$ 203,280	\$ 160,475	\$ 42,805	26.7%						
United States	155,284	132,432	22,852	17.3%						
Asia Pacific	64,853	59,121	5,732	9.7%						
Latin America	21,236	19,436	1,800	9.3%						
Net sales	\$ 444,653	\$ 371,464	\$ 73,189	19.7%						

The net sales increase of \$73.2 million was driven by higher sales from all regions. The increase in sales from Europe was primarily attributable to sales from acquisitions and higher sales of decoration products of \$9.6 million. The increase in sales from the United States was driven by sales from ESL of \$24.5 million and Dip-Tech of \$3.3 million, partially offset by a decrease in sales of industrial products of \$5.9 million. The increase from Asia Pacific was primarily due to higher sales of automobile and decoration products of \$3.9 million and \$1.1 million, respectively. The increase from Latin America was primarily driven by an increase in sales of decoration products of \$2.1 million, partially offset by a decrease in sales of automobile and industrial products.

Color Solutions

	2017	2016	\$ Change	% Change	Change due to					
					Price	Volume / Mix	Currency	Acquisitions	Other	
(Dollars in thousands)										
Segment net sales	\$ 358,060	\$ 246,847	\$ 111,213	45.1%	\$ 6,063	\$ 32,537	\$ 1,003	\$ 71,610	\$ —	
Segment gross profit	113,694	84,293	29,401	34.9%	6,063	4,993	202	16,213	1,930	
Gross profit as a % of segment net sales	31.8%	34.1%								

Net sales increased \$111.2 million compared with the prior year, primarily due to sales from Cappelle of \$69.5 million, and higher sales of pigments and surface technology products of \$28.8 million and \$12.7 million, respectively. The increase in net sales was driven by sales from acquisitions of \$71.6 million, higher volumes and mix of \$32.5 million, higher product pricing of \$6.1 million and favorable foreign currency impacts of \$1.0 million. Gross profit increased from the prior year, due to gross profit from acquisitions of \$16.2 million, lower manufacturing and product costs of \$10.9 million, higher product pricing of \$6.1 million, higher sales volumes and mix of \$5.0 million and favorable foreign currency impacts of \$0.2 million, partially offset by unfavorable raw material costs of \$9.0 million.

	<u>2017</u>	<u>2016</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Segment net sales by Region				
United States	\$ 154,730	\$ 121,692	\$ 33,038	27.1%
Europe	134,122	64,800	69,322	107.0%
Asia Pacific	36,343	30,770	5,573	18.1%
Latin America	32,865	29,585	3,280	11.1%
Net sales	\$ 358,060	\$ 246,847	\$ 111,213	45.1%

The net sales increase of \$111.2 million was driven by higher sales from all regions. The increase in sales from Europe was primarily driven by sales from Cappelle of \$58.3 million and higher sales of pigments of \$11.0 million. The increase in sales from the United States was primarily driven by sales from Cappelle of \$11.2 million, surface technology products of \$12.7 million and pigments of \$9.0 million. The increases in sales from Asia Pacific and Latin America of \$5.6 million and \$3.3 million, respectively, were driven by an increase in pigments sales.

Comparison of the years ended December 31, 2016 and 2015

Performance Coatings

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>	<u>Change due to</u>					
					<u>Price</u>	<u>Volume / Mix</u>	<u>Currency</u>	<u>Acquisitions</u>	<u>Other</u>	
	(Dollars in thousands)									
Segment net sales	\$ 526,981	\$ 533,370	\$ (6,389)	(1.2)%	\$ (15,923)	\$ 21,876	\$ (34,445)	\$ 22,103	\$ —	
Segment gross profit	139,454	126,945	12,509	9.9%	(15,923)	17,781	(7,265)	5,400	12,516	
Gross profit as a % of segment net sales	26.5%	23.8%								

Net sales declined in Performance Coatings compared with 2015, primarily driven by a decrease in sales of \$20.9 million in frits and glazes, and \$8.4 million due to the sale of our Venezuela business, partially mitigated by \$22.1 million in sales from Al Salomi. The decrease in net sales was impacted by unfavorable foreign currency impacts of \$34.4 million and lower product pricing of \$15.9 million, partially offset by increased sales from acquisitions of \$22.1 million and higher volume and mix of \$21.9 million. Gross profit increased \$12.5 million from 2015, primarily driven by lower manufacturing and product costs of \$4.6 million, higher sales

volumes and mix of \$17.8 million, lower raw material costs of \$7.9 million and gross profit from acquisitions of \$5.4 million, partially offset by unfavorable product pricing impacts of \$15.9 million and unfavorable foreign currency impacts of \$7.3 million.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Segment net sales by Region				
Europe	\$ 289,780	\$ 278,581	\$ 11,199	4.0%
Latin America	101,565	123,152	(21,587)	(17.5)%
Asia Pacific	89,573	85,850	3,723	4.3%
United States	46,063	45,787	276	0.6%
Net sales	\$ 526,981	\$ 533,370	\$ (6,389)	(1.2)%

The net sales decrease of \$6.4 million was driven by declines in sales from Latin America, partially mitigated by an increase in sales from Europe, Asia Pacific and the United States. The sales decline from Latin America included a decrease in sales in frits and glazes of \$23.9 million and a decrease in sales from Venezuela of \$8.4 million, partially mitigated by increased sales in digital inks and opacifiers of \$5.7 million and \$5.3 million, respectively. The increase in sales from Europe was primary attributable to \$22.1 million in sales from Al Salomi, partially offset by decreased sales in digital inks and Vetriceramici products of \$5.7 million and \$4.6 million, respectively. The increase from Asia Pacific was primarily due to increased sales in digital inks and frits and glazes of \$2.7 million and \$2.5 million, partially offset by decreased sales in porcelain enamel of \$1.3 million. The increase from the United States was fully attributable to increased sales in porcelain enamel of \$0.3 million.

Performance Colors and Glass

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>	<u>Change due to</u>				
	(Dollars in thousands)				<u>Price</u>	<u>Volume / Mix</u>	<u>Currency</u>	<u>Acquisitions</u>	<u>Other</u>
Segment net sales	\$ 371,464	\$ 376,769	\$ (5,305)	(1.4)%	\$ 587	(16,463)	\$ (4,941)	\$ 15,512	\$ —
Segment gross profit	133,716	128,209	5,507	4.3%	587	(9,555)	(1,636)	6,331	9,780
Gross profit as a % of segment net sales	36.0%	34.0%							

Net sales decreased compared with 2015, primarily driven by lower sales of our electronics products and industrial products of \$3.1 million and \$2.8 million, respectively. Net sales were impacted by unfavorable volume and mix of \$16.5 million and foreign currency impacts of \$4.9 million, partially mitigated by sales from acquisitions of \$15.5 million and higher product pricing of \$0.6 million. Gross profit increased from 2015, primarily due to lower raw material costs of \$7.9 million, gross profit from acquisitions of \$6.3 million, lower manufacturing and product costs of \$1.9 million and higher product pricing of \$0.6 million, partially offset by lower sales volumes and mix of \$9.6 million and unfavorable foreign currency impacts of \$1.6 million.

	<u>2016</u>	<u>2015</u>	<u>\$ Change</u>	<u>% Change</u>
	(Dollars in thousands)			
Segment net sales by Region				
Europe	\$ 160,475	\$ 157,174	\$ 3,301	2.1%
United States	132,432	143,919	(11,487)	(8.0)%
Asia Pacific	59,121	56,082	3,039	5.4%
Latin America	19,436	19,594	(158)	(0.8)%
Net sales	\$ 371,464	\$ 376,769	\$ (5,305)	(1.4)%

The net sales decline of \$5.3 million was driven by lower sales from the United States and Latin America, partially mitigated by increased sales from Europe and Asia Pacific. The decrease in sales from the United States was attributable to lower sales across all product lines, and the decline in sales from Latin America was primarily due to lower sales of decoration products of \$0.2 million. The increase in sales from Europe was partially attributable to increased sales of electronics and automobile products of \$2.3 million and \$1.4 million, respectively, partially offset by a decrease in sales in industrial products of \$0.9 million. The increase in sales from Asia Pacific was primarily due to higher sales of automotive products of \$3.4 million, partially offset by lower sales in decoration products of \$0.3 million.

Color Solutions

	2016	2015	\$ Change	% Change	Change due to				
					Price	Volume / Mix	Currency	Acquisitions	Other
(Dollars in thousands)									
Segment net sales	\$ 246,847	\$ 165,202	\$ 81,645	49.4%	\$ 368	\$ 10,400	\$ (823)	\$ 71,700	\$ —
Segment gross profit	84,293	45,678	38,615	84.5%	368	(15)	(186)	28,630	9,818
Gross profit as a % of segment net sales	34.1%	27.6%							

Net sales increased compared with 2015, primarily due to higher sales from Nubiola products of \$66.3 million, an increase in sales of surface technology products and of pigments of \$6.1 million and \$5.7 million, respectively, and an increase in sales from Cappelle of \$2.2 million. Net sales were positively impacted by sales from acquisitions of \$71.7 million, higher volumes and mix of \$10.4 million and favorable product pricing of \$0.4 million, partially offset by unfavorable foreign currency impacts of \$0.8 million. Gross profit increased from 2015, primarily due to gross profit from acquisitions of \$28.6 million, favorable raw material costs of \$5.2 million, lower manufacturing and product costs of \$4.6 million and favorable product pricing of \$0.4 million, partially offset by unfavorable foreign currency impacts of \$0.2 million. Gross profit was negatively impacted by a charge of \$5.8 million in 2015, related to a purchase price adjustment from the acquisition of Nubiola for step up of inventory acquired and subsequently sold that will not recur.

	2016	2015	\$ Change	% Change
(Dollars in thousands)				
Segment net sales by Region				
United States	\$ 121,692	\$ 92,270	\$ 29,422	31.9%
Europe	64,800	38,645	26,155	67.7%
Asia Pacific	30,770	19,095	11,675	61.1%
Latin America	29,585	15,192	14,393	94.7%
Net sales	\$ 246,847	\$ 165,202	\$ 81,645	49.4%

The increase in net sales of \$81.6 million compared with 2015 was due to higher sales across all regions. The increase in sales from the United States was driven by increased sales from Nuiobla of \$17.7 million and increased sales in surface technology and pigments of \$6.1 million and \$3.6 million, respectively. The increase in sales from Europe and Latin America was driven by sales from Nubiola of \$24.6 million and \$14.6 million, respectively. The increase in sales from Asia Pacific was primarily driven by sales from Nubiola of \$9.3 million and pigments of \$2.5 million.

Summary of Cash Flows for the years ended December 31, 2017, 2016, and 2015

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Net cash provided by operating activities	\$ 84,790	\$ 62,630	\$ 51,202
Net cash (used for) investing activities	(178,911)	(150,822)	(244,600)
Net cash provided by financing activities	108,363	81,997	119,726
Effect of exchange rate changes on cash and cash equivalents	3,727	(6,603)	(8,448)
Increase (decrease) in cash and cash equivalents	\$ 17,969	\$ (12,798)	\$ (82,120)

Operating activities. Cash flows from operating activities increased \$22.2 million in 2017 compared to 2016. The increase was primarily due to higher earnings after consideration of non-cash items, partially offset by higher cash outflows for net working capital of \$15.7 million and other current assets and liabilities of \$38.1 million.

Cash flows from operating activities increased \$11.4 million in 2016 compared to 2015. The increase was due to lower cash outflows for other assets and liabilities of \$28.0 million and higher earnings after consideration of non-cash items of \$30.4 million, partially offset by higher cash outflows for working capital of \$43.2 million.

Investing activities. Cash flows from investing activities decreased approximately \$28.1 million in 2017. The decrease was primarily due to higher cash outflows for capital expenditures of \$25.6 million.

Cash flows from investing activities increased approximately \$93.8 million in 2016. The increase was primarily due to lower cash outflows for business combinations of \$72.6 million and lower capital expenditures of \$18.1 million which was driven by lower spend for the Antwerp, Belgium facility. This facility capital project was substantially completed in the fourth quarter of 2015.

Financing activities. Cash flows from financing activities increased \$26.4 million in 2017 compared with 2016. As further discussed in Note 8, we paid off our 2014 Credit Facility and entered into our new Credit Facility, consisting of a \$400 million secured revolving line of credit, a \$357.5 million secured term loan facility and a €250 million secured euro term loan facility. This transaction resulted in additional borrowings in 2017 of \$53.6 million compared to 2016. Further, compared to 2016, net repayments under loans payable was \$24.2 million higher. Additionally, during 2017, we paid debt issuance costs related to the Credit Facility entered into during the period, partially offset by no repurchases of common stock being made during 2017.

Cash flows from financing activities decreased \$37.7 million in 2016 compared with 2015, driven by the \$50.0 million prepayment on the term loan facility that was made in January 2016 and a net borrowing decrease on the revolving credit facility of \$28.4 million, partially mitigated by decreased purchase of common stock of \$27.1 million and an increase in net borrowings on loans payable of \$11.9 million.

We have paid no dividends on our common stock since 2009.

Capital Resources and Liquidity

Major debt instruments that were outstanding during 2017 are described below.

Credit Facility

On February 14, 2017, the Company entered into a new credit facility (the “Credit Facility”) with a group of lenders to refinance its then outstanding credit facility debt and to provide liquidity for ongoing working capital requirements and general corporate purposes.

The Credit Facility consists of a \$400 million secured revolving line of credit with a term of five years, a \$357.5 million secured term loan facility with a term of seven years and a €250 million secured Euro term loan facility with a term of seven years. The term loans are payable in equal quarterly installments in an amount equal to 0.25% of the original principal amount of the term loans, with the remaining balance due on the maturity date thereof. In addition, the Company is required, on an annual basis, to make a prepayment of term loans until they are fully paid and then to the revolving loans in an amount equal to a portion of the Company's excess cash flow, as calculated pursuant to the Credit Facility.

Subject to the satisfaction of certain conditions, the Company can request additional commitments under the revolving line of credit or term loans in the aggregate principal amount of up to \$250 million, to the extent that existing or new lenders agree to provide such additional commitments and/or term loans. The Company can also raise certain additional debt or credit facilities subject to satisfaction of certain covenant levels.

Certain of the Company's U.S. subsidiaries have guaranteed the Company's obligations under the Credit Facility and such obligations are secured by (a) substantially all of the personal property of the Company and the U.S. subsidiary guarantors and (b) a pledge of 100% of the stock of certain of the Company's U.S. subsidiaries and 65% of the stock of certain of the Company's direct foreign subsidiaries.

Interest Rate — Term Loans: The interest rates applicable to the U.S. term loans will be, at the Company's option, equal to either a base rate or a LIBOR rate plus, in both cases, an applicable margin. The interest rates applicable to the Euro term loans will be a Euro Interbank Offered Rate ("EURIBOR") rate plus an applicable margin.

- The base rate for U.S. term loans will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent's prime rate or (iii) the daily LIBOR rate plus 1.00%. The applicable margin for base rate loans is 1.50%.
- The LIBOR rate for U.S. term loans shall not be less than 0.75% and the applicable margin for LIBOR rate U.S. term loans is 2.50%.
- The EURIBOR rate for Euro term loans shall not be less than 0% and the applicable margin for EURIBOR rate loans is 2.75%.
- For LIBOR rate term loans and EURIBOR rate term loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate or EURIBOR rate, as applicable, for the corresponding duration.

At December 31, 2017, the Company had borrowed \$354.8 million under the secured term loan facility at an interest rate of 4.07% and €248.1 million under the secured Euro term loan facility at an interest rate of 2.75%. At December 31, 2017, there were no additional borrowings available under the term loan facilities. We entered into interest rate swap agreements in the second quarter of 2017. These swaps converted \$150 million and €90 million of our term loans from variable interest rates to fixed interest rates. At December 31, 2017, the effective interest rate for the term loan facilities after adjusting for the interest rate swap was 4.27% for the secured term loan facility and 3.00% for the Euro term loan facility.

Interest Rate — Revolving Credit Line: The interest rates applicable to loans under the revolving credit line will be, at the Company's option, equal to either a base rate or a LIBOR rate plus, in both cases, an applicable variable margin. The variable margin will be based on the ratio of (a) the Company's total consolidated net debt outstanding at such time to (b) the Company's consolidated EBITDA computed for the period of four consecutive fiscal quarters most recently ended.

- The base rate for revolving loans will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent's prime rate or (iii) the daily LIBOR rate plus 1.00%. The applicable margin for base rate loans will vary between 0.75% and 1.75%.

- The LIBOR rate for revolving loans shall not be less than 0% and the applicable margin for LIBOR rate revolving loans will vary between 1.75% and 2.75%.
- For LIBOR rate revolving loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate for the corresponding duration.

At December 31, 2017, there were \$78.0 million borrowings under the revolving credit line at an interest rate of 3.63%. The borrowing on the revolving credit line was used to fund acquisitions and for other general business purposes. After reductions for outstanding letters of credit secured by these facilities, we had \$317.3 million of additional borrowings available under the revolving credit facilities at December 31, 2017.

The Credit Facility contains customary restrictive covenants including, but not limited to, limitations on use of loan proceeds, limitations on the Company's ability to pay dividends and repurchase stock, limitations on acquisitions and dispositions, and limitations on certain types of investments. The Credit Facility also contains standard provisions relating to conditions of borrowing and customary events of default, including the non-payment of obligations by the Company and the bankruptcy of the Company.

Specific to the revolving credit facility, the Company is subject to a financial covenant regarding the Company's maximum leverage ratio. If an event of default occurs, all amounts outstanding under the Credit Agreement may be accelerated and become immediately due and payable. At December 31, 2017, we were in compliance with the covenants of the Credit Facility.

2014 Credit Facility

In 2014, the Company entered into a credit facility that was amended on January 25, 2016, and August 29, 2016, resulting in a \$400 million secured revolving line of credit with a term of five years and a \$300 million secured term loan facility with a term of seven years from the original issuance date (the "2014 Credit Facility") with a group of lenders that was replaced on February 14, 2017, by the Credit Facility (as defined above).

Off Balance Sheet Arrangements

Consignment and Customer Arrangements for Precious Metals. We use precious metals, primarily silver, in the production of some of our products. We obtain most precious metals from financial institutions under consignment agreements. The financial institutions retain ownership of the precious metals and charge us fees based on the amounts we consign and the period of consignment. These fees were \$1.2 million, \$0.8 million and \$0.8 million for 2017, 2016, and 2015, respectively. We had on hand precious metals owned by participants in our precious metals consignment program of \$37.7 million at December 31, 2017 and \$28.7 million at December 31, 2016, measured at fair value based on market prices for identical assets and net of credits.

The consignment agreements under our precious metals program involve short-term commitments that typically mature within 30 to 90 days of each transaction and are typically renewed on an ongoing basis. As a result, the Company relies on the continued willingness of financial institutions to participate in these arrangements to maintain this source of liquidity. On occasion, we have been required to deliver cash collateral. While no deposits were outstanding at December 31, 2017, or December 31, 2016, we may be required to furnish cash collateral in the future based on the quantity and market value of the precious metals under consignment and the amount of collateral-free lines provided by the financial institutions. The amount of cash collateral required is subject to review by the financial institutions and can be changed at any time at their discretion, based in part on their assessment of our creditworthiness.

Bank Guarantees and Standby Letters of Credit.

At December 31, 2017, the Company and its subsidiaries had bank guarantees and standby letters of credit issued by financial institutions that totaled \$7.7 million. These agreements primarily relate to Ferro's insurance programs, foreign energy purchase contracts and foreign tax payments.

Other Financing Arrangements

We maintain other lines of credit to provide global flexibility for Ferro's short-term liquidity requirements. These facilities are uncommitted lines for our international operations and totaled \$64.5 million at December 31, 2017. We had \$39.4 million of additional borrowings available under these lines at December 31, 2017.

Liquidity Requirements

Our primary sources of liquidity are available cash and cash equivalents, available lines of credit under the Credit Facility, and cash flows from operating activities. As of December 31, 2017, we had \$63.6 million of cash and cash equivalents. Substantially all of our cash and cash equivalents were held by foreign subsidiaries. Cash generated in the U.S. is generally used to pay down amounts outstanding under our revolving credit facility and for general corporate purposes, including acquisitions. If needed, we could repatriate the majority of cash held by foreign subsidiaries without the need to accrue and pay U.S. income taxes. We do not anticipate a liquidity need requiring such repatriation of these funds to the U.S.

Our liquidity requirements primarily include debt service, purchase commitments, labor costs, working capital requirements, restructuring expenditures, acquisition costs, capital investments, precious metals cash collateral requirements, and postretirement benefit obligations. We expect to meet these requirements in the long term through cash provided by operating activities and availability under existing credit facilities or other financing arrangements. Cash flows from operating activities are primarily driven by earnings before noncash charges and changes in working capital needs. In 2017, cash flows from financing and operating activities were used to fund our investing activities. Additionally, we used the borrowings available under the Credit Facility to fund acquisitions and for other general business purposes. We had additional borrowing capacity of \$356.7 million at December 31, 2017, available under various credit facilities, primarily our revolving credit facility.

Our Credit Facility contains customary restrictive covenants, including those described in more detail in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K. These covenants include customary restrictions, including, but not limited to, limitations on use of loan proceeds, limitations on the Company's ability to pay dividends and repurchase stock, limitations on acquisitions and dispositions, and limitations on certain types of investments. Specific to the revolving credit facility, we are subject to a financial covenant regarding the Company's maximum leverage ratio. This covenant under our Credit Facility restricts the amount of our borrowings, reducing our flexibility to fund ongoing operations and strategic initiatives. This facility is described in more detail in "Capital Resources and Liquidity" under Item 7 and in Note 8 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

As of December 31, 2017, we were in compliance with our maximum leverage ratio covenant of 4.25x as our actual ratio was 2.69x, providing \$95.7 million of EBITDA cushion on the leverage ratio, as defined within the Credit Facility. To the extent that economic conditions in key markets deteriorate or we are unable to meet our business projections and EBITDA falls below approximately \$160 million for a rolling four quarters, based on reasonably consistent net debt levels with those as of December 31, 2017, we could become unable to maintain compliance with our leverage ratio covenant. In such case, our lenders could demand immediate payment of outstanding amounts and we would need to seek alternate financing sources to pay off such debts and to fund our ongoing operations. Such financing may not be available on favorable terms, if at all.

Difficulties experienced in global capital markets could affect the ability or willingness of counterparties to perform under our various lines of credit, forward contracts, and precious metals program. These counterparties are major, reputable, multinational institutions, all having investment-grade credit ratings. Accordingly, we do not anticipate counterparty default. However, an interruption in access to external financing could adversely affect our business prospects and financial condition.

We assess on an ongoing basis our portfolio of businesses, as well as our financial and capital structure, to ensure that we have sufficient capital and liquidity to meet our strategic objectives. As part of this process, from time to time we evaluate the possible divestiture of businesses that are not critical to our core strategic objectives and, where appropriate, pursue the sale of such businesses and assets. We also evaluate and pursue acquisition opportunities that we believe will enhance our strategic position such as the acquisitions we completed in 2017, 2016 and 2015. Generally, we publicly announce material divestiture and acquisition transactions only when we have entered into a material definitive agreement or closed on those transactions.

The Company's aggregate amount of contractual obligations for the next five years and thereafter is set forth below:

	2018	2019	2020	2021	2022	Thereafter	Totals
	(Dollars in thousands)						
Loans Payable ⁽¹⁾	\$ 16,360	\$ —	\$ —	\$ —	\$ —	\$ —	\$ 16,360
Long-term debt ⁽²⁾	9,109	8,349	7,736	7,490	86,440	624,728	743,852
Interest ⁽³⁾	360	311	304	272	257	3,803	5,307
Operating lease obligations	11,696	7,212	5,088	3,464	2,455	3,100	33,015
Purchase commitments ⁽⁴⁾	53,005	20,364	7,501	6,293	3,798	7,876	98,837
Taxes ⁽⁵⁾	8,327	—	—	—	—	—	8,327
Retirement and other postemployment benefits ⁽⁶⁾	11,181	11,397	—	—	—	—	22,578
	<u>\$ 110,038</u>	<u>\$ 47,633</u>	<u>\$ 20,629</u>	<u>\$ 17,519</u>	<u>\$ 92,950</u>	<u>\$ 639,507</u>	<u>\$ 928,276</u>

- (1) Loans Payable includes our loans payable to banks.
- (2) Long-term debt excludes imputed interest and executory costs on capitalized lease obligations and unamortized issuance costs on the term loan facility.
- (3) Interest represents only contractual payments for fixed-rate debt.
- (4) Purchase commitments are noncancelable contractual obligations for raw materials and energy, and exclude capital expenditures for property, plant and equipment.
- (5) We have not projected payments past 2018 due to uncertainties in estimating the amount and period of any payments. The amount above relates to our current income tax liability as of December 31, 2017. We have \$25.6 million in gross liabilities related to unrecognized tax benefits, including \$3.8 million of accrued interest and penalties that are not included in the above table since we cannot reasonably predict the timing of cash settlements with various taxing authorities.
- (6) The funding amounts are based on the minimum contributions required under our various plans and applicable regulations in each respective country. We have not projected contributions past 2019 due to uncertainties regarding the assumptions involved in estimating future required contributions.

Critical Accounting Policies

When we prepare our consolidated financial statements we are required to make estimates and assumptions that affect the amounts we report in the consolidated financial statements and footnotes. We consider the policies discussed below to be more critical than other policies because their application requires our most subjective or complex judgments. These estimates and judgments arise because of the inherent uncertainty in predicting future events. Management has discussed the development, selection and disclosure of these policies with the Audit Committee of the Board of Directors.

Revenue Recognition

We recognize sales typically when we ship goods to our customers and when all of the following criteria are met:

- Persuasive evidence of an arrangement exists;
- The selling price is fixed or determinable;
- Collection is reasonably assured; and
- Title and risk of loss has passed to our customers.

In order to ensure the revenue recognition in the proper period, we review material sales contracts for proper cut-off based upon the business practices and legal requirements of each country. For sales of products containing precious metals, we report revenues on a gross basis along with their corresponding cost of sales to arrive at gross profit. We record revenues this way because we act as the principal in the transactions into which we enter.

Restructuring and Cost Reduction Programs

In recent years, we have developed and initiated global cost reduction programs with the objectives of leveraging our global scale, realigning and lowering our cost structure, and optimizing capacity utilization. Management continues to evaluate our businesses, and therefore, there may be additional provisions for new optimization and cost-savings initiatives, as well as changes in estimates to amounts previously recorded, as payments are made or actions are completed.

Restructuring charges include both termination benefits and asset writedowns. We estimate accruals for termination benefits based on various factors including length of service, contract provisions, local legal requirements, projected final service dates, and salary levels. We also analyze the carrying value of long-lived assets and record estimated accelerated depreciation through the anticipated end of the useful life of the assets affected by the restructuring or record an asset impairment. In all likelihood, this accelerated depreciation will result in reducing the net book value of those assets to zero at the date operations cease. While we believe that changes to our estimates are unlikely, the accuracy of our estimates depends on the successful completion of numerous actions. Changes in our estimates could increase our restructuring costs to such an extent that it could have a material impact on the Company's results of operations, financial position, or cash flows. Other events, such as negotiations with unions and works councils, may also delay the resulting cost savings.

Accounts Receivable and the Allowance for Doubtful Accounts

Ferro sells its products to customers in diversified industries throughout the world. No customer or related group of customers represents greater than 10% of net sales or accounts receivable. We perform ongoing credit evaluations of our customers and require collateral principally for export sales, when industry practices allow and as market conditions dictate, subject to our ability to negotiate secured terms relative to competitive offers. We regularly analyze significant customer accounts and provide for uncollectible accounts based on historical experience, customer payment history, the length of time the receivables are past due, the financial health of the customer, economic conditions, and specific circumstances, as appropriate. Changes in these factors could result in additional allowances. Customer accounts we conclude to be uncollectible or to require excessive collection costs are written off against the allowance for doubtful accounts. Historically, write-offs of uncollectible accounts have been within our expectations.

Goodwill

We review goodwill for impairment each year using a measurement date of October 31st or more frequently in the event of an impairment indicator. We annually, or more frequently as warranted, evaluate the

appropriateness of our reporting units utilizing operating segments as the starting point of our analysis. In the event of a change in our reporting units, we would allocate goodwill based on the relative fair value. We estimate the fair values of the reporting units associated with these assets using the average of both the income approach and the market approach, which we believe provides a reasonable estimate of the reporting units' fair values, unless facts and circumstances exist that indicate more representative fair values. The income approach uses projected cash flows attributable to the reporting units over their useful lives and allocates certain corporate expenses to the reporting units. We use historical results, trends and our projections of market growth, internal sales efforts and anticipated cost structure assumptions to estimate future cash flows. Using a risk-adjusted, weighted-average cost of capital, we discount the cash flow projections to the measurement date. The market approach estimates a price reasonably expected to be paid by a market participant in the purchase of similar businesses. If the fair value of any reporting unit was determined to be less than its carrying value, we would proceed to the second step and obtain comparable market values or independent appraisals of its assets and liabilities to determine the amount of any impairment.

The significant assumptions and ranges of assumptions we used in our impairment analyses of goodwill at October 31, 2017 and 2016, were as follows:

<u>Significant Assumptions</u>	<u>2017</u>	<u>2016</u>
Weighted-average cost of capital	11.0% - 13.5%	10.75% - 13.5%
Residual growth rate	3.0%	3.0%

Our estimates of fair value can be adversely affected by a variety of factors. Reductions in actual or projected growth or profitability at our reporting units due to unfavorable market conditions or significant increases in cost structure could lead to the impairment of any related goodwill. Additionally, an increase in inflation, interest rates or the risk-adjusted, weighted-average cost of capital could also lead to a reduction in the fair value of one or more of our reporting units and therefore lead to the impairment of goodwill.

Based on our 2017 annual impairment test performed as of October 31, 2017, the fair values of the reporting units tested for impairment exceeded the carrying values of the respective reporting units by amounts ranging from 35.4% to 300.7% at the 2017 measurement date. The lowest cushion relates to goodwill associated with the Performance Coatings reportable segment, which had a goodwill balance of \$38.2 million at December 31, 2017. During 2016, we recognized an impairment loss of \$13.2 million in our Tile Coating Systems reporting unit, a component of our Performance Coatings segment. A future potential impairment is possible for any of these reporting units if actual results are materially less than forecasted results. Some of the factors that could negatively affect our cash flows and, as a result, not support the carrying values of our reporting units are: new environmental regulations or legal restrictions on the use of our products that would either reduce our product revenues or add substantial costs to the manufacturing process, thereby reducing operating margins; new technologies that could make our products less competitive or require substantial capital investment in new equipment or manufacturing processes; and substantial downturns in economic conditions.

Long-Lived Asset Impairment

The Company's long-lived assets include property, plant and equipment, and intangible assets. We review property, plant and equipment and intangible assets for impairment whenever events or circumstances indicate that their carrying values may not be recoverable. The following are examples of such events or changes in circumstances:

- An adverse change in the business climate of a long-lived asset or asset group;
- An adverse change in the extent or manner in which a long-lived asset or asset group is used or in its physical condition;
- Current operating losses for a long-lived asset or asset group combined with a history of such losses or projected or forecasted losses that demonstrate that the losses will continue; or

- A current expectation that, more likely than not, a long-lived asset or asset group will be sold or otherwise significantly disposed of before the end of its previously estimated useful life.

The carrying amount of property, plant and equipment and intangible assets is not recoverable if the carrying value of the asset group exceeds the sum of the undiscounted cash flows expected to result from the use and eventual disposition of the asset group. In the event of impairment, we recognize a loss for the excess of the recorded value over fair value. The long-term nature of these assets requires the estimation of cash inflows and outflows several years into the future and only takes into consideration technological advances known at the time of review.

Income Taxes

The breadth of our operations and complexity of income tax regulations require us to assess uncertainties and make judgments in estimating the ultimate amount of income taxes we will pay. Our income tax expense, deferred tax assets and liabilities, and reserves for unrecognized tax benefits reflect management's best assessment of estimated current and future taxes to be paid. The final income taxes we pay are based upon many factors, including existing income tax laws and regulations, negotiations with taxing authorities in various jurisdictions, outcomes of tax litigation, and resolution of disputes arising from federal, state and international income tax audits. The resolution of these uncertainties may result in adjustments to our income tax assets and liabilities in the future.

Deferred income taxes result from differences between the financial and tax basis of our assets and liabilities. We adjust our deferred income tax assets and liabilities for changes in income tax rates and income tax laws when changes are enacted. We record valuation allowances to reduce deferred income tax assets when it is more likely than not that a tax benefit will not be realized. Significant judgment is required in evaluating the need for and the magnitude of appropriate valuation allowances against deferred income tax assets. The realization of these assets is dependent on generating future taxable income, our ability to carry back or carry forward net operating losses and credits to offset tax liabilities, as well as successful implementation of various tax strategies to generate tax where net operating losses or credit carryforwards exist. In evaluating our ability to realize the deferred income tax assets, we rely principally on the reversal of existing temporary differences, the availability of tax planning strategies, and forecasted income.

We recognize a tax benefit from an uncertain tax position when it is more likely than not that the position will be sustained upon examination, including resolutions of any related appeals or litigation processes, based on the technical merits. Our estimate of the potential outcome of any uncertain tax positions is subject to management's assessment of relevant risks, facts, and circumstances existing at that time. We record a liability for the difference between the benefit recognized and measured based on a more-likely-than-not threshold and the tax position taken or expected to be taken on the tax return. To the extent that our assessment of such tax positions changes, the change in estimate is recorded in the period in which the determination is made. We report tax-related interest and penalties as a component of income tax expense.

Derivative Financial Instruments

We use derivative financial instruments in the normal course of business to manage our exposure to fluctuations in interest rates, foreign currency exchange rates, and precious metal prices. The accounting for derivative financial instruments can be complex and can require significant judgment. Generally, the derivative financial instruments that we use are not complex, and observable market-based inputs are available to measure their fair value. We do not engage in speculative transactions for trading purposes. The use of financial derivatives is managed under a policy that identifies the conditions necessary to identify the transaction as a financial derivative. Financial instruments, including derivative financial instruments, expose us to counterparty credit risk for nonperformance. We manage our exposure to counterparty credit risk through minimum credit standards and procedures to monitor concentrations of credit risk. We enter into these derivative financial

instruments with major, reputable, multinational financial institutions. Accordingly, we do not anticipate counterparty default. We continuously evaluate the effectiveness of derivative financial instruments designated as hedges to ensure that they are highly effective. In the event the hedge becomes ineffective, we discontinue hedge treatment. Except as noted below, we do not expect any changes in our risk policies or in the nature of the transactions we enter into to mitigate those risks.

Our exposure to interest rate changes arises from our debt agreements with variable interest rates. To reduce our exposure to interest rate changes on variable rate debt, we entered into interest rate swap agreements. These swaps are settled in cash, and the net interest paid or received is effectively recognized as interest expense. We mark these swaps to fair value and recognize the resulting gains or losses as other comprehensive income.

To help protect the value of the Company's net investment in European operations against adverse changes in exchange rates, the Company uses non-derivative financial instruments, such as its foreign currency denominated debt, as economic hedges of its net investments in certain foreign subsidiaries.

We manage foreign currency risks in a wide variety of foreign currencies principally by entering into forward contracts to mitigate the impact of currency fluctuations on transactions arising from international trade. Our objective in entering into these forward contracts is to preserve the economic value of nonfunctional currency cash flows. Our principal foreign currency exposures relate to the Euro, the Thailand Baht, the Indonesian Rupiah, the Japanese Yen, the Chinese Renminbi and the Romanian Leu. We mark these forward contracts to fair value based on market prices for comparable contracts and recognize the resulting gains or losses as other income or expense from foreign currency transactions.

Precious metals (primarily silver, gold, platinum and palladium) represent a significant portion of raw material costs in our electronics products. When we enter into a fixed price sales contract at the customer's request to establish the price for the precious metals content of the order, we also enter into a forward purchase arrangement with a precious metals supplier to completely cover the value of the precious metals content. Our current precious metal contracts are designated as normal purchase contracts, which are not marked to market.

We also purchase portions of our energy requirements, including natural gas and electricity, under fixed price contracts to reduce the volatility of cost changes. Our current energy contracts are designated as normal purchase contracts, which are not marked to market.

Pension and Other Postretirement Benefits

We sponsor defined benefit plans in the U.S. and many countries outside the U.S., and we also sponsor retiree medical benefits for a segment of our salaried and hourly work force within the U.S. The U.S. pension plans and retiree medical plans represent approximately 86% of pension plan assets, 69% of benefit obligations and 72% of net periodic pension expense as of December 31, 2017.

The assumptions we use in actuarial calculations for these plans have a significant impact on benefit obligations and annual net periodic benefit costs. We meet with our actuaries annually to discuss key economic assumptions used to develop these benefit obligations and net periodic costs.

We determine the discount rate for the U.S. pension and retiree medical plans based on a bond model. Using the pension plans' projected cash flows, the bond model considers all possible bond portfolios that produce matching cash flows and selects the portfolio with the highest possible yield. These portfolios are based on bonds with a quality rating of AA or better under either Moody's Investor Services, Inc. or Standard & Poor's Rating Group, but exclude certain bonds, such as callable bonds, bonds with small amounts outstanding, and bonds with unusually high or low yields. The discount rates for the non-U.S. plans are based on a yield curve method, using AA-rated bonds applicable in their respective capital markets. The duration of each plan's liabilities is used to select the rate from the yield curve corresponding to the same duration.

For the market-related value of plan assets, we use fair value, rather than a calculated value. The market-related value recognizes changes in fair value in a systematic and rational manner over several years. We calculate the expected return on assets at the beginning of the year for defined benefit plans as the weighted-average of the expected return for the target allocation of the principal asset classes held by each of the plans. In determining the expected returns, we consider both historical performance and an estimate of future long-term rates of return. The Company consults with and considers the opinion of its actuaries in developing appropriate return assumptions. Our target asset allocation percentages are 35% fixed income, 60% equity, and 5% other investments for U.S. plans and 75% fixed income, 24% equity, and 1% other investments for non-U.S. plans. In 2017, investment returns on average plan assets were approximately 16% within the U.S. plans and 3% within non-U.S. plans. In 2016, actual return on plan assets, were lower than the expected return. Future actual pension expense will depend on future investment allocation and performance, changes in future discount rates and various other factors related to the population of participants in the Company's pension plans.

All other assumptions are reviewed periodically by our actuaries and us and may be adjusted based on current trends and expectations as well as past experience in the plans.

The following table provides the sensitivity of net annual periodic benefit costs for our pension plans, including a U.S. nonqualified retirement plan, and the retiree medical plan to a 25-basis-point decrease in both the discount rate and asset return assumption:

	<u>25 Basis Point Decrease in Discount Rate</u>	<u>25 Basis Point Decrease in Asset Return Assumption</u>
	(Dollars in thousands)	
U.S. pension plans	\$ (438)	\$ 598
U.S. retiree medical plan	(35)	N/A
Non-U.S. pension plans	(52)	33
Total	\$ (525)	\$ 631

The following table provides the rates used in the assumptions and the changes between 2017 and 2016:

	<u>2017</u>	<u>2016</u>	<u>Change</u>
Discount rate used to measure the benefit cost:			
U.S. pension plans	4.40%	4.70%	(0.30)%
U.S. retiree medical plan	4.20%	4.50%	(0.30)%
Non-U.S. pension plans	2.24%	3.12%	(0.88)%
Discount rate used to measure the benefit obligation:			
U.S. pension plans	3.80%	4.40%	(0.60)%
U.S. retiree medical plan	3.70%	4.20%	(0.50)%
Non-U.S. pension plans	2.35%	2.24%	0.11%
Expected return on plan assets:			
U.S. pension plans	8.20%	8.20%	—%
Non-U.S. pension plans	2.54%	3.41%	(0.87)%

Our overall net periodic benefit credit for all defined benefit plans was \$6.4 million in 2017 and a cost of \$20.2 million in 2016. The change is mainly the result of mark to market actuarial net gains in 2017.

For 2018, assuming expected returns on plan assets and no actuarial gains or losses, we expect our overall net periodic benefit income to be approximately \$0.2 million, compared with income of approximately \$1.2 million in 2017 on a comparable basis.

Inventories

We value inventory at the lower of cost or market, with cost determined utilizing the first-in, first-out (FIFO) method. We periodically evaluate the net realizable value of inventories based primarily upon their age, but also upon assumptions of future usage in production, customer demand and market conditions. Inventories have been reduced to the lower of cost or realizable value by allowances for slow moving or obsolete goods. If actual circumstances are less favorable than those projected by management in its evaluation of the net realizable value of inventories, additional write-downs may be required. Slow moving, excess or obsolete materials are specifically identified and may be physically separated from other materials, and we rework or dispose of these materials as time and manpower permit.

Environmental Liabilities

Our manufacturing facilities are subject to a broad array of environmental laws and regulations in the countries in which they are located. The costs to comply with complex environmental laws and regulations are significant and will continue for the foreseeable future. We expense these recurring costs as they are incurred. While these costs may increase in the future, they are not expected to have a material impact on our financial position, liquidity or results of operations.

We also accrue for environmental remediation costs and other obligations when it is probable that a liability has been incurred and we can reasonably estimate the amount. We determine the timing and amount of any liability based upon assumptions regarding future events. Inherent uncertainties exist in such evaluations primarily due to unknown conditions and other circumstances, changing governmental regulations and legal standards regarding liability, and evolving technologies. We adjust these liabilities periodically as remediation efforts progress or as additional technical or legal information becomes available.

Impact of Newly Issued Accounting Pronouncements

Refer to Note 2 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K for a discussion of accounting standards we recently adopted or will be required to adopt.

Item 7A — Quantitative and Qualitative Disclosures about Market Risk

The primary objective of the following information is to provide forward-looking quantitative and qualitative information about our exposure to instruments that are sensitive to fluctuations in interest rates and foreign currency exchange rates.

Our exposure to interest rate risk arises from our debt portfolio. We manage this risk by controlling the mix of fixed versus variable-rate debt after considering the interest rate environment and expected future cash flows. To reduce our exposure to interest rate changes on variable rate debt, we entered into interest rate swap agreements. These swaps effectively convert a portion of our variable rate debt to a fixed rate. Our objective is to limit variability in earnings, cash flows and overall borrowing costs caused by changes in interest rates, while preserving operating flexibility.

We operate internationally and enter into transactions denominated in foreign currencies. These transactions expose us to gains and losses arising from exchange rate movements between the dates foreign currencies are recorded and the dates they are settled. We manage this risk by entering into forward currency contracts that substantially offset these gains and losses.

We are subject to cost changes with respect to our raw materials and energy purchases. We attempt to mitigate raw materials cost increases through product reformulations, price increases and productivity improvements. We enter into forward purchase arrangements with precious metals suppliers to completely cover

the value of the precious metals content of fixed price sales contracts. These agreements are designated as normal purchase contracts, which are not marked to market, and had purchase commitments totaling \$1.4 million at December 31, 2017. In addition, we purchase portions of our natural gas, electricity and oxygen requirements under fixed price contracts to reduce the volatility of these costs. These energy contracts are designated as normal purchase contracts, which are not marked to market, and had purchase commitments totaling \$97.5 million at December 31, 2017.

The notional amounts, carrying amounts of assets (liabilities), and fair values associated with our exposure to these market risks and sensitivity analysis about potential gains (losses) resulting from hypothetical changes in market rates are presented below:

	<u>December 31,</u> <u>2017</u>	<u>December 31,</u> <u>2016</u>
	(Dollars in thousands)	
Variable-rate debt:		
Carrying amount	\$ 739,602	\$ 562,537
Fair value	742,634	581,893
Increase in annual interest expense from 1% increase in interest rates	4,890	5,611
Decrease in annual interest expense from 1% decrease in interest rates	(2,992)	(5,611)
Fixed-rate debt:		
Carrying amount	7,112	8,228
Fair value	3,973	7,315
Change in fair value from 1% increase in interest rates	NM	NM
Change in fair value from 1% decrease in interest rates	NM	NM
Interest rate swaps:		
Notional amount	258,045	—
Carrying amount and fair value	1,492	—
Change in fair value from 1% increase in interest rates	9,157	—
Change in fair value from 1% decrease in interest rates	(3,678)	—
Foreign currency forward contracts:		
Notional amount	238,457	338,186
Carrying amount and fair value	(469)	350
Change in fair value from 10% appreciation of U.S. dollar	3,541	15,589
Change in fair value from 10% depreciation of U.S. dollar	(4,328)	(19,054)

NM — Not meaningful

Item 8 — Financial Statements and Supplementary Data

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders of Ferro Corporation

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Ferro Corporation and subsidiaries (the “Company”) as of December 31, 2017 and 2016, the related consolidated statements of operations, comprehensive (loss) income, equity, and cash flows for each of the three years in the period ended December 31, 2017, and the related notes and the financial statement schedule listed in the Index at Item 15 (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2017 and 2016, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2017, in conformity with accounting principles generally accepted in the United States of America.

We have also 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, 2017, based on criteria established in Internal Control — Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated February 28, 2018, expressed an unqualified opinion on the Company’s internal control over financial reporting.

Basis for Opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the 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/ Deloitte & Touche LLP

Cleveland, Ohio
February 28, 2018

We have served as the Company’s auditor since 2006.

FERRO CORPORATION AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF OPERATIONS

	Years Ended December 31,		
	2017	2016	2015
	(Dollars in thousands, except per share amounts)		
Net sales	\$ 1,396,742	\$ 1,145,292	\$ 1,075,341
Cost of sales	980,521	794,075	773,661
Gross profit	416,221	351,217	301,680
Selling, general and administrative expenses	258,604	241,702	216,899
Restructuring and impairment charges	11,409	15,907	9,655
Other expense (income):			
Interest expense	27,754	21,547	15,163
Interest earned	(901)	(630)	(363)
Foreign currency losses, net	6,554	12,906	4,495
Loss on extinguishment of debt	3,905	—	—
Miscellaneous (income) expense, net	(1,622)	(2,660)	1,048
Income before income taxes	110,518	62,445	54,783
Income tax expense (benefit)	52,750	17,868	(45,100)
Income from continuing operations	57,768	44,577	99,883
Loss from discontinued operations, net of income taxes	—	(64,464)	(36,779)
Net income (loss)	57,768	(19,887)	63,104
Less: Net income (loss) attributable to noncontrolling interests	714	930	(996)
Net income (loss) attributable to Ferro Corporation common shareholders	\$ 57,054	\$ (20,817)	\$ 64,100
Amounts attributable to Ferro Corporation:			
Income from continuing operations, net of income tax	57,054	43,647	100,879
Loss from discontinued operations, net of income tax	—	(64,464)	(36,779)
Income (loss) attributable to Ferro Corporation	\$ 57,054	\$ (20,817)	\$ 64,100
Weighted-average common shares outstanding	83,713	83,298	86,718
Incremental common shares attributable to performance shares, deferred stock units, restricted stock units, and stock options	1,443	1,612	1,715
Weighted-average diluted shares outstanding	85,156	84,910	88,433
Earnings (loss) per share attributable to Ferro Corporation common shareholders:			
Basic earnings (loss):			
Continuing operations	\$ 0.68	\$ 0.52	\$ 1.16
Discontinued operations	—	(0.77)	(0.42)
	\$ 0.68	\$ (0.25)	\$ 0.74
Diluted earnings (loss):			
Continuing operations	\$ 0.67	\$ 0.51	\$ 1.14
Discontinued operations	—	(0.76)	(0.42)
	\$ 0.67	\$ (0.25)	\$ 0.72

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)

	Years Ended December 31,		
	2017	2016	2015
	(Dollars in thousands)		
Net income (loss)	\$57,768	\$(19,887)	\$ 63,104
Other comprehensive (income) loss, net of income tax:			
Foreign currency translation income (loss)	30,558	(45,986)	(40,801)
Cash flow hedging instruments unrealized gain	945	—	—
Postretirement benefit liabilities gain (loss)	24	330	(77)
Other comprehensive income (loss), net of income tax	31,527	(45,656)	(40,878)
Total comprehensive income (loss)	89,295	(65,543)	22,226
Less: Comprehensive income (loss) attributable to noncontrolling interests	1,066	599	(2,361)
Comprehensive income (loss) attributable to Ferro Corporation	\$88,229	\$(66,142)	\$ 24,587

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

	<u>December 31,</u> <u>2017</u>	<u>December 31,</u> <u>2016</u>
(Dollars in thousands)		
ASSETS		
Current assets		
Cash and cash equivalents	\$ 63,551	\$ 45,582
Accounts receivable, net	354,416	259,687
Inventories	324,180	229,847
Other receivables	67,137	37,814
Other current assets	16,448	9,087
Total current assets	825,732	582,017
Other assets		
Property, plant and equipment, net	321,742	262,026
Goodwill	195,369	148,296
Intangible assets, net	187,616	137,850
Deferred income taxes	108,025	106,454
Other non-current assets	43,718	47,126
Total assets	\$1,682,202	\$1,283,769
LIABILITIES AND EQUITY		
Current liabilities		
Loans payable and current portion of long-term debt	\$ 25,136	\$ 17,310
Accounts payable	211,711	127,655
Accrued payrolls	48,201	35,859
Accrued expenses and other current liabilities	70,151	65,203
Total current liabilities	355,199	246,027
Other liabilities		
Long-term debt, less current portion	726,491	557,175
Postretirement and pension liabilities	166,680	162,941
Other non-current liabilities	77,152	62,594
Total liabilities	1,325,522	1,028,737
Equity		
Ferro Corporation shareholders' equity:		
Common stock, par value \$1 per share; 300.0 million shares authorized; 93.4 million shares issued; 84.0 million and 83.4 million shares outstanding at December 31, 2017, and December 31, 2016, respectively	93,436	93,436
Paid-in capital	302,158	306,566
Retained earnings	171,744	114,690
Accumulated other comprehensive loss	(75,468)	(106,643)
Common shares in treasury, at cost	(147,056)	(160,936)
Total Ferro Corporation shareholders' equity	344,814	247,113
Noncontrolling interests	11,866	7,919
Total equity	356,680	255,032
Total liabilities and equity	\$1,682,202	\$1,283,769

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF EQUITY

	Ferro Corporation Shareholders							Non- controlling Interests	Total Equity
	Common Shares in Treasury		Common Stock	Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive (Loss) Income			
	Shares	Amount							
	(In thousands)								
Balances at December 31, 2014	6,445	\$(136,058)	\$93,436	\$317,404	\$ 71,407	\$ (21,805)	\$11,632	\$336,016	
Net income (loss)	—	—	—	—	64,100	—	(996)	63,104	
Other comprehensive (loss)	—	—	—	—	—	(39,513)	(1,365)	(40,878)	
Purchase of treasury stock	3,283	(38,571)	—	—	—	—	—	(38,571)	
Stock-based compensation transactions	(297)	8,609	—	(2,550)	—	—	—	6,059	
Sale of noncontrolling interest	—	—	—	—	—	—	(581)	(581)	
Distributions to noncontrolling interests	—	—	—	—	—	—	(868)	(868)	
Balances at December 31, 2015	9,431	(166,020)	93,436	314,854	135,507	(61,318)	7,822	324,281	
Net (loss) income	—	—	—	—	(20,817)	—	930	(19,887)	
Other comprehensive (loss)	—	—	—	—	—	(45,325)	(331)	(45,656)	
Purchase of treasury stock	1,175	(11,429)	—	—	—	—	—	(11,429)	
Stock-based compensation transactions	(610)	16,513	—	(8,288)	—	—	—	8,225	
Distributions to noncontrolling interests	—	—	—	—	—	—	(502)	(502)	
Balances at December 31, 2016	9,996	(160,936)	93,436	306,566	114,690	(106,643)	7,919	255,032	
Net income	—	—	—	—	57,054	—	714	57,768	
Other comprehensive income	—	—	—	—	—	31,175	352	31,527	
Stock-based compensation transactions	(610)	13,880	—	(4,408)	—	—	—	9,472	
Change in ownership interest	—	—	—	—	—	—	3,355	3,355	
Distributions to noncontrolling interests	—	—	—	—	—	—	(474)	(474)	
Balances at December 31, 2017	9,386	\$(147,056)	\$93,436	\$302,158	\$171,744	\$ (75,468)	\$11,866	\$356,680	

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF CASH FLOWS

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Cash flows from operating activities			
Net income (loss)	\$ 57,768	\$ (19,887)	\$ 63,104
Adjustments to reconcile net income (loss) to net cash provided by operating activities:			
(Gain) loss on sale of assets and businesses	(852)	(2,764)	1,836
Depreciation and amortization	50,085	46,805	41,061
Interest amortization	3,496	1,353	1,125
Restructuring and impairment charges	7,593	50,868	13,270
Loss on extinguishment of debt	3,905	—	—
Provision for allowance for doubtful accounts	44	1,383	639
Retirement benefits	(6,417)	14,436	(5,986)
Deferred income taxes	23,490	(11,451)	(66,328)
Stock-based compensation	11,770	7,245	8,868
Changes in current assets and liabilities, net of effects of acquisitions:			
Accounts receivable	(25,852)	(21,893)	20,208
Inventories	(46,962)	(10,271)	6,562
Other receivables and other current assets	(7,099)	(3,006)	4,147
Accounts payable	26,150	1,162	(14,605)
Accrued expenses and other current liabilities	(22,398)	11,626	(23,547)
Other operating activities	10,069	(2,976)	848
Net cash provided by operating activities	84,790	62,630	51,202
Cash flows from investing activities			
Capital expenditures for property, plant and equipment and other long-lived assets	(50,552)	(24,945)	(43,087)
Proceeds from sale of assets	—	3,634	642
Proceeds from sale of equity method investment	2,268	—	—
Business acquisitions, net of cash acquired	(131,194)	(129,511)	(202,155)
Other investing	567	—	—
Net cash (used in) investing activities	(178,911)	(150,822)	(244,600)
Cash flows from financing activities			
Net (repayments) borrowings under loans payable	(19,634)	4,596	(7,261)
Proceeds from revolving credit facility, maturing 2019	15,628	355,743	242,390
Principal payments on revolving credit facility, maturing 2019	(327,183)	(214,188)	(72,390)
Proceeds from term loan facility, maturing 2024	623,827	—	—
Principal payments on term loan facility, maturing 2024	(4,872)	—	—
Principal payments on term loan facility, maturing 2021	(243,250)	(53,000)	(3,000)
Proceeds from revolving credit facility, maturing 2022	180,605	—	—
Principal payments on revolving credit facility, maturing 2022	(102,605)	—	—
Principal payments on other long-term debt	(3,971)	—	—
Proceeds from other long-term debt	2,700	—	—
Payment of debt issuance costs	(12,927)	(711)	—
Acquisition related contingent consideration payment	(1,315)	—	—
Proceeds from exercise of stock options	4,526	1,140	404
Purchase of treasury stock	—	(11,429)	(38,571)
Other financing activities	(3,166)	(154)	(1,846)
Net cash provided by financing activities	108,363	81,997	119,726
Effect of exchange rate changes on cash and cash equivalents	3,727	(6,603)	(8,448)
Increase (decrease) in cash and cash equivalents	17,969	(12,798)	(82,120)
Cash and cash equivalents at beginning of period	45,582	58,380	140,500
Cash and cash equivalents at end of period	\$ 63,551	\$ 45,582	\$ 58,380
Cash paid during the period for:			
Interest	\$ 26,850	\$ 17,486	\$ 16,188
Income taxes	\$ 25,662	\$ 19,734	\$ 21,364

See accompanying notes to consolidated financial statements.

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1. Our Business

Ferro Corporation (“Ferro,” “we,” “us” or “the Company”) is a leading producer of specialty materials that are sold to a broad range of manufacturers who, in turn, make products for many end-use markets. Ferro’s products fall into two general categories: functional coatings, which perform specific functions in the manufacturing processes and end products of our customers; and color solutions, which provide aesthetic and performance characteristics to our customers’ products. We differentiate ourselves in our industry by innovation and new products and services and the consistent high quality of our products, combined with delivery of localized technical service and customized application technology support. Our value-added technical services assist customers in their material specification and evaluation, product design, and manufacturing process characterization in order to help them optimize the application of our products. We manage our businesses through four business units that are differentiated from one another by product type. The four business units are listed below:

- Tile Coating Systems⁽¹⁾
- Porcelain Enamel⁽¹⁾
- Performance Colors and Glass
- Color Solutions

(1) Tile Coating Systems and Porcelain Enamel are combined into one reportable segment, Performance Coatings, for financial reporting purposes.

We produce our products primarily in the Europe-Middle East region, the U.S., the Asia Pacific region, and Latin America.

We sell our products directly to customers and through the use of agents or distributors throughout the world. Our products are sold principally in Europe-Middle East region, the U.S., the Asia Pacific region, and Latin America. Our customers manufacture products to serve a variety of end markets, including appliances, automobiles, building and renovation, electronics, household furnishings, industrial products, packaging, and sanitary.

The Company owned 51% of an operating affiliate in Venezuela that was a consolidated subsidiary. During the fourth quarter of 2015, we sold our interest in the operating affiliate in Venezuela for a cash purchase price of \$0.5 million.

As discussed in Note 3, in the third quarter of 2016, we completed the disposition of the Europe-based Polymer Additives business and have classified the related operating results, net of income tax, as discontinued operations in the accompanying consolidated statements of operations for the years ended December 31, 2016 and 2015.

During the first quarter of 2017, the Company renamed the Pigments, Powders and Oxides segment “Color Solutions.”

2. Significant Accounting Policies

Principles of Consolidation

Our consolidated financial statements include the accounts of the parent company and the accounts of its subsidiaries and include the results of the Company and all entities in which the Company has a controlling

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interest. When we consolidate our financial statements, we eliminate intercompany transactions, accounts and profits. When we exert significant influence over an investee but do not control it, we account for the investment and the investment income using the equity method. These investments are reported in the Other non-current assets on our balance sheet. We consolidate financial results for six legal entities in which we do not own 100% of the equity interests, either directly or indirectly through our subsidiaries. These entities have non-controlling interest ownerships ranging from 5% to 41%.

When we acquire a subsidiary, its financial results are included in our consolidated financial statements from the date of the acquisition. When we dispose of a subsidiary, its financial results are included in our consolidated financial statements until the date of the disposition. In the event that a disposal group meets the criteria for discontinued operations, prior periods are adjusted to reflect the classification.

Use of Estimates and Assumptions in the Preparation of Financial Statements

We prepare our consolidated financial statements in conformity with accounting principles generally accepted in the United States, which requires us to make estimates and to use judgments and assumptions that affect the timing and amount of assets, liabilities, equity, revenues and expenses recorded and disclosed. The more significant estimates and judgments relate to revenue recognition, restructuring and cost reduction programs, asset impairment, income taxes, inventories, goodwill, pension and other postretirement benefits, purchase price accounting and environmental liabilities. Actual outcomes could differ from our estimates, resulting in changes in revenues or costs that could have a material impact on the Company's results of operations, financial position, or cash flows.

Foreign Currency Translation

The financial results of our operations outside of the U.S. are recorded in local currencies, which generally are also the functional currencies for financial reporting purposes. The results of operations outside of the U.S. are translated from these functional currencies into U.S. dollars using the average monthly currency exchange rates. We use the average currency exchange rate for these results of operations as a reasonable approximation of the results had specific currency exchange rates been used for each individual transaction. Foreign currency transaction gains and losses are recorded, as incurred, as Other expense (income) in the consolidated statements of operations. Assets and liabilities are translated into U.S. dollars using exchange rates at the balance sheet dates, and we record the resulting foreign currency translation adjustments as a separate component of Accumulated other comprehensive loss in equity.

Revenue Recognition

We typically recognize sales when we ship goods to our customers and when all of the following criteria are met:

- Persuasive evidence of an arrangement exists;
- The selling price is fixed or determinable;
- Collection is reasonably assured; and
- Title and risk of loss has passed to our customers.

In order to ensure the revenue recognition in the proper period, we review material sales contracts for proper cut-off based upon the business practices and legal requirements of each country. For sales of all products,

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including those containing precious metals, we report revenues on a gross basis, along with their corresponding cost of sales to arrive at gross profit. We record revenues this way because we act as the principal in the transactions into which we enter.

The amount of shipping and handling fees invoiced to our customers at the time our product is shipped is included in net sales. Credit memos issued to customers for sales returns, discounts allowed and sales adjustments are recorded when they are incurred as a reduction of sales.

Additionally, we provide certain of our customers with incentive rebate programs to promote customer loyalty and encourage increased product sales. We accrue customer rebates over the rebate periods based upon estimated attainments of the provisions in the rebate agreements, and record these rebate accruals as reductions of sales.

Research and Development Expenses

Research and development expenses are expensed as incurred and are included in Selling, general and administrative expenses. Total expenditures for product and application technology, including research and development, customer technical support and other related activities, were approximately \$36.4 million for 2017, \$27.3 million for 2016 and \$25.6 million for 2015.

Restructuring Programs

We expense costs associated with exit and disposal activities designed to restructure operations and reduce ongoing costs of operations when we incur the related liabilities or when other triggering events occur. After the appropriate level of management, having the authority, approves the detailed restructuring plan and the appropriate criteria for recognition are met, we establish accruals for employee termination and other costs, as applicable. The accruals are estimates that are based upon factors including statutory and union requirements, affected employees' lengths of service, salary level, health care benefit choices and contract provisions. We also analyze the carrying value of affected long-lived assets for impairment and reductions in their remaining estimated useful lives. In addition, we record the fair value of any new or remaining obligations when existing operating lease contracts are terminated or abandoned as a result of our exit and disposal activities.

Asset Impairment

The Company's long-lived assets include property, plant and equipment, goodwill, and intangible assets. We review property, plant and equipment and intangible assets for impairment whenever events or circumstances indicate that their carrying values may not be recoverable. The following are examples of such events or changes in circumstances:

- An adverse change in the business climate of a long-lived asset or asset group;
- An adverse change in the extent or manner in which a long-lived asset or asset group is used or in its physical condition;
- Current operating losses for a long-lived asset or asset group combined with a history of such losses or projected or forecasted losses that demonstrate that the losses will continue; or
- A current expectation that, more likely than not, a long-lived asset or asset group will be sold or otherwise significantly disposed of before the end of its previously estimated useful life.

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The carrying amount of property, plant and equipment and intangible assets is not recoverable if the carrying value of the asset group exceeds the sum of the undiscounted cash flows expected to result from the use and eventual disposition of the asset group. In the event of impairment, we recognize a loss for the excess of the recorded value over fair value. The long-term nature of these assets requires the estimation of cash inflows and outflows several years into the future and only takes into consideration technological advances known at the time of review.

We review goodwill for impairment annually using a measurement date of October 31, primarily due to the timing of our annual budgeting process, or more frequently in the event of an impairment indicator. The fair value of each reporting unit that has goodwill is estimated using the average of both the income approach and the market approach, which we believe provides a reasonable estimate of the reporting unit's fair value, unless facts or circumstances exist which indicate a more representative fair value. The income approach is a discounted cash flow model, which uses projected cash flows attributable to the reporting unit, including an allocation of certain corporate expenses based primarily on proportional sales. We use historical results, trends and our projections of market growth, internal sales efforts and anticipated cost structure assumptions to estimate future cash flows. Using a risk-adjusted, weighted-average cost of capital, we discount the cash flow projections to the measurement date. The market approach estimates a price reasonably expected to be paid by a market participant in the purchase of the reporting units based on a comparison to similar businesses. If the fair value of any reporting unit was determined to be less than its carrying value, we would obtain comparable market values or independent appraisals of its net assets.

Derivative Financial Instruments

As part of our risk management activities, we employ derivative financial instruments, primarily interest rate swaps and foreign currency forward contracts, to hedge certain anticipated transactions, firm commitments, or assets and liabilities denominated in foreign currencies. We also purchase portions of our energy and precious metal requirements under fixed price forward purchase contracts designated as normal purchase contracts.

We record derivatives on our balance sheet as either assets or liabilities that are measured at fair value. For derivative instruments that are designated and qualify as cash flow hedges, the gain or loss on the derivative is reported as a component of other comprehensive income or loss and reclassified from accumulated other comprehensive loss into earnings when the hedged transaction affects earnings. The ineffective portion, if any, in the change in value of these derivatives is immediately recognized in earnings. For derivatives that are not designated as hedges, the gain or loss on the derivative is recognized in current earnings. We only use derivatives to manage well-defined risks and do not use derivatives for speculative purposes.

Postretirement and Other Employee Benefits

We recognize postretirement and other employee benefits expense as employees render the services necessary to earn those benefits. We determine defined benefit pension and other postretirement benefit costs and obligations with the assistance of third parties who perform certain actuarial calculations. The calculations and the resulting amounts recorded in our consolidated financial statements are affected by assumptions including the discount rate, expected long-term rate of return on plan assets, the annual rate of change in compensation for plan-eligible employees, estimated changes in costs of healthcare benefits, mortality tables, and other factors. We evaluate the assumptions used on an annual basis.

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Income Taxes

We account for income taxes in accordance with Accounting Standards Codification (“ASC”) Topic 740, Income Taxes, which requires the recognition of deferred tax assets and liabilities for the expected future tax effects of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial statements and tax basis of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income in the period that includes the enactment date.

We record deferred tax assets to the extent we believe these assets will more likely than not be realized. In making such determination, we consider all available positive and negative evidence, including future reversals of existing temporary differences, the availability of tax planning strategies, forecasted income, and recent financial operations.

We recognize a tax benefit from an uncertain tax position when it is more likely than not that the position will be sustained upon examination, including resolutions of any related appeals or litigation processes, based on the technical merits.

We recognize interest and penalties related to uncertain tax positions within the income tax expense line in the accompanying consolidated statements of operations.

Cash Equivalents

We consider all highly liquid instruments with original maturities of three months or less when purchased to be cash equivalents. These instruments are carried at cost, which approximates fair value.

Accounts Receivable and the Allowance for Doubtful Accounts

Ferro sells its products to customers in diversified industries throughout the world. No customer or related group of customers represents greater than 10% of net sales or accounts receivable. We perform ongoing credit evaluations of our customers and require collateral principally for export sales, when industry practices allow and as market conditions dictate, subject to our ability to negotiate secured terms relative to competitive offers. We regularly analyze significant customer accounts and provide for uncollectible accounts based on historical experience, customer payment history, the length of time the receivables are past due, the financial health of the customer, economic conditions and specific circumstances, as appropriate. Changes in these factors could result in additional allowances. Customer accounts we conclude to be uncollectible or to require excessive collection costs are written off against the allowance for doubtful accounts. Historically, write-offs of uncollectible accounts have been within our expectations. Detailed information about the allowance for doubtful accounts is provided below:

	2017	2016	2015
	(Dollars in thousands)		
Allowance for doubtful accounts	\$ 7,821	\$ 8,166	\$ 7,784
Bad debt expense	44	1,383	667

Inventories

We value inventory at the lower of cost or market, with cost determined utilizing the first-in, first-out (FIFO) method. We periodically evaluate the net realizable value of inventories based primarily upon their age,

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but also upon assumptions of future usage in production, customer demand and market conditions. Inventory values have been reduced to the lower of cost or market value by allowances for slow moving or obsolete goods.

We maintain raw materials on our premises that we do not own, including precious metals consigned from financial institutions and customers. We also consign inventory to our broker and vendors. Although we have physical possession of the goods, their value is not reflected on our balance sheet because we do not have legal title.

We obtain precious metals under consignment agreements with financial institutions for periods of one year or less. These precious metals are primarily silver, gold, platinum, and palladium and are used in the production of certain products for our customers. Under these arrangements, the financial institutions own the precious metals, and accordingly, we do not report these precious metals as inventory on our consolidated balance sheets although they are physically in our possession. The financial institutions charge us fees for these consignment arrangements, and these fees are recorded as cost of sales. These agreements are cancelable by either party at the end of each consignment period, however, because we have access to a number of consignment arrangements with available capacity, our consignment needs can be shifted among the other participating institutions in order to ensure our supply. In certain cases, these financial institutions can require cash deposits to provide additional collateral beyond the value of the underlying precious metals.

Property, Plant and Equipment

We record property, plant and equipment at historical cost. In addition to the original purchased cost, including transportation, installation and taxes, we capitalize expenditures that increase the utility or useful life of existing assets. For constructed assets, we capitalize interest costs incurred during the period of construction. We expense repair and maintenance costs, as incurred. We depreciate property, plant and equipment on a straight-line basis, generally over the following estimated useful lives of the assets:

Buildings	20 to 40 years
Machinery and equipment	5 to 15 years

Other Capitalized Costs

We capitalize the costs of computer software developed or obtained for internal use after the preliminary project stage has been completed, and management, with the relevant authority, authorizes and commits to funding a computer software project, and it is probable that the project will be completed and the software will be used to perform the function intended. External direct costs of materials and services consumed in developing or obtaining internal-use computer software, payroll and payroll-related costs for employees who are directly associated with the project, and interest costs incurred when developing computer software for internal use are capitalized within Intangible assets. Capitalization ceases when the project is substantially complete, generally after all substantial testing is completed. We expense training costs and data conversion costs as incurred. We amortize software on a straight-line basis over its estimated useful life, which has historically been in a range of 1 to 10 years.

Environmental Liabilities

As part of the production of some of our products, we handle, process, use and store hazardous materials. As part of these routine processes, we expense recurring costs associated with control and disposal of hazardous

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materials as they are incurred. Occasionally we are subject to ongoing, pending or threatened litigation related to the handling of these materials or other matters. If, based on available information, we believe that we have incurred a liability and we can reasonably estimate the amount, we accrue for environmental remediation and other contingent liabilities. We disclose material contingencies if the likelihood of the potential loss is reasonably possible but the amount is not reasonably estimable.

In estimating the amount to be accrued for environmental remediation, we use assumptions about:

- Remediation requirements at the contaminated site;
- The nature of the remedy;
- Existing technology;
- The outcome of discussions with regulatory agencies;
- Other potentially responsible parties at multi-party sites; and
- The number and financial viability of other potentially responsible parties.

We actively monitor the status of sites, and, as assessments and cleanups proceed, we update our assumptions and adjust our estimates as necessary. Because the timing of related payments is uncertain, we do not discount the estimated remediation costs.

Recently Adopted Accounting Pronouncement

In March 2016, the Financial Accounting Standards Board (“FASB”) issued Accounting Standards Update (“ASU”) 2016-09, *Compensation — Stock Compensation: (Topic 718): Improvements to Employee Share-Based Payment Accounting*. ASU 2016-09 is intended to simplify several aspects of the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities, and classification on the statement of cash flows. This new guidance requires all income tax effects of awards to be recognized as income tax expense or benefit in the income statement when the awards vest or are settled. Cash flow related to excess tax benefits will no longer be classified as a financing activity on the statement of cash flows but will be presented with all other income tax cash flows as an operating activity. The new guidance also provides an accounting policy election to account for award forfeitures as they occur. Finally, the updated standard also allows the Company to repurchase more of an employee’s shares for tax withholding purposes without triggering liability accounting and clarifies that all cash tax payments made on an employee’s behalf for withheld shares should be presented as financing activities on the statement of cash flows.

The Company adopted ASU 2016-09, in the first quarter of 2017. As a result of the adoption, tax benefits of \$0.3 million were recorded in income tax expense. The Company has elected to account for award forfeitures as they occur. In addition, the Company elected to apply the presentation requirements for cash flows related to excess tax benefits prospectively. The presentation requirements for cash flows related to employee taxes paid for withheld shares had no impact on the statements of cash flows since the Company has historically presented such payments as financing activities.

New Accounting Standards

In August 2017, the FASB issued ASU 2017-12, *Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities*. ASU 2017-12 provides guidance to better align an entity’s

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risk management activities and financial reporting for hedging relationships through changes to both the designation and measurement guidance for qualifying hedging relationships and the presentation of hedge results. This pronouncement is effective for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In May 2017, the FASB issued ASU 2017-09, *Compensation — Stock Compensation: (Topic 718): Scope of Modification Accounting*. ASU 2017-09 provides guidance about which changes to the terms or conditions of a share-based payment award require an entity to apply modification accounting in Topic 718. This pronouncement is effective for annual periods beginning after December 15, 2017, including interim periods within those annual periods. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In March 2017, the FASB issued ASU 2017-07, *Compensation — Retirement Benefits: (Topic 715): Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Costs*. ASU 2017-07 requires that an employer report the service cost component in the same line item as other compensation costs arising from services rendered during the period. The other components of net benefit costs are to be presented in the income statement separately from the service costs component and outside a subtotal of income from operations. Employers will have to disclose the line(s) used to present the other components of net periodic benefit cost, if the components are not presented separately in the income statement. This pronouncement is effective for annual periods beginning after December 15, 2017, including interim periods within those annual periods. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In January 2017, the FASB issued ASU 2017-04, *Intangibles — Goodwill and Other: (Topic 350): Simplifying the Test for Goodwill Impairment*. ASU 2017-04 is intended to simplify the subsequent measurement of goodwill by eliminating Step 2 from the current goodwill impairment test. This pronouncement is effective for the annual or any interim goodwill impairment tests conducted in fiscal years beginning after December 15, 2019. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In January 2017, the FASB issued ASU 2017-01, *Business Combinations: (Topic 805): Clarifying the Definition of a Business*. ASU 2017-01 is intended to clarify the definition of a business with the objective of adding guidance to assist entities in evaluating whether transactions should be accounted for as acquisitions (or dispositions) of assets or businesses. This pronouncement is effective for annual periods beginning after December 15, 2017, including interim periods within those fiscal years. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In October 2016, the FASB issued ASU 2016-16, *Income Taxes: (Topic 740): Intra-Entity Transfers of Assets Other Than Inventory*. ASU 2016-16 is intended to improve the accounting for the income tax consequences of intra-entity transfers of assets other than inventory and requires the recognition of the income tax consequences of an intra-entity transfer of an asset, other than inventory, when the transfer occurs. This pronouncement is effective for annual periods beginning after December 15, 2017, including interim reporting periods within those annual reporting periods. The Company is in the process of assessing the impact that the adoption of this ASU will have on our consolidated financial statements.

In August 2016, the FASB issued ASU 2016-15, *Statement of Cash Flow: (Topic 230): Classification of Certain Cash Receipts and Cash Payments*. ASU 2016-15 is intended to address eight specific cash flow issues

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with the objective of reducing the existing diversity in practice. This pronouncement is effective for fiscal years beginning after December 15, 2017, and interim periods within those fiscal years. The Company is in the process of assessing the impact the adoption of this ASU will have on our consolidated financial statements.

In February 2016, the FASB issued ASU 2016-02, *Leases: (Topic 842)*. ASU 2016-02 requires companies to recognize a lease liability and asset on the balance sheet for operating leases with a term greater than one year. This pronouncement is effective for fiscal years beginning after December 15, 2018, and interim periods within those fiscal years. The Company is in the process of assessing the impact the adoption of this ASU will have on our consolidated financial statements.

In May 2014, the FASB issued ASU 2014-09, *Revenue from Contracts with Customers: (Topic 606)*. This ASU replaces nearly all existing U.S. GAAP guidance on revenue recognition. The standard prescribes a five-step model for recognizing revenue, the application of which will require significant judgment. This standard is effective for fiscal years, and interim periods within those fiscal years, beginning after December 15, 2017. We will adopt the new standard effective January 1, 2018, using the modified retrospective method. We have completed our assessment and review of specific contracts and the assessment will not result in an adjustment to the opening retained earnings balance. We expect the impact of the adoption of the new standard to be immaterial to our net income on an ongoing basis.

No other new accounting pronouncements issued or with effective dates during fiscal 2017 had or are expected to have a material impact of the Company's consolidated financial statement.

3. Discontinued Operations

During 2014, we commenced a process to market for sale our Europe-based Polymer Additives business. We determined that the criteria to classify these assets as held-for-sale under ASC Topic 360, Property, Plant and Equipment, were met at that time. During 2016, the Company completed the disposition of the Europe-based Polymer Additives business to Plahoma Two AG, an affiliate of the LIVIA Group. The Company made a capital contribution of €12 million (approximately \$13.6 million) to its subsidiaries that owned the assets prior to the close of the sale. In 2016, an impairment charge of \$50.9 million was recorded under ASC Topic 360 Property, Plant and Equipment. The charge was calculated as the difference of the executed transaction price and the carrying value of the assets. The impairment charge included \$1.1 million associated with the reclassification of foreign currency translation loss from Accumulated other comprehensive loss. The Europe-based Polymer Additives operating results, net of income tax, are classified as discontinued operations in the accompanying consolidated statements of operations for the years ended December 31, 2016 and 2015.

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The table below summarizes results for the Europe-based Polymer Additives assets, for the years ended December 31, 2016 and 2015, which are reflected in our consolidated statements of operations as discontinued operations. Interest expense has been allocated to the discontinued operations based on the ratio of net assets of each business to consolidated net assets excluding debt.

	<u>2016</u>	<u>2015</u>
Net sales	\$ 18,481	\$ 33,825
Cost of sales	28,473	53,213
Gross loss	(9,992)	(19,388)
Selling, general and administrative expenses	3,094	4,189
Restructuring and impairment charges	50,902	11,792
Interest expense	325	763
Miscellaneous (income) expense, net	(392)	647
Loss from discontinued operations before income taxes	(63,921)	(36,779)
Income tax expense	543	—
Loss from discontinued operations, net of income taxes	\$ (64,464)	\$ (36,779)

4. Acquisitions

Endeka Group

On November 1, 2017, the Company acquired 100% of the equity interests of Endeka Group (“Endeka”), a global producer of high-value coatings and key raw materials for the ceramic tile market, for €72.7 million (approximately \$84.6 million), including the assumption of debt of €13.1 million (approximately \$15.3 million). The Company incurred acquisition costs for the year ended December 31, 2017, of \$2.5 million, which is included in Selling, general and administrative expenses in our consolidated statements of operations. The acquired business contributed net sales of \$19.4 million for the year ended December 31, 2017, and net loss attributable to Ferro Corporation of \$1.7 million for the year ended December 31, 2017.

The information included herein has been prepared based on the preliminary allocation of the purchase price using estimates of the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches, and estimates made by management. As of December 31, 2017, the purchase price allocation is subject to further adjustment until all information is fully evaluated by the Company. The Company preliminarily recorded \$39.8 million of net working capital, \$24.1 million of deferred tax assets, \$21.8 million of personal and real property and \$1.1 million of noncontrolling interest on the consolidated balance sheet.

Gardenia Quimica S.A.

On August 3, 2017, the Company acquired a majority interest in Gardenia Quimica S.A. (“Gardenia”) for \$3.0 million. The Company previously owned 46% of Gardenia and recorded it as an equity method investment. Following this transaction, the Company now owns 83.5% and fully consolidates Gardenia. Due to a change of control that occurred, the Company recorded a gain on purchase of \$2.6 million related to the difference between the Company’s carrying value and fair value of the previously held equity method investment.

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Dip Tech Ltd.

On August 2, 2017, the Company acquired 100% of the equity interests of Dip Tech Ltd. (“Dip-Tech”), a leading provider of digital printing solutions for glass, for \$76.0 million, excluding customary adjustments. Dip-Tech is headquartered in Kfar Saba, Israel. The purchase consideration consisted of cash paid at closing of \$59.1 million, net of the net working capital adjustment, and contingent consideration of \$16.9 million. The Company incurred acquisition costs for the year ended December 31, 2017, of \$3.2 million, which is included in Selling, general and administrative expenses in our consolidated statements of operations. The acquired business contributed net sales of \$18.2 million for the year ended December 31, 2017, and net loss attributable to Ferro Corporation of \$2.2 million for the year ended December 31, 2017. The net loss attributable to Ferro Corporation was driven by the amortization of inventory step up costs of \$1.1 million and acquired intangible asset amortization costs of \$1.6 million for the year ended December 31, 2017. Dip-Tech incurred research and development costs of \$2.6 million for the year ended December 31, 2017.

The information included herein has been prepared based on the preliminary allocation of the purchase price using estimates of the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches, and estimates made by management. As of December 31, 2017, the purchase price allocation is subject to further adjustment until all information is fully evaluated by the Company. The Company preliminarily recorded \$41.2 million of amortizable intangible assets, \$32.5 million of goodwill, \$7.2 million of deferred tax liabilities, \$5.1 million of unamortizable intangible assets, \$3.2 million of personal and real property and \$1.2 million of net working capital on the consolidated balance sheet.

Smalti per Ceramiche, s.r.l

On April 24, 2017, the Company acquired 100% of the equity interests of S.P.C. Group s.r.l., and 100% of the equity interest of Smalti per Ceramiche, s.r.l. (together “SPC”), for €18.7 million (approximately \$20.3 million), including the assumption of debt of €5.7 million (approximately \$6.2 million). SPC is a high-end tile coatings manufacturer based in Italy focused on fast-growing specialty products. SPC’s products, strong technology, design capabilities, and customer-centric business model are complementary to our Performance Coatings segment, and position us for continued growth in the high-end tile markets. The Company incurred acquisition costs for the year ended December 31, 2017, of \$1.5 million which is included in Selling, general and administrative expenses in our consolidated statements of operations.

The information included herein has been prepared based on the preliminary allocation of the purchase price using estimates of the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches, and estimates made by management. As of December 31, 2017, the purchase price allocation is subject to further adjustment until all information is fully evaluated by the Company. The Company preliminarily recorded \$6.1 million of personal and real property, \$6.0 million of amortizable intangible assets, \$5.2 million of goodwill, \$5.0 million of net working capital and \$2.0 million of a deferred tax liability on the consolidated balance sheet.

Cappelle Pigments NV

On December 9, 2016, the Company acquired 100% of the equity interests of Belgium-based Cappelle Pigments NV (“Cappelle”), a leader in specialty, high-performance inorganic and organic pigments used in coatings, inks and plastics, for €49.8 million (approximately \$52.7 million), including the assumption of debt of

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€9.8 million (approximately \$10.4 million). The acquired business contributed net sales of \$71.8 million and net income attributable to Ferro Corporation of \$5.4 million for the year ended December 31, 2017, and net sales of \$2.2 million and net loss attributable to Ferro Corporation of \$1.8 million for the year ended December 31, 2016.

The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$27.7 million of net working capital, \$25.0 million of personal and real property, \$3.8 million of goodwill and \$3.8 million of a deferred tax liability on the consolidated balance sheet.

Electro-Science Laboratories, Inc.

On October 31, 2016, the Company acquired 100% of the equity interests of Electro-Science Laboratories, Inc. (“ESL”), a leader in electronic packaging materials for \$78.5 million. ESL is headquartered in King of Prussia, Pennsylvania. The acquisition of ESL enhances the Company’s position in the electronic packaging materials space with complementary products, and offers a platform for growth in our Performance Colors and Glass segment. ESL produces thick-film pastes and ceramics tape systems that enable important functionality in a wide variety of industrial and consumer applications. The acquired business contributed net sales of \$44.3 million and net income attributable to Ferro Corporation of \$5.1 million for the year ended December 31, 2017, and net sales of \$6.1 million and net income attributable to Ferro Corporation of \$0.5 million for the year ended December 31, 2016. The Company incurred acquisition costs of \$0.3 million for the year ended December 31, 2017 and \$1.9 million for the year ended December 31, 2016, which is included in Selling, general and administrative expenses in our consolidated statements of operations.

The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$39.7 million of intangible assets, \$19.0 million of goodwill, \$18.9 million of net working capital, \$2.9 million of personal and real property and, \$2.0 million of a deferred tax liability on the consolidated balance sheet.

Delta Performance Products, LLC

On August 1, 2016, the Company acquired certain assets of Delta Performance Products, LLC, for a cash purchase price of \$4.4 million. The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$3.2 million of amortizable intangible assets, \$0.6 million of net working capital, \$0.4 million of goodwill and, \$0.2 million of a deferred tax asset on the consolidated balance sheet.

Pinturas Benicarló, S.L.

On June 1, 2016, the Company acquired 100% of the equity interests of privately held Pinturas Benicarló, S.L. (“Pinturas”) for €16.5 million in cash (approximately \$18.4 million). The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets

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acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$8.8 million of amortizable intangible assets, \$7.7 million of net working capital, \$3.9 million of goodwill, \$2.7 million of a deferred tax liability and, \$0.7 million of personal and real property on the consolidated balance sheet.

Ferer Dis Ticaret Ve Kimyasallar Anonim Sirketi A.S.

On January 5, 2016, the Company acquired 100% of the equity interests of privately held Istanbul-based Ferer Dis Ticaret Ve Kimyasallar Anonim Sirketi A.S. (“Ferer”) for \$9.4 million in cash. The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$4.5 million of goodwill, \$3.3 million of amortizable intangible assets, \$1.7 million of net working capital, \$0.7 million of a deferred tax liability, and \$0.6 million of personal and real property on the consolidated balance sheet.

Al Salomi for Frits and Glazes

On November 17, 2015, the Company acquired 100% of the equity interests of Egypt-based tile coatings manufacturer Al Salomi for Frits and Glazes (“Al Salomi”) for Egyptian Pound (“EGP”) 307.0 million (approximately \$38.2 million), including the assumption of debt. The acquired business contributed net sales of \$25.4 million and net income attributable to Ferro Corporation of \$3.7 million for the year ended December 31, 2017, net sales of \$24.4 million and net loss attributable to Ferro Corporation of \$11.8 million for the year ended December 31, 2016, and net sales of \$2.3 million and net loss attributable to Ferro Corporation of \$0.5 million for the year ended December 31, 2015. The net loss attributable to Ferro Corporation for the year ended December 31, 2016 includes an impairment charge of \$13.2 million related to the impairment loss of goodwill.

The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management. The Company recorded \$15.0 million of amortizable intangible assets, \$14.3 million of goodwill, \$10.7 million of personal and real property, \$4.8 million of a deferred tax liability, and \$3.0 million of net working capital on the consolidated balance sheet.

Corporación Química Vhem, S.L., Dibon USA, LLC and Ivory Corporation, S.A.

On July 7, 2015, the Company acquired 100% of the equity interests of Corporación Química Vhem, S.L., Dibon USA, LLC and Ivory Corporation, S.A. (together with their direct and indirect subsidiaries, “Nubiola”) on a cash-free and debt-free basis for €167.0 million (approximately \$184.2 million). The acquisition was funded with excess cash and borrowings under the Company’s existing revolving credit facility. During the second quarter of 2016, the Company finalized a purchase price adjustment for the settlement of an escrow that reduced the fair value of the net assets acquired to \$168.1 million. As a result of the purchase price adjustment, the carrying amount of goodwill decreased \$11.7 million, amortizable intangible assets decreased \$6.4 million and the related deferred tax liability decreased \$1.9 million. The impact of the change on the consolidated statements of operations was not material. Nubiola is a worldwide producer of specialty inorganic pigments and the world’s largest producer of Ultramarine Blue. Nubiola also produces specialty Iron Oxides, Chrome Oxide Greens and Corrosion Inhibitors. Nubiola has production facilities in Spain, Colombia, Romania, and India and a joint venture in China.

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The information included herein has been prepared based on the allocation of the purchase price using the fair value and useful lives of the assets acquired and liabilities assumed, which were determined with the assistance of third parties who performed independent valuations using discounted cash flow and comparative market approaches and estimates made by management.

The following table summarizes the purchase price allocations:

	July 7, 2015
	(Dollars in thousands)
Net working capital ⁽¹⁾	\$ 46,642
Cash and equivalents	19,966
Personal property	39,444
Real property	28,510
Intangible assets	26,757
Other assets and liabilities	(20,733)
Goodwill	27,498
Net assets acquired	\$ 168,084

(1) Net working capital is defined as current assets, less cash, less current liabilities.

The acquired business contributed net sales of \$138.9 million and net income attributable to Ferro Corporation of \$21.8 million for the year ended December 31, 2017, net sales of \$123.2 million and net income attributable to Ferro Corporation of \$24.4 million for the year ended December 31, 2016, and net sales of \$56.9 million and net income attributable to Ferro Corporation of \$0.3 million for the year ended December 31, 2015. The Company incurred acquisition related costs of \$5.4 million for the year ended December 31, 2015, which is recorded within Selling, general and administrative expenses, in our consolidated statements of operations.

The fair value of the receivables acquired was \$24.5 million, with a gross contractual amount of \$25.2 million. The Company recorded acquired intangible assets subject to amortization of \$21.1 million, which was comprised of \$5.4 million of customer relationships and \$15.7 million of technology/know-how, which will be amortized over 20 years and 15 years, respectively. The Company recorded acquired indefinite-lived intangible assets of \$5.6 million related to trade names and trademarks. Goodwill is calculated as the excess of the purchase price over the fair values of the assets acquired and the liabilities assumed in the acquisition and is a result of anticipated synergies. Goodwill is not deductible for tax purposes.

The following unaudited pro forma information represents the consolidated results of the Company as if the Nubiola acquisition occurred as of January 1, 2015:

	2015
	(unaudited)
	(In thousands, except per share amounts)
Net sales	\$ 1,141,200
Net income attributable to Ferro Corporation common shareholders	\$ 69,489
Net earnings per share attributable to Ferro Corporation common shareholders — Basic	\$ 0.80
Net earnings per share attributable to Ferro Corporation common shareholders — Diluted	\$ 0.79

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The unaudited pro forma information has been adjusted with the respect to certain aspects of the acquisition to reflect the following:

- Additional depreciation and amortization expenses that would have been recognized assuming fair value adjustments to the existing Nubiola assets acquired, including intangible assets and fixed assets.
- Elimination of revenue and costs of goods sold for sales from Nubiola to the Company, which would be eliminated as intercompany transactions for Nubiola and the Company on a consolidated basis.
- Increased interest expense due to additional borrowings to fund the acquisition.
- Acquisition-related costs, which were included in the Company's results.
- Adjustments for the income tax effect of the pro forma adjustments related to the acquisition.

TherMark Holdings, Inc.

In February 2015, the Company acquired TherMark Holdings, Inc., a leader in laser marking technology, for a cash purchase price of \$5.5 million. The Company recorded \$4.6 million of amortizable intangible assets, \$2.5 million of goodwill, \$1.7 million of a deferred tax liability, and \$0.1 million of net working capital on our consolidated balance sheet.

5. Inventories

Inventory at December 31 consisted of the following:

	2017	2016
	(Dollars in thousands)	
Raw materials	\$ 112,300	\$ 72,943
Work in process	39,454	38,859
Finished goods	172,426	118,045
Total inventories	\$ 324,180	\$ 229,847

In the production of some of our products, we use precious metals, some of which we obtain from financial institutions under consignment agreements with terms of one year or less. The financial institutions retain ownership of the precious metals and charge us fees based on the amounts we consign. These fees were \$1.2 million for 2017, \$0.8 million for 2016, and \$0.8 million for 2015. We had on hand precious metals owned by participants in our precious metals consignment program of \$37.7 million at December 31, 2017, and \$28.7 million at December 31, 2016, measured at fair value based on market prices for identical assets.

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6. Property, Plant and Equipment

Property, Plant and Equipment at December 31 consisted of the following:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Land	\$ 48,566	\$ 37,136
Buildings	199,076	171,809
Machinery and equipment	548,864	477,376
Construction in progress	28,125	15,063
Total property, plant and equipment	824,631	701,384
Total accumulated depreciation	(502,889)	(439,358)
Property, plant and equipment, net	\$ 321,742	\$ 262,026

Depreciation expense was \$36.9 million for 2017, \$37.9 million for 2016, and \$36.2 million for 2015. Noncash investing activities for capital expenditures, consisting of new capital leases during the year and unpaid capital expenditure liabilities at year end, were \$8.8 million for 2017, \$5.0 million for 2016, and \$6.6 million for 2015.

As discussed in Note 3 — Discontinued Operations, our Europe-based Polymer Additives assets were classified as held-for-sale under ASC Topic 360, Property, Plant and Equipment from 2014 until the ultimate sale of the business in 2016. As such, at each historical reporting date, these assets were tested for impairment comparing the fair value of the assets, less costs to sell, to the carrying value. The fair value at each reporting date was determined using both the market approach and income approach, utilizing Level 3 measurements within the fair value hierarchy, which indicated the fair value, less costs to sell, was less than the carrying value at certain reporting periods. As a result of the respective analyses, the assets had a carrying value that exceeded fair value, resulting in impairment charges totaling \$50.9 million and \$11.8 million that are included in Loss from discontinued operations, net of income taxes, in our consolidated statements of operations for the years ended December 31, 2016 and 2015, respectively.

The following table presents information about the Company's impairment charges on assets that were required to be measured on a fair value basis for the years ended December 31, 2016 and 2015. The table also indicates the level within the fair value hierarchy of the valuation techniques used by the Company to determine the fair value:

<u>Description</u>	<u>Fair Value Measurements Using</u>				<u>Total (Losses)</u>
	<u>Level 1</u>	<u>Level 2</u>	<u>Level 3</u>	<u>Total</u>	
	(Dollars in thousands)				
December 31, 2016	\$ —	\$ —	\$ —	\$ —	\$ (50,902)
December 31, 2015	\$ —	\$ —	\$ 33,711	\$ 33,711	\$ (11,792)

The inputs to the valuation techniques used to measure fair value are classified into the following categories:

Level 1: Quoted market prices in active markets for identical assets or liabilities.

Level 2: Observable market-based inputs or unobservable inputs that are corroborated by market data.

Level 3: Unobservable inputs that are not corroborated by market data.

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During 2016, we recorded a \$3.9 million gain on sale from the sale proceeds of a closed site in Australia which was recorded in Miscellaneous (income) expense, net in our consolidated statements of operations for the year ended December 31, 2016.

7. Goodwill and Other Intangible Assets

Details and activity in the Company's goodwill by segment are as follows:

	<u>Performance Coatings</u>	<u>Color Solutions</u>	<u>Performance Colors and Glass</u>	<u>Total</u>
	(Dollars in thousands)			
Goodwill, net at December 31, 2015	\$ 43,484	\$ 48,794	\$ 53,391	\$ 145,669
Acquisitions	—	(7,756) ^{(1),(2)}	28,332 ⁽³⁾	20,576
Impairments	(13,198)	—	—	(13,198)
Foreign currency adjustments	(2,196)	(617)	(1,938)	(4,751)
Goodwill, net at December 31, 2016	28,090	40,421	79,785	148,296
Acquisitions	5,970 ⁽⁵⁾	328 ⁽⁷⁾	31,616 ^{(4),(6)}	37,914
Foreign currency adjustments	4,176	1,786	3,197	9,159
Goodwill, net at December 31, 2017	\$ 38,236	\$ 42,535	\$ 114,598	\$ 195,369

- (1) During 2016, the Company recorded a purchase price adjustment within the measurement period for goodwill related to the Nubiola acquisition. Refer to Note 4 for additional details.
- (2) During 2016, the Company recorded goodwill related to the Delta Performance Products and Cappelle acquisitions. Refer to Note 4 for additional details.
- (3) During 2016, the Company recorded goodwill related to Ferer, Pinturas and ESL acquisitions. Refer to Note 4 for additional details.
- (4) During 2017, the Company recorded a purchase price adjustment within the measurement period for goodwill related to the ESL acquisition.
- (5) During 2017, the Company recorded goodwill related to the SPC and Gardenia acquisitions. Refer to Note 4 for additional details.
- (6) During 2017, the Company recorded goodwill related to the Dip-Tech acquisition. Refer to Note 4 for additional details.
- (7) During 2017, the Company recorded a purchase price adjustment within the measurement period for goodwill related to the Cappelle acquisition.

	<u>December 31, 2017</u>	<u>December 31, 2016</u>
	(Dollars in thousands)	
Goodwill, gross	\$253,836	\$206,763
Accumulated impairment losses	(58,467)	(58,467)
Goodwill, net	\$195,369	\$148,296

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The significant assumptions and ranges of assumptions we used in our impairment analyses of goodwill follow:

<u>Significant Assumptions</u>	<u>2017</u>	<u>2016</u>
Weighted-average cost of capital	11.0% - 13.5%	10.75% - 13.5%
Residual growth rate	3.0%	3.0%

During the fourth quarter of 2017 and 2016, we performed our annual goodwill impairment testing. The test entailed comparing the fair value of our reporting units to their carrying value as of the measurement date of October 31, 2017, and October 31, 2016, respectively. We performed step 1 of the annual impairment test as defined in ASC Topic 350, Intangibles — Goodwill and Other. During our 2017 assessment, the result of the goodwill impairment test was that there were no indicators of impairment. During our 2016 assessment, an impairment indicator was identified within our Tile Coating Systems reporting unit, a component of our Performance Coatings segment. The impairment indicator was the current, and forecasted, performance of the reporting unit in total. We compared the carrying value against the fair value, and determined that the carrying value exceeded the fair value. As a result, an impairment loss of \$13.2 million has been included in restructuring and impairment charges in the consolidated statement of operations for the year ended December 31, 2016. The Company is not aware of any events or circumstances that occurred between the annual assessment date and December 31, 2017, which would require further testing of goodwill for impairment.

<u>Description</u>	<u>Fair Value Measurements Using</u>				<u>Total (Losses)</u>
	<u>Level 1</u>	<u>Level 2</u>	<u>Level 3</u>	<u>Total</u>	
	(Dollars in thousands)				
December 31, 2016	\$ —	\$ —	\$ —	\$ —	\$ (13,198)

Amortizable intangible assets at December 31 consisted of the following:

	<u>Estimated Economic Life</u>	<u>2017</u>	<u>2016</u>
			(Dollars in thousands)
Gross amortizable intangible assets:			
Patents	10 - 16 years	\$ 5,279	\$ 5,147
Land rights	20 - 40 years	4,947	4,746
Technology/know-how and other	1 - 30 years	131,070	84,837
Customer relationships	10 - 20 years	93,500	80,153
Total gross amortizable intangible assets		234,796	174,883
Accumulated amortization:			
Patents		(5,226)	(4,981)
Land rights		(2,883)	(2,698)
Technology/know-how and other		(45,214)	(34,775)
Customer relationships		(11,114)	(5,311)
Total accumulated amortization		(64,437)	(47,765)
Amortizable intangible assets, net		\$ 170,359	\$ 127,118

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We amortize amortizable intangible assets on a straight-line basis over the estimated useful lives of the assets. Amortization expense related to amortizable intangible assets was \$13.1 million for 2017, \$8.9 million for 2016, and \$4.9 million for 2015. Amortization expense for amortizable intangible assets is expected to be approximately \$16.6 million for 2018, \$16.1 million for 2019, \$14.8 million for 2020, \$13.4 million for 2021, and \$13.2 million for 2022.

Indefinite-lived intangible assets at December 31 consisted of the following:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Indefinite-lived intangibles assets:		
Trade names and trademarks	\$17,257	\$10,732

8. Debt and Other Financing

Loans payable and current portion of long-term debt at December 31 consisted of the following:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Loans payable	\$ 16,360	\$ 11,452
Current portion of long-term debt	8,776	5,858
Loans payable and current portion of long-term debt	\$ 25,136	\$ 17,310

Long-term debt at December 31 consisted of the following:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Revolving credit facility, maturing 2019	\$ —	\$ 311,555
Revolving credit facility, maturing 2022	78,000	—
Term loan facility, net of unamortized issuance costs, maturing 2021 ⁽¹⁾	—	239,530
Term loan facility, net of unamortized issuance costs, maturing 2024 ⁽²⁾	645,242	—
Capital lease obligations	4,913	3,720
Other notes	7,112	8,228
Total long-term debt	735,267	563,033
Current portion of long-term debt	(8,776)	(5,858)
Long-term debt, less current portion	\$ 726,491	\$ 557,175

(1) The carrying value of the term loan facility, maturing 2021, was net of unamortized debt issuance costs of \$3.7 million.

(2) The carrying value of the term loan facility, maturing 2024, is net of unamortized debt issuance costs of \$7.5 million.

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The annual maturities of long-term debt for each of the five years after December 31, 2017, are as follows (in thousands):

2018	\$ 9,109
2019	8,349
2020	7,736
2021	7,490
2022	86,440
Thereafter	624,728
<hr/>	
Total maturities of long-term debt	743,852
Unamortized issuance costs on Term loan facility	(7,451)
Imputed interest and executory costs on capitalized lease obligations	(1,134)
<hr/>	
Total long-term debt	\$ 735,267

2017 Credit Facility

On February 14, 2017, the Company entered into a new credit facility (the “Credit Facility”) with a group of lenders to refinance its then outstanding credit facility debt and to provide liquidity for ongoing working capital requirements and general corporate purposes.

The Credit Facility consists of a \$400 million secured revolving line of credit with a term of five years, a \$357.5 million secured term loan facility with a term of seven years and a €250 million secured Euro term loan facility with a term of seven years. The term loans are payable in equal quarterly installments in an amount equal to 0.25% of the original principal amount of the term loans, with the remaining balance due on the maturity date thereof. In addition, the Company is required, on an annual basis, to make a prepayment of term loans until they are fully paid and then to the revolving loans in an amount equal to a portion of the Company’s excess cash flow, as calculated pursuant to the Credit Facility.

Subject to the satisfaction of certain conditions, the Company can request additional commitments under the revolving line of credit or term loans in the aggregate principal amount of up to \$250 million, to the extent that existing or new lenders agree to provide such additional commitments and/or term loans. The Company can also raise certain additional debt or credit facilities subject to satisfaction of certain covenant levels.

Certain of the Company’s U.S. subsidiaries have guaranteed the Company’s obligations under the Credit Facility and such obligations are secured by (a) substantially all of the personal property of the Company and the U.S. subsidiary guarantors and (b) a pledge of 100% of the stock of certain of the Company’s U.S. subsidiaries and 65% of the stock of certain of the Company’s direct foreign subsidiaries.

Interest Rate – Term Loans: The interest rates applicable to the U.S. term loans will be, at the Company’s option, equal to either a base rate or a LIBOR rate plus, in both cases, an applicable margin. The interest rates applicable to the Euro term loans will be a Euro Interbank Offered Rate (“EURIBOR”) rate plus an applicable margin.

- The base rate for U.S. term loans will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent’s prime rate or (iii) the daily LIBOR rate plus 1.00%. The applicable margin for base rate loans is 1.50%.

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- The LIBOR rate for U.S. term loans shall not be less than 0.75% and the applicable margin for LIBOR rate U.S. term loans is 2.50%.
- The EURIBOR rate for Euro term loans shall not be less than 0% and the applicable margin for EURIBOR rate loans is 2.75%.
- For LIBOR rate term loans and EURIBOR rate term loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate or EURIBOR rate, as applicable, for the corresponding duration.

At December 31, 2017, the Company had borrowed \$354.8 million under the secured term loan facility at an interest rate of 4.07% and €248.1 million (approximately \$297.9 million) under the secured Euro term loan facility at an interest rate of 2.75%. At December 31, 2017, there were no additional borrowings available under the term loan facilities. We entered into interest rate swap agreements in the second quarter of 2017. These swaps converted \$150 million and €90 million of our term loans from variable interest rates to fixed interest rates. At December 31, 2017, the effective interest rate for the term loan facilities after adjusting for the interest rate swap was 4.27% for the secured term loan facility and 3.00% for the Euro term loan facility.

Interest Rate – Revolving Credit Line: The interest rates applicable to loans under the revolving credit line will be, at the Company's option, equal to either a base rate or a LIBOR rate plus, in both cases, an applicable variable margin. The variable margin will be based on the ratio of (a) the Company's total consolidated net debt outstanding at such time to (b) the Company's consolidated EBITDA computed for the period of four consecutive fiscal quarters most recently ended.

- The base rate for revolving loans will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent's prime rate or (iii) the daily LIBOR rate plus 1.00%. The applicable margin for base rate loans will vary between 0.75% and 1.75%.
- The LIBOR rate for revolving loans shall not be less than 0% and the applicable margin for LIBOR rate revolving loans will vary between 1.75% and 2.75%.
- For LIBOR rate revolving loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate for the corresponding duration.

At December 31, 2017, there were \$78.0 million borrowings under the revolving credit line at an interest rate of 3.63%. After reductions for outstanding letters of credit secured by these facilities, we had \$317.3 million of additional borrowings available under the revolving credit facilities at December 31, 2017.

The Credit Facility contains customary restrictive covenants including, but not limited to, limitations on use of loan proceeds, limitations on the Company's ability to pay dividends and repurchase stock, limitations on acquisitions and dispositions, and limitations on certain types of investments. The Credit Facility also contains standard provisions relating to conditions of borrowing and customary events of default, including the non-payment of obligations by the Company and the bankruptcy of the Company.

Specific to the revolving credit facility, the Company is subject to a financial covenant regarding the Company's maximum leverage ratio. If an event of default occurs, all amounts outstanding under the Credit Facility may be accelerated and become immediately due and payable. At December 31, 2017, we were in compliance with the covenants of the Credit Facility.

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2014 Credit Facility

On July 31, 2014, the Company entered into a credit facility (the “2014 Credit Facility”) with a group of lenders to refinance the majority of its then outstanding debt. The 2014 Credit Facility consisted of a \$200 million secured revolving line of credit with a term of five years and a \$300 million secured term loan facility with a term of seven years. On January 25, 2016, the Company amended the Credit Facility by entering into the Incremental Assumption Agreement (the “Incremental Agreement”) to increase the revolving line of credit commitment amount from \$200 million to \$300 million. The Company then used a portion of the increase in the revolving line of credit to repay \$50 million of the term loan facility. The 2014 Credit Facility was amended and a portion of the outstanding term loan was repaid to increase the amount of total liquidity available under the 2014 Credit Facility and reduce the total cost of borrowings. On August 29, 2016, the Company amended the 2014 Credit Facility by entering into the Second Incremental Assumption Agreement (the “Second Incremental Agreement”) to increase the revolving line of credit commitment amount to \$400 million.

Principal payments on the term loan facility of \$0.75 million quarterly, are payable commencing December 31, 2014, with the remaining balance due on the maturity date. At December 31, 2016, after taking into account all prior quarterly payments and the \$50 million prepayment that was made in January 2016, the Company had borrowed \$243.3 million under the term loan facility at an annual rate of 4.0%. There are no additional borrowings available under the term loan facility.

Certain of the Company’s U.S. subsidiaries have guaranteed the Company’s obligations under the Credit Facility and such obligations are secured by (a) substantially all of the personal property of the Company and the U.S. subsidiary guarantors and (b) a pledge of 100% of the stock of most of the Company’s U.S. subsidiaries and 65% of most of the stock of the Company’s first tier foreign subsidiaries.

Interest Rate – Term Loan: The interest rates applicable to the term loans will be, at the Company’s option, equal to either a base rate or a London Interbank Offered Rate (“LIBOR”) rate plus, in both cases, an applicable margin.

- The base rate will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent’s prime rate or (iii) the daily LIBOR rate plus 1.00%.
- The applicable margin for base rate loans is 2.25%.
- The LIBOR rate will be set as quoted by Bloomberg and shall not be less than 0.75%.
- The applicable margin for LIBOR rate loans is 3.25%.
- For LIBOR rate loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate for the corresponding duration.

Interest Rate – Revolving Credit Line: The interest rates applicable to loans under the revolving credit line will be, at the Company’s option, equal to either a base rate or a LIBOR rate plus an applicable variable margin. The variable margin will be based on the ratio of (a) the Company’s total consolidated debt outstanding at such time to (b) the Company’s consolidated EBITDA computed for the period of four consecutive fiscal quarters most recently ended.

- The base rate will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent’s prime rate or (iii) the daily LIBOR rate plus 1.00%.
- The applicable margin for base rate loans will vary between 1.50% and 2.00%.

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- The LIBOR rate will be set as quoted by Bloomberg for U.S. Dollars.
- The applicable margin for LIBOR Rate Loans will vary between 2.50% and 3.00%.
- For LIBOR rate loans, the Company may choose to set the duration on individual borrowings for periods of one, two, three or six months, with the interest rate based on the applicable LIBOR rate for the corresponding duration.

At December 31, 2016, the Company had borrowed \$311.6 million under the revolving credit facilities at a weighted average interest rate of 3.5%. After reductions for outstanding letters of credit secured by these facilities, we had \$84.1 million of additional borrowings available under the revolving credit facilities at December 31, 2016.

In conjunction with the refinancing of the 2014 Credit Facility, we recorded a charge of \$3.9 million in connection with the write-off of unamortized issuance costs, which is recorded within Loss on extinguishment of debt in our consolidated statement of operations for the year ended December 31, 2017.

Other Financing Arrangements

We maintain other lines of credit to provide global flexibility for Ferro's short-term liquidity requirements. These facilities are uncommitted lines for our international operations and totaled \$64.5 million at December 31, 2017, and \$7.3 million at December 31, 2016. The unused portions of these lines provided additional liquidity of \$39.4 million at December 31, 2017, and \$6.7 million at December 31, 2016.

9. Financial Instruments

The following table presents financial instrument assets (liabilities) at the carrying amount, fair value and classification within the fair value hierarchy:

	December 31, 2017				
	Carrying Amount	Fair Value			
		Total	Level 1	Level 2	Level 3
	(Dollars in thousands)				
Cash and cash equivalents	\$ 63,551	\$ 63,551	\$ 63,551	\$ —	\$ —
Loans payable	(16,360)	(16,360)	—	(16,360)	—
Revolving credit facility, maturing 2022	(78,000)	(79,295)	—	(79,295)	—
Term loan facility, maturing 2024 ⁽¹⁾	(645,242)	(646,979)	—	(646,979)	—
Other long-term notes payable	(7,112)	(3,973)	—	(3,973)	—
Interest rate swaps — asset	1,616	1,616	—	1,616	—
Interest rate swaps — liability	(124)	(124)	—	(124)	—
Foreign currency forward contracts, net	(469)	(469)	—	(469)	—

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	December 31, 2016				
	Carrying Amount	Fair Value			
		Total	Level 1	Level 2	Level 3
	(Dollars in thousands)				
Cash and cash equivalents	\$ 45,582	\$ 45,582	\$ 45,582	\$ —	\$ —
Loans payable	(11,452)	(11,452)	—	(11,452)	—
Revolving credit facility, maturing 2019	(311,555)	(318,389)	—	(318,389)	—
Term loan facility, maturing 2021 ⁽¹⁾	(239,530)	(252,052)	—	(252,052)	—
Other long-term notes payable	(8,228)	(7,315)	—	(7,315)	—
Foreign currency forward contracts, net	350	350	—	350	—

(1) The carrying values of the term loan facilities are net of unamortized debt issuance costs of \$7.5 million and \$3.7 million for the period ended December 31, 2017, and December 31, 2016, respectively.

The fair values of cash and cash equivalents are based on the fair values of identical assets. The fair values of loans payable are based on the present value of expected future cash flows and approximate their carrying amounts due to the short periods to maturity. At December 31, 2017, the fair value of the term loan facility is based on market price information and is measured using the last available bid price of the instrument on a secondary market and at December 31, 2016, is based on the present value of expected future cash flows and interest rates that would be currently available to the Company for issuance of similar types of debt instruments with similar terms and remaining maturities adjusted for the Company's performance risk. The revolving credit facility and other long-term notes payable are based on the present value of expected future cash flows and interest rates that would be currently available to the Company for issuance of similar types of debt instruments with similar terms and remaining maturities adjusted for the Company's performance risk. The fair values of our interest rate swaps are determined based on inputs that are readily available in public markets or can be derived from information available in publicly quoted markets. The fair values of the foreign currency forward contracts are based on market prices for comparable contracts.

Derivative Instruments

The Company may use derivative instruments to mitigate its business exposure to foreign currency and interest rate risk on expected future cash flows, on net investment in certain foreign subsidiaries and on certain existing assets and liabilities. However, the Company may choose not to hedge in countries where it is not economically feasible to enter into hedging arrangements or where hedging inefficiencies exist, such as timing of transactions.

Derivatives Designated as Hedging Instruments

Interest rate swaps. To reduce our exposure to interest rate changes on our variable-rate debt, we entered into interest rate swap agreements in the second quarter of 2017. These swaps converted \$150 million and €90 million of our term loans from variable interest rates to fixed interest rates. These swaps qualify and were designated as cash flow hedges. The effective portions of cash flow hedges are recorded in accumulated other comprehensive loss ("AOCL") and are reclassified into earnings in the same period the underlying hedged items impact earnings. The ineffective portions of cash flow hedges is recognized immediately into earnings. The Company did not have any ineffectiveness related to the interest rate swaps during the year ended December 31, 2017.

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The amount of gain recognized in AOCL at December 31, 2017 and the amount of loss reclassified into earnings for the year ended December 31, 2017, follow:

	Amount of Gain Recognized in AOCL — Effective Portion	Amount of Loss Reclassified from AOCL into Income — Effective Portion
	2017	2017
	(Dollars in thousands)	
Interest rate swap	\$ 1,492	\$ (527)

Net investment hedge. To help protect the value of the Company's net investment in European operations against adverse changes in exchange rates, the Company uses non-derivative financial instruments, such as its foreign currency denominated debt, as economic hedges of its net investments in certain foreign subsidiaries. Net investment hedges that use foreign currency denominated debt to hedge net investments are not impacted by ASC Topic 820, *Fair Value Measurements*, as the debt used as a hedging instrument is marked to a value with respect to changes in spot foreign currency exchange rates and not with respect to other factors that may impact fair value. The effective portions of net investment hedges are recorded in AOCL as a part of the cumulative translation adjustment. The ineffective portions of net investment hedges are recognized immediately into earnings.

Effective May 1, 2017, the Company designated a portion of its Euro denominated debt as a net investment hedge for accounting purposes. The fair value of the net investment hedge is €31.0 million at December 31, 2017. The Company did not have any ineffectiveness related to net investment hedges during the year ended December 31, 2017.

The amount of loss recognized in AOCL at December 31, 2017 and the amount of loss reclassified into earnings for the year ended December 31, 2017, follow:

	Amount of Loss Recognized in AOCL — Effective Portion	Amount of Loss Reclassified from AOCL into Income — Effective Portion
	2017	2017
	(Dollars in thousands)	
Net investment hedge	\$ (10,972)	\$ —

Derivatives Not Designated as Hedging Instruments

Foreign currency forward contracts. We manage foreign currency risks principally by entering into forward contracts to mitigate the impact of currency fluctuations on transactions. These forward contracts are not formally designated as hedges. Gains and losses on these foreign currency forward contracts are netted with gains and losses from currency fluctuations on transactions arising from international trade, primarily intercompany transactions, and reported as Foreign currency losses, net in the consolidated statements of operations. We incurred net losses of \$2.9 million in 2017, net losses of \$2.7 million in 2016 and net gains of \$8.3 million in 2015, arising from the change in fair value of our financial instruments, which are netted against the related net gains and losses on international trade transactions. The fair values of these contracts are based on market prices for comparable contracts. The notional amount of foreign currency forward contracts was \$238.5 million at December 31, 2017, and \$338.2 million at December 31, 2016.

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The following table presents the effect on our consolidated statements of operations for the years ended December 31, 2017, 2016 and 2015, respectively, of foreign currency forward contracts:

	Amount of (Loss) Gain Recognized in Earnings			Location of (Loss) Gain in Earnings
	2017	2016	2015	
	(Dollars in thousands)			
Foreign currency forward contracts	\$ (2,938)	\$ (2,714)	\$ 8,304	Foreign currency losses, net

Location and Fair Value Amount of Derivative Instruments

The following table presents the fair values on our consolidated balance sheets at December 31 of derivative instruments:

	2017	2016	Balance Sheet Location
	(Dollars in thousands)		
Asset derivatives:			
Interest rate swaps	\$ 1,616	\$ —	Other non-current assets
Foreign currency forward contracts	661	1,854	Other current assets
Liability derivatives:			
Interest rate swaps	(124)	—	Accrued expenses and other current liabilities
Foreign currency forward contracts	\$ (1,130)	\$ (1,504)	Accrued expenses and other current liabilities

10. Income Taxes

Income tax expense (benefit) is based on our earnings from continuing operations before income taxes as presented in the following table:

	2017	2016	2015
	(Dollars in thousands)		
U.S.	\$ 9,857	\$ 7,416	\$ 10,520
Foreign	100,661	55,029	44,263
Total	\$ 110,518	\$ 62,445	\$ 54,783

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Our income tax expense (benefit) from continuing operations consists of the following components:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Current:			
U.S. federal	\$ (82)	\$ 4,616	\$ 146
Foreign	29,289	24,675	21,041
State and local	53	28	41
Total current	29,260	29,319	21,228
Deferred:			
U.S. federal	24,534	379	(56,521)
Foreign	(1,064)	(11,830)	(3,764)
State and local	20	—	(6,043)
Total deferred	23,490	(11,451)	(66,328)
Total income tax expense (benefit)	\$ 52,750	\$ 17,868	\$ (45,100)

In addition, income tax (benefit) expense that we allocated directly to Ferro Corporation shareholders' equity is detailed in the following table:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Interest rate swaps	\$ 547	\$ —	\$ —
Postretirement benefit liability adjustments	18	30	32
Net investment hedge	(4,025)	—	—
Stock options exercised	—	(2,355)	—
Total income tax (benefit) expense allocated to Ferro Corporation shareholders' equity	\$ (3,460)	\$ (2,325)	\$ 32

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A reconciliation of the U.S. federal statutory income tax rate and our effective tax rate follows:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
U.S. federal statutory income tax rate	35.0%	35.0%	35.0%
U.S. tax rate change due to the Tax Act	19.5	—	—
Uncertain tax positions	5.1	1.7	4.3
Non-deductible expenses	2.4	3.4	3.0
U.S. tax costs of foreign dividends	0.3	0.6	1.7
State taxes	(0.1)	(0.7)	0.6
Adjustment of valuation allowances	(0.3)	(7.4)	(118.4)
Tax rate changes	(0.5)	(0.7)	3.4
Notional interest deduction	(0.5)	(2.8)	(2.8)
Net adjustment of prior-year accrual, including tax audit settlements	(0.5)	1.5	0.2
Foreign currency	(0.6)	(1.6)	2.3
Domestic production activities deduction	(0.6)	(0.2)	—
Other tax credits	(1.1)	(2.9)	(2.3)
Miscellaneous	(1.3)	3.2	1.7
Goodwill dispositions and impairments	(1.8)	8.3	(0.2)
Foreign tax rate difference	(7.3)	(8.8)	(6.9)
Foreign substitute tax payment	—	—	(3.9)
Effective tax rate	<u>47.7%</u>	<u>28.6%</u>	<u>(82.3)%</u>

On December 22, 2017, U.S. federal tax legislation, commonly referred to as the Tax Cut and Jobs Act (the “Tax Act”), was signed into law, significantly changing the U.S. corporate income tax system. These changes include a federal statutory rate reduction from 35% to 21% effective January 1, 2018. Changes in tax rates and tax law are accounted for in the period of enactment. Accordingly, the Company’s net deferred tax assets were re-measured to reflect the reduction in the federal statutory rate, resulting in a \$21.5 million increase in income tax expense for the year ended December 31, 2017. The Tax Act also changed the U.S. taxation of worldwide income. Accordingly, we have assessed the one-time mandatory deemed repatriation tax on accumulated foreign subsidiaries’ previously untaxed foreign earnings and profits and have preliminarily determined no tax is due.

Additional provisions of the Tax Act which may have an impact to the Company include, but are not limited to, the repeal of the domestic production deduction, limitations on interest expense, accelerated depreciation that will allow for full expensing of qualified property, provisions related to performance-based executive compensation and international provisions, which generally establish a territorial-style system for taxing foreign-source income of domestic multinational corporations.

We have recognized the provisional tax impacts related to the Tax Act under the guidance of SEC Staff Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act (“SAB 118”). The ultimate impact may differ from these provisional amounts due to additional analysis, changes in interpretations and assumptions, additional regulatory guidance that may be issued, and actions we may take as a result of the Tax Act. Pursuant to SAB 118, adjustments to the provisional amounts recorded by the Company as of December 31, 2017, that are identified within a subsequent measurement period of up to one year from the

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enactment date will be included as an adjustment to income tax expense in the period the amounts are determined.

We have refundable income taxes of \$6.9 million at December 31, 2017, and \$9.2 million at December 31, 2016, classified as Other receivables on our consolidated balance sheets. We also have income taxes payable of \$8.3 million at December 31, 2017, and \$15.8 million at December 31, 2016, classified as Accrued expenses and other current liabilities on our consolidated balance sheets.

The components of deferred tax assets and liabilities at December 31 were:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Deferred tax assets:		
Foreign operating loss carryforwards	\$ 44,804	\$ 30,352
Pension and other benefit programs	36,720	51,189
U.S foreign tax credit carryforwards	20,054	19,753
Accrued liabilities	14,625	20,942
Other credit carryforwards	10,889	11,277
Currency differences	7,376	3,138
Other	5,823	5,643
State and local operating loss carryforwards	4,808	3,975
Inventories	2,679	1,962
Allowance for doubtful accounts	1,822	1,744
Total deferred tax assets	149,600	149,975
Deferred tax liabilities:		
Property, plant and equipment and intangibles — depreciation and amortization	38,785	28,418
Other	2,339	3,091
Unremitted earnings of foreign subsidiaries	1,163	779
Total deferred tax liabilities	42,287	32,288
Net deferred tax assets before valuation allowance	107,313	117,687
Valuation allowance	(32,579)	(37,354)
Net deferred tax assets	\$ 74,734	\$ 80,333

The amounts of foreign operating loss carryforwards, foreign tax credit carryforwards, and other credit carryforwards included in the table of temporary differences are net of reserves for unrecognized tax benefits.

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At December 31, 2017, we had \$2.6 million of tax benefits from domestic operating loss carryforwards and \$49.3 million from foreign operating loss carryforwards, some of which can be carried forward indefinitely and others that expire in one to twenty years. At December 31, 2017, we had \$35.4 million of tax benefits from tax credit carryforwards, some of which can be carried forward indefinitely. These operating loss carryforwards and tax credit carryforwards expire as follows:

	Operating Loss Carryforwards	Tax Credit Carryforwards
	(Dollars in thousands)	
Expiring in:		
2018	\$ 809	\$ —
2019-2023	9,765	16,103
2024-2028	2,513	11,666
2029-2033	2,794	5,403
2034-2038	123	1,566
2039-Indefinitely	35,859	684
Total	\$ 51,863	\$ 35,422

We assess the available positive and negative evidence to determine if sufficient future taxable income will be generated to utilize the existing deferred tax assets. A significant piece of objective negative evidence evaluated by jurisdiction was whether a cumulative loss over the three-year period ended December 31, 2017 had been incurred. Such objective evidence limits the ability to consider other subjective evidence such as our projections for future income.

Based on this assessment, the Company has recorded a valuation allowance of \$32.6 million in order to measure only the portion of the deferred tax assets that more likely than not will be realized. The lower valuation allowance from 2016 to 2017 primarily related to the removal of a valuation allowance in a jurisdictions where it was deemed the valuation allowance was no longer necessary and the expiration of assets with an off-setting valuation allowance.

We classified net deferred income tax assets as of December 31 as detailed in the following table:

	2017	2016
	(Dollars in thousands)	
Non-current assets	\$ 108,025	\$ 106,454
Non-current liabilities	(33,291)	(26,121)
Net deferred tax assets	\$ 74,734	\$ 80,333

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Activity and balances of unrecognized tax benefits are summarized below:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Balance at beginning of year	\$ 30,085	\$ 34,541	\$ 36,879
Additions for tax positions of prior years	2,057	170	4,136
Foreign currency adjustments	1,644	(526)	(1,744)
Additions based on tax positions related to the current year	1,609	1,445	2,664
Reductions for tax positions of prior years	(288)	(2,827)	(1,135)
Settlements with taxing authorities	(353)	—	—
Reductions as a results of expiring statutes of limitations	(6,284)	(2,718)	(6,259)
Balance at end of year	\$ 28,470	\$ 30,085	\$ 34,541

The total amount of unrecognized tax benefits that, if recognized, would affect the effective rate was \$9.8 million at December 31, 2017, and \$11.0 million at December 31, 2016. The Company recognizes interest and penalties related to unrecognized tax benefits as part of income tax expense. The Company recognized \$0.7 million of expense in 2017, \$0.1 million of expense in 2016, and \$0.6 million of expense in 2015 for interest, net of tax, and penalties. The Company accrued \$3.8 million at December 31, 2017, and \$3.1 million at December 31, 2016, for payment of interest, net of tax, and penalties.

We anticipate that \$1.0 million of liabilities for unrecognized tax benefits, including accrued interest and penalties, may be reversed within the next 12 months. These liabilities relate to international tax issues and are expected to reverse due to the expiration of the applicable statute of limitations periods and the anticipation of the closure of tax examinations.

The Company conducts business globally, and, as a result, the U.S. parent company or one of its subsidiaries files income tax returns in the U.S. federal jurisdiction and various state and foreign jurisdictions. In the normal course of business, the U.S. parent company and its subsidiaries are subject to examination by taxing authorities throughout the world. With few exceptions, we are not subject to federal, state, local or non-U.S. income tax examinations for years before 2005.

At December 31, 2017, we provided \$1.2 million for deferred income taxes on \$8.6 million of undistributed earnings of foreign subsidiaries. We have not provided deferred income taxes on undistributed earnings of all our foreign subsidiaries since we intend to indefinitely reinvest the earnings and it is not practicable to estimate the additional taxes that might be payable on the eventual remittance of such earnings.

11. Contingent Liabilities

The Company had bank guarantees and standby letters of credit issued by financial institutions that totaled \$7.7 million at December 31, 2017, and \$6.4 million at December 31, 2016. These agreements primarily relate to Ferro's insurance programs, foreign energy purchase contracts and foreign tax payments. If the Company fails to perform its obligations, the guarantees and letters of credit may be drawn down by their holders, and we would be liable to the financial institutions for the amounts drawn.

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We have recorded environmental liabilities of \$6.7 million at December 31, 2017, and \$7.2 million at December 31, 2016, for costs associated with the remediation of certain of our properties that have been contaminated. The balance at December 31, 2017, and December 31, 2016, was primarily comprised of liabilities related to a non-operating facility in Brazil, and for retained environmental obligations related to a site in the United States that was part of the sale of our North American and Asian metal powders product lines in 2013. The costs include legal and consulting fees, site studies, the design and implementation of remediation plans, post-remediation monitoring, and related activities. The ultimate liability could be affected by numerous uncertainties, including the extent of contamination found, the required period of monitoring and the ultimate cost of required remediation.

In 2013, the Supreme Court in Argentina ruled unfavorably related to certain export taxes associated with a divested operation. As a result of this ruling, we recorded a liability for \$8.7 million at December 31, 2016. During 2017, the Company participated in a newly available tax regime, resulting in the reduction of interest on these outstanding tax liabilities of \$4.5 million. The liability recorded at December 31, 2017, is \$3.3 million.

There are various lawsuits and claims pending against the Company and its consolidated subsidiaries. We do not currently expect the ultimate liabilities, if any, and expenses related to such lawsuits and claims to materially affect the consolidated financial position, results of operations, or cash flows of the Company.

12. Retirement Benefits

Defined Benefit Pension Plans

	U.S. Pension Plans			Non-U.S. Plans		
	2017	2016	2015	2017	2016	2015
	(Dollars in thousands)					
Service cost	\$ 11	\$ 16	\$ 17	\$ 1,717	\$ 1,372	\$ 1,478
Interest cost	14,594	15,552	18,718	2,468	3,319	3,560
Expected return on plan assets	(20,111)	(19,735)	(29,168)	(896)	(1,712)	(2,623)
Amortization of prior service cost	7	11	12	42	37	259
Mark-to-market actuarial net (gains) losses	(5,432)	9,127	18,807	(1,459)	11,180	5,085
Curtailement and settlement effects losses (gains)	2,581	—	(12,640)	39	688	35
Special termination benefits	—	—	—	52	330	35
Net periodic benefit (credit) cost	\$ (8,350)	\$ 4,971	\$ (4,254)	\$ 1,963	\$ 15,214	\$ 7,829

Weighted-average assumptions:

Discount rate	4.40%	4.70%	4.25%	2.24%	3.12%	2.72%
Rate of compensation increase	N/A	N/A	N/A	3.14%	3.16%	3.28%
Expected return on plan assets	8.20%	8.20%	8.20%	2.54%	3.41%	3.50%

For the majority of our U.S. defined benefit pension plans, the participants stopped accruing benefit service costs after March 31, 2006, except for one plan with a single employee.

In 2017, the mark-to-market actuarial net gain on the U.S. pension plans of \$5.4 million was based on \$20.8 million of gain from actual returns on plan assets exceeding expected returns on plan assets, partially offset

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by a loss on remeasurement of the liability from a lower discount rate compared with the prior year. The mark-to-market actuarial net gain of \$1.5 million for non-U.S. plans was primarily driven by remeasurement of the respective liabilities at a higher discount rate.

In 2016, the mark-to-market actuarial net loss on the U.S. pension plans of \$9.1 million consisted of a charge of \$5.7 million to remeasure the liability based on a lower discount rate compared with the prior year, and \$3.4 million of loss from expected returns on plan assets exceeding actual returns. The mark-to-market actuarial net loss of \$11.2 million for non-U.S. plans was primarily driven by remeasurement of the respective liabilities at lower discount rates.

In 2015, the mark-to-market actuarial net loss on the U.S. pension plans of \$18.8 million primarily consisted of \$20.8 million of loss from expected returns on plan assets exceeding actual returns, partially offset by an increase in the discount rate compared with the prior year. The mark-to-market actuarial net loss of \$5.1 million for non-U.S. plans primarily consisted of \$11.0 million of loss from expected returns on plan assets exceeding actual returns, partially offset by an increase in the discount rate. In 2015, the Company initiated and executed on a buyout of terminated vested participants in our U.S. defined benefit pension plan. In October 2015, the buyout was funded and reduced plan assets and liability by \$71 million and resulted in a settlement gain of \$12.6 million.

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	U.S. Pension Plans		Non-U.S. Pension Plans	
	2017	2016	2017	2016
	(Dollars in thousands)			
Change in benefit obligation				
Benefit obligation at beginning of year	\$ 345,202	\$ 346,951	\$ 103,490	\$ 123,764
Service cost	11	16	1,717	1,372
Interest cost	14,594	15,552	2,468	3,319
Settlements	(51,124)	(144)	(387)	(34,528)
Special termination benefits	—	—	52	330
Plan participants' contributions	—	—	25	54
Benefits paid	(23,469)	(22,918)	(2,826)	(3,195)
Net transfer in	—	—	416	—
Actuarial loss (gain)	17,956	5,745	(1,381)	20,490
Exchange rate effect	—	—	13,572	(8,116)
Benefit obligation at end of year	\$ 303,170	\$ 345,202	\$ 117,146	\$ 103,490
Accumulated benefit obligation at end of year	\$ 303,170	\$ 345,202	\$ 112,732	\$ 93,401
Change in plan assets:				
Fair value of plan assets at beginning of year	\$ 272,549	\$ 278,735	\$ 33,683	\$ 63,649
Actual return on plan assets	40,919	16,354	933	10,977
Employer contributions	385	522	2,515	3,060
Plan participants' contributions	—	—	25	54
Benefits paid	(23,469)	(22,918)	(2,826)	(3,195)
Effect of settlements	(51,124)	(144)	(387)	(34,746)
Exchange rate effect	—	—	4,327	(6,116)
Fair value of plan assets at end of year	\$ 239,260	\$ 272,549	\$ 38,270	\$ 33,683
Amounts recognized in the balance sheet:				
Other non-current assets	\$ —	\$ —	\$ —	\$ 484
Accrued expenses and other current liabilities	(422)	(579)	(2,354)	(2,070)
Postretirement and pension liabilities	(63,488)	(72,074)	(76,522)	(68,221)
Funded status	\$ (63,910)	\$ (72,653)	\$ (78,876)	\$ (69,807)

During 2017, the Company settled a portion of its pension obligation in the U.S. for \$51.1 million. During 2016, the Company settled a pension obligation in Great Britain for \$32.2 million.

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	U.S. Pension Plans		Non-U.S. Pension Plans	
	2017	2016	2017	2016
	(Dollars in thousands)			
Weighted-average assumptions as of December 31:				
Discount rate	3.80%	4.40%	2.35%	2.24%
Rate of compensation increase	N/A	N/A	3.18%	3.14%
Pension plans with benefit obligations in excess of plan assets:				
Benefit obligations	\$ 303,170	\$ 345,202	\$ 87,990	\$ 73,903
Plan assets	239,260	272,549	9,114	3,612
Pension plans with accumulated benefit obligations in excess of plan assets:				
Projected benefit obligations	\$ 303,170	\$ 345,202	\$ 84,206	\$ 73,393
Accumulated benefit obligations	303,170	345,202	73,902	63,538
Plan assets	239,260	272,549	5,464	3,179

Activity and balances in Accumulated other comprehensive loss related to defined benefit pension plans are summarized below:

	U.S. Pension Plans		Non-U.S. Pension Plans	
	2017	2016	2017	2016
	(Dollars in thousands)			
Prior service (cost):				
Balance at beginning of year	\$ (7)	\$ (18)	\$ (265)	\$ (425)
Amounts recognized as net periodic benefit costs	7	11	42	37
Exchange rate effects	—	—	(38)	123
Balance at end of year	\$ —	\$ (7)	\$ (261)	\$ (265)
Estimated amounts to be amortized in 2018	\$ —		\$ (41)	

The overall investment objective for our defined benefit pension plan assets is to achieve the highest level of investment return that is compatible with prudent investment practices, asset class risk and current and future benefit obligations of the plans. Based on the potential risks and expected returns of various asset classes, the Company establishes asset allocation ranges for major asset classes. For U.S. plans, the target allocations are 35% fixed income, 60% equity, and 5% other investments. For non-U.S. plans, the target allocations are 75% fixed income, 24% equity, and 1% other investments. The Company invests in funds and with asset managers that track broad investment indices. The equity funds generally capture the returns of the equity markets in the U.S., Europe, and Asia Pacific and also reflect various investment styles, such as growth, value, and large or small capitalization. The fixed income funds generally capture the returns of government and investment-grade corporate fixed income securities in the U.S. and Europe and also reflect various durations of these securities.

We derive our assumption for expected return on plan assets at the beginning of the year based on the weighted-average expected return for the target asset allocations of the major asset classes held by each plan. In determining the expected return, the Company considers both historical performance and an estimate of future long-term rates of return. The Company consults with, and considers the opinion of, its actuaries in developing appropriate return assumptions.

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The fair values of our pension plan assets at December 31, 2017, by asset category are as follows:

	<u>Level 1</u>	<u>Level 2</u>	<u>Level 3</u>	<u>Total</u>
	(Dollars in thousands)			
U.S. plans:				
Fixed income:				
Cash and cash equivalents	\$ 3	\$ —	\$ —	\$ 3
Guaranteed deposits	—	1,802	—	1,802
Mutual funds	74,875	—	—	74,875
Commingled funds	—	667	269	936
Equities:				
U.S. common stocks	6,678	—	—	6,678
Mutual funds	129,887	—	—	129,887
Commingled funds	—	999	—	999
<hr/>				
Total assets in the fair value hierarchy	\$ 211,443	\$ 3,468	\$ 269	\$ 215,180
Investments measured at net asset value				24,080
<hr/>				
Investments at fair value	\$ 211,443	\$ 3,468	\$ 269	\$ 239,260
<hr/>				
Non-U.S. plans				
Fixed income:				
Guaranteed deposits	\$ 42	\$ 751	\$ 30,127	\$ 30,920
Mutual funds	1,122	—	—	1,122
Other	3,293	2,332	—	5,625
Equities:				
Mutual funds	517	—	—	517
Other assets	86	—	—	86
<hr/>				
Total	\$ 5,060	\$ 3,083	\$ 30,127	\$ 38,270
<hr/>				

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The fair values of our pension plan assets at December 31, 2016, by asset category are as follows:

	<u>Level 1</u>	<u>Level 2</u>	<u>Level 3</u>	<u>Total</u>
	(Dollars in thousands)			
U.S. plans:				
Fixed income:				
Cash and cash equivalents	\$ 3	\$ —	\$ —	\$ 3
Guaranteed deposits	—	1,817	—	1,817
Mutual funds	85,580	—	—	85,580
Commingled funds	—	777	371	1,148
Equities:				
U.S. common stocks	4,057	—	—	4,057
Mutual funds	156,675	—	—	156,675
Commingled funds	—	1,096	—	1,096
Real estate	—	—	22,173	22,173
Total	\$ 246,315	\$ 3,690	\$ 22,544	\$ 272,549
Non-U.S. plans				
Fixed income:				
Guaranteed deposits	\$ 97	\$ 726	\$ 26,332	\$ 27,155
Mutual funds	365	—	—	365
Other	3,679	2,153	—	5,832
Equities:				
Mutual funds	200	—	—	200
Real estate	—	—	84	84
Other assets	47	—	—	47
Total	\$ 4,388	\$ 2,879	\$ 26,416	\$ 33,683

The Company's U.S. pension plans held 0.3 million shares of the Company's common stock with a market value of \$6.7 million at December 31, 2017, and 0.3 million shares with a market value of \$4.1 million at December 31, 2016.

Level 3 assets consist primarily of guaranteed deposits. The guaranteed deposits in Level 3 are in the form of contracts with insurance companies that secure the payment of benefits and are valued based on discounted cash flow models using the same discount rate used to value the related plan liabilities. The investments measured at net investment value, which is a practical expedient to estimating fair value, seek both current income and long term capital appreciation through investing in underlying funds that acquire, manage, and dispose of commercial real estate properties.

A rollforward of Level 3 assets is presented below. Unrealized gains included in earnings were \$2.3 million in 2017 and \$13.0 million in 2016. Transfers out of Level 3 during 2017 represent a correction to remove certain

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U.S. real estate assets measured at net investment value per share using a practical expedient from the fair value hierarchy.

	<u>Guaranteed deposits</u>	<u>Real estate</u>	<u>Commingled funds</u>	<u>Total</u>
	(Dollars in thousands)			
Balance at December 31, 2015	\$ 54,006	\$ 20,133	\$ 366	\$ 74,505
Sales	(33,084)	—	—	(33,084)
Gains included in earnings	10,867	2,124	5	12,996
Exchange rate effect	(5,457)	—	—	(5,457)
Balance at December 31, 2016	\$ 26,332	\$ 22,257	\$ 371	\$ 48,960
Sales	(465)	—	—	(465)
Gains (losses) included in earnings	531	1,823	(102)	2,252
Transfers	—	(24,080)	—	(24,080)
Exchange rate effect	3,729	—	—	3,729
Balance at December 31, 2017	\$ 30,127	\$ —	\$ 269	\$ 30,396

We expect to contribute approximately \$0.4 million to our U.S. pension plans and \$2.7 million to our non-U.S. pension plans in 2018.

We estimate that future pension benefit payments, will be as follows:

	<u>U.S. Plans</u>	<u>Non-U.S. Plans</u>
	(Dollars in thousands)	
2018	\$ 19,222	\$ 5,049
2019	19,353	4,861
2020	19,491	4,312
2021	19,642	4,388
2022	19,844	5,360
2023-2027	97,664	24,979

Postretirement Health Care and Life Insurance Benefit Plans

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Net periodic benefit cost:			
Interest expense	\$ 843	\$ 944	\$ 970
Mark-to-market actuarial net loss (gain)	458	(164)	(3,051)
Total net periodic benefit cost (credit)	\$ 1,301	\$ 780	\$ (2,081)
Weighted-average assumptions:			
Discount rate	4.20%	4.50%	3.95%
Current trend rate for health care costs	6.50%	6.60%	7.10%
Ultimate trend rate for health care costs	4.50%	4.50%	4.50%
Year that ultimate trend rate is reached	2036	2036	2028

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A one-percentage-point change in the assumed health care cost trend rates would have the following effect:

	1-Percentage- Point Increase	1-Percentage- Point Decrease
	(Dollars in thousands)	
Effect on total of service and interest costs components	\$ 53	\$ (46)
Effect on postretirement benefit obligation	1,180	(1,034)
	2017	2016
	(Dollars in thousands)	
Change in benefit obligation:		
Benefit obligation at beginning of year	\$ 21,056	\$ 22,030
Interest cost	843	944
Benefits paid	(1,632)	(1,754)
Actuarial loss (gain)	458	(164)
Benefit obligation at end of year	\$ 20,725	\$ 21,056
Change in plan assets:		
Fair value of plan assets at beginning of year	\$ —	\$ —
Employer contributions	1,632	1,754
Benefits paid	(1,632)	(1,754)
Fair value of plan assets at end of year	\$ —	\$ —
Amounts recognized in the balance sheet:		
Accrued expenses and other current liabilities	\$ (2,132)	\$ (2,208)
Postretirement and pension liabilities	(18,593)	(18,848)
Funded status	\$ (20,725)	\$ (21,056)
Weighted-average assumptions as of December 31:		
Discount rate	3.70%	4.20%
Current trend rate for health care costs	6.40%	6.50%
Ultimate trend rate for health care costs	4.50%	4.50%
Year that ultimate trend rate is reached	2036	2036

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The Medicare Prescription Drug, Improvement, and Modernization Act of 2003 provides subsidies for certain drug costs to companies that provide coverage that is actuarially equivalent to the drug coverage under Medicare Part D. We estimate that future postretirement health care and life insurance benefit payments will be as follows:

	<u>Before Medicare Subsidy</u>	<u>After Medicare Subsidy</u>
	(Dollars in thousands)	
2018	\$ 2,132	\$ 1,905
2019	2,060	1,843
2020	1,977	1,771
2021	1,896	1,701
2022	1,806	1,621
2023-2027	7,659	6,908

Other Retirement Plans

We also have defined contribution retirement plans covering certain employees. Our contributions are determined by the terms of the plans and are limited to amounts that are deductible for income taxes. Generally, benefits under these plans vest over a period of five years from date of employment. The largest plan covers salaried and most hourly employees in the U.S. In this plan, the Company contributes a percentage of eligible employee basic compensation and also a percentage of employee contributions. The expense applicable to these plans was \$5.7 million, \$4.2 million, and \$3.4 million in 2017, 2016, and 2015, respectively.

13. Stock-based Compensation

On May 22, 2013, our shareholders approved the 2013 Omnibus Incentive Plan (the “Plan”), which was adopted by the Board of Directors on February 22, 2013, subject to shareholder approval. The Plan’s purpose is to promote the Company’s long-term financial interests and growth by attracting, retaining and motivating high quality key employees and directors, motivating such employees and directors to achieve the Company’s short- and long-range performance goals and objectives, thereby aligning their interests with those of its shareholders. The Plan reserves 4,400,000 shares of common stock to be issued for grants of several different types of long-term incentives including stock options, stock appreciation rights, restricted shares, performance shares, other common stock based awards, and dividend equivalent rights.

The 2010 Long Term Incentive Plan (the “Previous Plan”) was replaced by the Plan, and no future grants have been made under the Previous Plan. However, any outstanding awards or grants made under the Previous Plan will continue until the end of their specified terms.

Stock options, performance share units, deferred stock units, and restricted stock units were the only grant types outstanding at December 31, 2017. Stock options, performance share units, and restricted stock units are discussed below. Activities in other grant types were not significant.

Stock Options

General Information

Stock options outstanding at December 31, 2017 have a term of 10 years, vest evenly over three years on the anniversary of the grant date, and have an exercise price equal to the per share fair market value of our common

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stock on the grant date. Accelerated vesting is used for options held by employees who meet both the age and years of service requirements to retire prior to the end of the vesting period. In the case of death or retirement, the stock options become 100% vested and exercisable.

Stock Option Valuation Model and Method Information

We estimate the fair value of each stock option on the date of grant using the Black-Scholes option pricing model. We use judgment in selecting assumptions for the model, which may significantly impact the timing and amount of compensation expense, and we base our judgments primarily on historical data. When appropriate, we adjust the historical data for circumstances that are not likely to occur in the future.

The following table details the determination of the assumptions used to estimate the fair value of stock options:

<u>Assumption</u>	<u>Estimation Method</u>
Expected life, in years	Historical stock option exercise experience
Risk-free interest rate	Yield of U.S. Treasury Bonds with remaining maturity equal to expected life of the stock option
Expected volatility	Historical daily price observations of the Company's common stock over a period equal to the expected life of the stock option
Expected dividend yield	Historical dividend rate at the date of grant

The following table details the weighted-average grant-date fair values and the assumptions used for estimating the fair values of stock options granted in the respective years:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
Weighted-average grant-date fair value	\$7.29	\$4.94	\$8.45
Expected life, in years	6.0	6.0	6.0
Risk-free interest rate	1.9%–2.3%	1.4%–1.6%	1.9%–2.1%
Expected volatility	48.0%–51.5%	52.0%–53.6%	55.0%–80.1%
Expected dividend yield	—%	—%	—%

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Stock Option Activity Information

A summary of stock option activity follows:

	<u>Number of Options</u>	<u>Weighted- Average Exercise Price</u>	<u>Weighted- Average Remaining Contractual Term</u>	<u>Aggregate Intrinsic Value</u>
Outstanding at December 31, 2016	1,818,850	10.85		
Granted	211,400	14.35		
Exercised	(350,698)	12.90		
Forfeited or expired	(112,283)	21.73		
Outstanding at December 31, 2017	1,567,269	\$10.08	5.86	\$21,168
Exercisable at December 31, 2017	1,116,629	\$14.15	4.81	\$15,984
Vested or expected to vest at December 31, 2017	1,567,269	\$10.08	5.86	\$21,168

We calculated the aggregate intrinsic value in the table above by taking the total pretax difference between our common stock's closing market value per share on the last trading day of the year and the stock option exercise price for each grant and multiplying that result by the number of shares that would have been received by the option holders had they exercised all their in-the-money stock options.

Information related to stock options exercised follows:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Proceeds from the exercise of stock options	\$ 4,526	\$ 1,140	\$ 404
Intrinsic value of stock options exercised	2,898	1,496	457
Income tax benefit related to stock options exercised	1,014	524	160

Stock Options Expense Information

A summary of amounts recorded and to be recorded for stock-based compensation related to stock options follows:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Compensation expense recorded in Selling, general and administrative expenses	\$ 1,588	\$ 1,388	\$ 1,736
Deferred income tax benefits related to compensation expense	333	486	608
Total fair value of stock options vested	1,388	1,757	1,664
Unrecognized compensation cost	621	513	702
Expected weighted-average recognition period for unrecognized compensation, in years	2.0	2.1	2.6

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Performance Share Units

General Information

Performance share units, expressed as shares of the Company's common stock, are earned only if the Company meets specific performance targets over a three-year period. The grants have a vesting period of three years.

The Plan allows for payout of up to 200% of the vesting-date fair value of the awards. We pay half of the earned value in cash and half in unrestricted shares of common stock. The portion of the grants that will be paid in cash are treated as liability awards, and therefore, we remeasure our liability and the related compensation expense at each balance sheet date, based on fair value. We treat the portion of the grants that will be settled with common stock as equity awards, and therefore, the amount of stock-based compensation we record over the performance period is based on the fair value on the grant date. The compensation expense and number of shares expected to vest for all performance share units are adjusted each reporting period for the achievement of the performance share units' performance metrics, based upon our best estimate using available information.

Performance Share Unit Valuation Model and Method Information

The estimated fair value of performance share units granted in 2017, 2016 and 2015 is based on the closing price of the Company's common stock on the date of issuance and recorded based on achievement of target performance metrics. As of December 31, 2017, we had 0.2 million, 0.2 million and 0.2 million performance share units outstanding associated with our 2017, 2016 and 2015 grants, respectively.

The weighted average grant date fair value of our performance share units was \$14.89 for shares granted in 2017, \$10.07 for shares granted in 2016 and \$12.32 for shares granted in 2015. All performance share units are initially expensed at target and are evaluated each reporting period for likelihood of achieving the performance metrics, and the expense is adjusted, as appropriate.

Performance Share Unit Activity Information

A summary of performance share unit activity follows:

	<u>Number of Units</u>	<u>Weighted- Average Remaining Contractual Term</u>
Outstanding at December 31, 2016	653,990	
Granted	174,800	
Earned	(120,192)	
Forfeited or expired	(87,108)	
Outstanding at December 31, 2017	621,490	1.0
Vested or expected to vest at December 31, 2017	621,490	1.0

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Performance Share Unit Expense Information

A summary of amounts recorded and to be recorded for stock-based compensation related to performance share units follows:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Compensation expense recorded in Selling, general and administrative expenses	\$ 6,881	\$ 3,437	\$ 4,669
Deferred income tax benefits related to compensation expense	1,445	1,203	1,634
Unrecognized compensation cost	3,801	3,733	2,858
Expected weighted-average recognition period for unrecognized compensation, in years	1.4	2.0	1.5

Restricted Stock Units

We granted 0.2 million, 0.3 million and 0.2 million restricted stock units in 2017, 2016, and 2015, respectively. Fair value of restricted stock units is determined based on the closing price of the Company's common stock on the date of issuance. Restricted stock units are expressed as equivalent shares of the Company's common stock, and have a three-year vesting period. Total expense included in Selling, general and administrative expense related to restricted stock units granted in 2017, 2016 and 2015 was \$2.5 million, \$1.7 million and \$1.7 million, respectively. Total unrecognized compensation cost in 2017, 2016 and 2015 was \$2.8 million, \$2.4 million and \$2.9 million, respectively.

Directors' Deferred Compensation

Separate from the Plan, the Company has established the Ferro Corporation Deferred Compensation Plan for Non-employee Directors, permitting its non-employee directors to voluntarily defer all or a portion of their compensation. The voluntarily deferred amounts are placed in individual accounts in a benefit trust known as a "rabbi trust" and invested in the Company's common stock with dividends reinvested in additional shares. All disbursements from the trust are made in the Company's common stock. The stock held in the rabbi trust is classified as treasury stock in shareholders' equity and the deferred compensation obligation that is required to be settled in shares of the Company's common stock, is classified as paid-in capital. The rabbi trust held 0.1 million shares, valued at \$1.6 million, at December 31, 2017, and 0.2 million shares, valued at \$2.1 million, at December 31, 2016.

14. Restructuring and Cost Reduction Programs

Our restructuring and cost reduction programs have been developed with the objective of leveraging our global scale, realigning and lowering our cost structure and optimizing capacity utilization. Total restructuring charges resulting from these activities were \$9.8 million in 2017, \$2.7 million in 2016, and \$9.5 million in 2015, which are reported in Restructuring and impairment charges in our consolidated statement of operations. Descriptions of the restructuring program follow:

Global Cost Reduction Program

In 2013, we initiated a Global Cost Reduction Program that was designed to address 3 key areas of the company — (1) business realignment, (2) operational efficiency and (3) corporate and back office functions.

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Business realignment was targeted at right-sizing our commercial management organizations globally. The operational efficiency component of the program was designed to improve the efficiency of our plant operations and supply chain. The corporate and back office initiative is principally comprised of work that we are doing with our strategic partners in the areas of finance and accounting and information technology outsourcing.

We have summarized the charges associated with this restructuring program by major type of charges below:

	<u>Employee Severance</u>	<u>Other Costs</u>	<u>Asset Impairment</u>	<u>Total</u>
	(Dollars in thousands)			
Expected restructuring charges:				
Global Cost Reduction Program	\$39,135	\$29,562	1,176	\$69,873
Total expected restructuring charges	\$39,135	\$29,562	\$1,176	\$69,873
Restructuring charges incurred:				
Global Cost Reduction Program	\$ 4,015	\$ 5,519	—	\$ 9,534
Charges incurred in 2015	\$ 4,015	\$ 5,519	\$ —	\$ 9,534
Global Cost Reduction Program	1,353	1,356	—	2,709
Charges incurred in 2016	\$ 1,353	\$ 1,356	\$ —	\$ 2,709
Global Cost Reduction Program	5,167	3,500	1,176	9,843
Charges incurred in 2017	\$ 5,167	\$ 3,500	\$1,176	\$ 9,843
Cumulative restructuring charges incurred:				
Global Cost Reduction Program	35,024	25,979	1,176	62,179
Cumulative restructuring charges incurred as of December 31, 2017	\$35,024	\$25,979	\$1,176	\$62,179

We have summarized the charges associated with the restructuring programs by segments below:

	<u>Total Expected Charges</u>	<u>2017</u>	<u>2016</u>	<u>2015</u>	<u>Cumulative Charges To Date</u>
	(Dollars in thousands)				
Performance Coatings	\$11,506	\$2,948	\$ 192	\$ 204	\$ 7,052
Performance Colors and Glass	20,032	971	205	2,300	20,032
Color Solutions	4,189	1,250	630	1,970	4,189
Segment Total	35,727	5,169	1,027	4,474	31,273
Corporate Restructuring Charges	34,146	4,674	1,682	5,060	30,906
Total Restructuring Charges	\$69,873	\$9,843	\$2,709	\$9,534	\$62,179

FERRO CORPORATION AND SUBSIDIARIES
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Years ended December 31, 2017, 2016 and 2015 — (Continued)

We have summarized the activities and accruals related to our restructuring and cost reduction programs below:

	<u>Employee Severance</u>	<u>Other Costs</u>	<u>Asset Impairment</u>	<u>Total</u>
	(Dollars in thousands)			
Balance at December 31, 2014	\$ 519	\$ 937	\$ —	\$ 1,456
Restructuring charges	4,015	5,519	—	9,534
Cash payments	(3,832)	(4,341)	—	(8,173)
Non-cash items	(9)	(38)	—	(47)
Balance at December 31, 2015	\$ 693	\$ 2,077	\$ —	\$ 2,770
Restructuring charges	\$ 1,353	\$ 1,356	\$ —	\$ 2,709
Cash payments	(1,634)	(1,089)	—	(2,723)
Non-cash items	(173)	(855)	—	(1,028)
Balance at December 31, 2016	\$ 239	\$ 1,489	\$ —	\$ 1,728
Restructuring charges	\$ 5,167	\$ 3,500	\$ 1,176	\$ 9,843
Cash payments	(3,316)	(500)	—	(3,816)
Non-cash items	196	(3,255)	(1,176)	(4,235)
Balance at December 31, 2017	\$ 2,286	\$ 1,234	\$ —	\$ 3,520

We expect to make cash payments to settle the remaining liability for employee severance benefits and other costs primarily over the next twelve months where applicable, except where legal or contractual obligations would require it to extend beyond that period.

FERRO CORPORATION AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

15. Leases

Rent expense for all operating leases was \$12.2 million in 2017, \$9.8 million in 2016, and \$9.1 million in 2015.

The Company has a number of capital lease arrangements primarily relating to buildings and equipment. Assets held under capital leases are included in property, plant and equipment, and at December 31 are as follows:

	2017	2016
	(Dollars in thousands)	
Gross amounts capitalized		
Buildings	\$ 4,781	\$ 3,100
Equipment	3,710	3,989
	8,491	7,089
Accumulated amortization		
Buildings	(3,190)	(3,100)
Equipment	(2,420)	(2,079)
	(5,610)	(5,179)
Net assets under capital leases	\$ 2,881	\$ 1,910

At December 31, 2017, future minimum lease payments under all non-cancelable leases are as follows:

	Capital Leases	Operating Leases
	(Dollars in thousands)	
2018	\$ 1,112	\$ 11,696
2019	1,070	7,212
2020	773	5,088
2021	486	3,464
2022	1,352	2,455
Thereafter	1,254	3,100
Net minimum lease payments	\$ 6,047	\$ 33,015
Less amount representing imputed interest and executory costs	1,134	
Present value of net minimum lease payments	4,913	
Less current portion	782	
Long-term obligations at December 31, 2017	\$ 4,131	

FERRO CORPORATION AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

16. Miscellaneous (Income) Expense, Net

Components of Miscellaneous (income) expense, net follow:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Argentina export tax matter	\$ (3,549)	\$ 1,128	\$ 1,070
(Gain) on change of control	(2,561)	—	—
Dividends/royalty from affiliates, net	(993)	(1,245)	(364)
Equity method investment loss (income)	261	(260)	(817)
Loss (gain) on sale of assets	722	(3,891)	57
Contingent consideration paid	1,721	—	—
Bank fees	2,229	1,855	1,407
Other, net	548	(247)	(305)
Total Miscellaneous (income) expense, net	\$ (1,622)	\$ (2,660)	\$ 1,048

In 2017, the Company acquired a majority equity interest in Gardenia (Note 4), and due to the change of control that occurred, the Company recorded a gain on purchase of \$2.6 million related to the difference between the Company's carrying value and fair value of the previously held equity method investment.

In 2013, the Supreme Court in Argentina ruled unfavorably related to certain export taxes associated with a divested operation. In 2017, the Company participated in a newly available tax regime, resulting in the reduction of these outstanding tax liabilities, and as a result recorded a gain of \$4.5 million for the year ended December 31, 2017. We recorded a \$0.9 million charge in 2017, \$1.1 million charge in 2016 and \$1.1 million charge in 2015 related to interest on the liabilities.

In 2016, we recorded a \$3.9 million gain on sale from the proceeds of a closed site in Australia which was recorded for the year ended December 31, 2016.

FERRO CORPORATION AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

17. Earnings per Share

Details of the calculations of basic and diluted earnings per share follow:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands, except per share amounts)		
Basic earnings (loss) per share computation:			
Net income (loss) attributable to Ferro Corporation common shareholders	\$ 57,054	\$ (20,817)	\$ 64,100
Adjustment for loss from discontinued operations	—	64,464	36,779
Total	\$ 57,054	\$ 43,647	\$ 100,879
Weighted-average common shares outstanding	83,713	83,298	86,718
Basic earnings per share from continuing operations attributable to Ferro Corporation common shareholders	\$ 0.68	\$ 0.52	\$ 1.16
Diluted earnings (loss) per share computation:			
Net income (loss) attributable to Ferro Corporation common shareholders	\$ 57,054	\$ (20,817)	\$ 64,100
Adjustment for loss from discontinued operations	—	64,464	36,779
Total	\$ 57,054	\$ 43,647	\$ 100,879
Weighted-average common shares outstanding	83,713	83,298	86,718
Assumed exercise of stock options	762	549	432
Assumed satisfaction of deferred stock unit conditions	—	36	—
Assumed satisfaction of restricted stock unit conditions	351	544	338
Assumed satisfaction of performance stock unit conditions	330	483	945
Weighted-average diluted shares outstanding	85,156	84,910	88,433
Diluted earnings per share from continuing operations attributable to Ferro Corporation common shareholders	\$ 0.67	\$ 0.51	\$ 1.14

The number of anti-dilutive or unearned shares was 1.6 million, 1.7 million, and 1.8 million for 2017, 2016, and 2015, respectively. These shares were excluded from the calculation of diluted earnings per share due to their anti-dilutive impact.

18. Share Repurchase Program

The Company's Board of Directors approved share repurchase programs, under which the Company is authorized to repurchase up to \$100 million of the Company's outstanding shares of Common Stock on the open market, including through a Rule 10b5-1 plan, or in privately negotiated transactions.

The timing and amount of shares to be repurchased will be determined by the Company, based on evaluation of market and business conditions, share price, and other factors. The share repurchase programs do

FERRO CORPORATION AND SUBSIDIARIES
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Years ended December 31, 2017, 2016 and 2015 — (Continued)

not obligate the Company to repurchase any dollar amount or number of common shares, and may be suspended or discontinued at any time.

The Company made no repurchases during 2017. The Company repurchased 1,175,437 shares of common stock at an average price of \$9.72 per share for a total cost of \$11.4 million during 2016, and had repurchased 3,282,908 shares of common stock at average price of \$11.75 for a total cost of \$38.6 million during 2015. Under the share repurchase programs, the Company has repurchased an aggregate of 4,458,345 shares of common stock, at an average price of \$11.21 per share, for a total cost of \$50.0 million. As of December 31, 2017, \$50.0 million of common stock may still be repurchased under the programs.

FERRO CORPORATION AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

19. Accumulated Other Comprehensive Income (Loss)

Changes in Accumulated other comprehensive income (loss) by component, net of income tax, were as follows:

	Postretirement Benefit Liability Adjustments	Translation Adjustments	Net Gain on Cash Flow Hedges	Total
	(Dollars in thousands)			
Balance at December 31, 2014	\$ 888	\$ (22,693)	\$ —	\$ (21,805)
Other comprehensive income (loss) before reclassifications, before tax	—	(39,436)	—	(39,436)
Reclassification to earnings:				
Postretirement benefit liabilities loss, before tax	(109)	—	—	(109)
Current period other comprehensive loss, before tax	(109)	(39,436)	—	(39,545)
Tax effect	(32)	—	—	(32)
Current period other comprehensive loss, net of tax	(77)	(39,436)	—	(39,513)
Balance at December 31, 2015	811	(62,129)	—	(61,318)
Other comprehensive income (loss) before reclassifications, before tax	—	(46,770)	—	(46,770)
Reclassification to earnings:				
Postretirement benefit liabilities gain, before tax	360	—	—	360
Foreign currency translation adjustment, before tax ⁽¹⁾	—	1,115	—	1,115
Current period other comprehensive income (loss), before tax	360	(45,655)	—	(45,295)
Tax effect	30	—	—	30
Current period other comprehensive income (loss), net of tax	330	(45,655)	—	(45,325)
Balance at December 31, 2016	1,141	(107,784)	—	(106,643)
Other comprehensive income before reclassifications, before tax	—	26,181	2,019	28,200
Reclassification to earnings:				
Cash flow hedge loss, before tax	—	—	(527)	(527)
Postretirement benefit liabilities gain, before tax	42	—	—	42
Current period other comprehensive income, before tax	42	26,181	1,492	27,715
Tax effect	18	(4,025)	547	(3,460)
Current period other comprehensive income, net of tax	24	30,206	945	31,175
Balance at December 31, 2017	\$ 1,165	\$ (77,578)	\$ 945	\$ (75,468)

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NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

- (1) Includes a release of accumulated foreign currency translation of \$1.1 million related to the Company's sale of the Europe-based Polymer Additives business (Note 3), which is included in Loss from discontinued operations, net of income taxes in our consolidated statements of operations for the year ended December 31, 2016.

20. Reporting for Segments

The Company's reportable segments are Performance Coatings, Performance Colors and Glass, and Color Solutions.

Net sales to external customers by segment are presented in the table below. Sales between segments were not material.

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Performance Coatings	\$ 594,029	\$ 526,981	\$ 533,370
Performance Colors and Glass	444,653	371,464	376,769
Color Solutions	358,060	246,847	165,202
Total net sales	\$ 1,396,742	\$ 1,145,292	\$ 1,075,341

Segment gross profit is the metric utilized by management to evaluate segment performance. We measure segment gross profit for internal reporting purposes by excluding certain other cost of sales not directly attributable to business units, and pension and other postretirement benefits mark-to-market adjustments. Assets by segment are not regularly reviewed by the chief operating decision maker. Each segment's gross profit and reconciliations to Income before income taxes are presented in the table below:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Performance Coatings	\$ 145,797	\$ 139,454	\$ 126,945
Performance Colors and Glass	157,544	133,716	128,209
Color Solutions	113,694	84,293	45,678
Other cost of sales	(814)	(6,246)	848
Total gross profit	416,221	351,217	301,680
Selling, general and administrative expenses	258,604	241,702	216,899
Restructuring and impairment charges	11,409	15,907	9,655
Other expense, net	35,690	31,163	20,343
Income before income taxes	\$ 110,518	\$ 62,445	\$ 54,783

FERRO CORPORATION AND SUBSIDIARIES
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2017, 2016 and 2015 — (Continued)

Each segment's capital expenditures for long-lived assets are detailed below:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Performance Coatings	\$19,734	\$ 9,139	\$ 8,148
Performance Colors and Glass	9,374	7,123	6,620
Color Solutions	20,356	4,867	2,412
Total segment expenditures for long-lived assets	49,464	21,129	17,180
Unallocated corporate expenditures for long-lived assets	1,088	2,896	3,142
Total expenditures for long lived assets ⁽¹⁾	\$50,552	\$24,025	\$20,322

(1) Excludes capital expenditures of discontinued operations of \$0.9 million and \$22.7 million in 2016 and 2015, respectively.

We sell our products throughout the world and we attribute sales to countries based on the country where we generate the customer invoice. No single country other than the U.S. and Spain represent greater than 10% of our net sales. Net sales by geography are as follows:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
United States	\$ 356,482	\$ 300,187	\$ 281,976
Spain	214,732	188,972	174,742
Other international	825,528	656,133	618,623
Total net sales	\$1,396,742	\$1,145,292	\$1,075,341

None of our operations in countries other than Spain, U.S. and Colombia owns greater than 10% of consolidated long-lived assets. Long-lived assets that consist of property, plant, and equipment by geography at December 31 are as follows:

	<u>2017</u>	<u>2016</u>
	(Dollars in thousands)	
Spain	\$ 76,142	\$ 51,358
United States	44,956	40,661
Colombia	29,731	30,700
Other international	170,913	139,307
Total long-lived assets	\$ 321,742	\$ 262,026

21. Unconsolidated Affiliates Accounted For Under the Equity Method

At December 31, 2017, our percentage of ownership interest in these affiliates ranged from 34% to 50%. Because we exert significant influence over these affiliates, but we do not control them, our investments have been accounted for under the equity method. Investment income from these equity method investments, which is reported in Miscellaneous (income) expense, net was a loss of \$0.3 million in 2017, income of \$0.3 million in 2016, and income of \$0.8 million in 2015. The balance of our equity method investments, which is reported in Other non-current assets, was \$7.6 million at December 31, 2017, and \$15.1 million at December 31, 2016.

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The (loss) income that we record for these investments is equal to our proportionate share of the affiliates' income or loss and our investments are equal to our proportionate share of the affiliates' shareholders' equity based on our ownership percentage. We have summarized below condensed income statement and balance sheet information for the combined equity method investees:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Net sales	\$33,851	\$42,555	\$47,443
Gross profit	5,655	4,842	4,799
Income from continuing operations	(224)	694	1,887
Net (loss) income	(220)	236	1,292
	<u>2017</u>	<u>2016</u>	
	(Dollars in thousands)		
Current assets	\$ 19,908	\$ 38,246	
Non-current assets	10,834	28,124	
Current liabilities	(13,207)	(16,283)	
Non-current liabilities	(467)	(16,923)	

We had the following transactions with our equity-method investees:

	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(Dollars in thousands)		
Sales	\$ 5,378	\$ 4,589	\$ 6,740
Purchases	2,006	758	3,485
Dividends and interest received	920	268	332
Commission and royalties received	130	1,003	197
Commissions and royalties paid	57	26	165

FERRO CORPORATION AND SUBSIDIARIES
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Years ended December 31, 2017, 2016 and 2015 — (Continued)

22. Quarterly Data (Unaudited)

	<u>Net Sales</u>	<u>Gross Profit</u>	<u>Net (Loss) Income</u>	<u>Net (Loss) Income Attributable to Ferro Corporation</u>	<u>(Loss) Earnings Attributable to Ferro Corporation Common Shareholders Per Common Share</u>	
					<u>Basic</u>	<u>Diluted</u>
(Dollars in thousands, except per share data)						
2016						
Quarter 1	\$ 277,451	\$ 84,229	\$ (9,730)	\$ (9,966)	\$ (0.12)	\$ (0.12)
Quarter 2	297,977	98,373	19,112	18,969	0.23	0.22
Quarter 3	288,527	88,981	(8,674)	(8,884)	(0.11)	(0.11)
Quarter 4	281,337	79,634	(20,595)	(20,936)	(0.25)	(0.25)
Total	\$ 1,145,292	\$ 351,217	\$ (19,887)	\$ (20,817)	\$ (0.25)	\$ (0.25)
2017						
Quarter 1	\$ 320,555	\$ 98,794	\$ 22,121	\$ 21,898	\$ 0.26	\$ 0.26
Quarter 2	348,632	108,342	21,229	21,025	0.25	0.25
Quarter 3	350,012	103,616	22,965	22,817	0.27	0.27
Quarter 4	377,543	105,469	(8,547)	(8,686)	(0.10)	(0.10)
Total	\$ 1,396,742	\$ 416,221	\$ 57,768	\$ 57,054	\$ 0.68	\$ 0.67

Quarterly earnings per share amounts do not always add to the full-year amounts due to the averaging of shares.

Restructuring and impairment charges in 2017 were \$3.0 million in the first quarter, \$3.2 million in the second quarter, \$1.5 million in the third quarter, and \$3.7 million in the fourth quarter. Restructuring and impairment charges in 2016 were \$0.9 million in the first quarter, \$0.8 million in the second quarter, \$0 million in the third quarter, and \$14.2 million in the fourth quarter. Mark-to-market net gains on our postretirement benefit plans were \$6.4 million and net losses \$20.1 million in the fourth quarter of 2017 and 2016, respectively.

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

None.

Item 9A — Controls and Procedures

Evaluation of Disclosure Controls and Procedures

Ferro is committed to maintaining disclosure controls and procedures that are designed to ensure that information required to be disclosed in its Exchange Act reports is recorded, processed, summarized, and reported within the time periods specified in the U.S. Securities and Exchange Commission's rules and forms, and that such information is accumulated and communicated to its management, including its Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

The Company's management, under the supervision and with the participation of the Chief Executive Officer and the Chief Financial Officer, evaluated the effectiveness of the design and operation of the Company's disclosure controls and procedures, as defined in Exchange Act Rule 13a-15(e), as of December 31, 2017. The Company's disclosure controls and procedures include components of the Company's internal control over financial reporting. Based on that evaluation, management concluded that the disclosure controls and procedures were effective as of December 31, 2017.

Changes in Internal Control over Financial Reporting and Other Remediation

During the fourth quarter of 2017, there were no changes in our internal controls or in other factors that materially affected, or are reasonably likely to materially affect, our internal controls over financial reporting.

Management's Annual Report on Internal Control over Financial Reporting

The Company's management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Exchange Act Rule 13a-15(f). The Company's internal control system is a process designed by, or under the supervision of, the Company's principal executive and principal financial officers, or persons performing similar functions, and effected by the Company's board of directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with U.S. generally accepted accounting principles ("U.S. GAAP").

The Company's internal control over financial reporting includes policies and procedures that pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect transactions and dispositions of assets; provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with U.S. GAAP, and that receipts and expenditures are being made only in accordance with the authorization of its management and directors; and 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 its consolidated 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 risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate. Entities that management has excluded from its assessment of the Company's internal control over financial reporting are S.P.C. Group s.r.l and Smalti per Ceramiche, s.r.l. (together "SPC"), which was acquired on April 24, 2017, Dip-Tech Ltd. ("Dip-Tech"), which was acquired on August 2, 2017, Gardenia Quimica S.A. ("Gardenia"), which was acquired on August 3, 2017, and Endeka Group ("Endeka"), which was acquired on November 1, 2017, whose financial statements constitute in the aggregate 16.4% of the Company's total assets, 4.5% of total net sales, and 0.8% of total net income of the consolidated financial statement amounts as of and for the year ended December 31, 2017.

Management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2017. In making this assessment, the Company used the control criteria framework of the Committee of Sponsoring Organizations of the Treadway Commission published in its report entitled *Internal Control—Integrated Framework (2013)*. Management concluded that the Company's internal control over financial reporting was effective as of December 31, 2017.

Deloitte & Touche LLP, the independent registered public accounting firm that audited the Company's consolidated financial statements, has issued an attestation report on the Company's internal control over financial reporting as of December 31, 2017, which is included below.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders of Ferro Corporation

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of Ferro Corporation and subsidiaries (the “Company”) as of December 31, 2017, based on criteria established in Internal Control — Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2017, based on criteria established in Internal Control — Integrated Framework (2013) issued by COSO.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements and financial statement schedule as of and for the year ended December 31, 2017, of the Company and our report dated February 28, 2018, expressed an unqualified opinion on those financial statements and financial statement schedule.

As described in Management’s Annual Report on Internal Control over Financial Reporting, management excluded from its assessment the internal control over financial reporting at S.P.C. Group s.r.l. and Smalti per Ceramiche, s.r.l. (together “SPC”), which was acquired on April 24, 2017, Dip-Tech, Ltd. (“Dip-Tech”), which was acquired on August 2, 2017, Gardenia Quimica S.A. (“Gardenia”), which was acquired on August 3, 2017, and Endeka Group (“Endeka”), which was acquired on November 1, 2017, and whose financial statements constitute in the aggregate 16.4% of the Company’s total assets, 4.5% of total net sales, and 0.8% of total net income of the consolidated financial statement amounts as of and for the year ended December 31, 2017. Accordingly, our audit did not include the internal control over financial reporting at SPC, Dip-Tech, Gardenia and Endeka.

Basis for Opinion

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

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail,

accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

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

/s/ Deloitte & Touche LLP

Cleveland, Ohio
February 28, 2018

Item 9B — Other Information

None.

PART III

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

The information on Ferro's directors is contained under the heading "Election of Directors" of the Proxy Statement for Ferro Corporation's 2018 Annual Meeting of Shareholders and is incorporated here by reference. The information about the Audit Committee and the Audit Committee financial expert is contained under the heading "Corporate Governance — Board Committees" of the Proxy Statement for Ferro Corporation's 2018 Annual Meeting of Shareholders and is incorporated here by reference. Information on Ferro's executive officers is contained under the heading "Executive Officers of the Registrant" in Part 1 of this Annual Report on Form 10-K. Section 16(a) filing information is contained under the heading "Security Ownership of Certain Beneficial Owners and Management — Section 16(a) Beneficial Ownership Reporting Compliance" of the Proxy Statement for Ferro Corporation's 2018 Annual Meeting of Shareholders and is incorporated here by reference.

Ferro has adopted a series of policies dealing with business and ethics. These policies apply to all Ferro Directors, officers and employees. A summary of these policies may be found on Ferro's Web site and the full text of the policies is available in print, free of charge, by writing to: General Counsel, Ferro Corporation, 6060 Parkland Blvd. Suite 250, Mayfield Heights, Ohio, 44124, USA. Exceptions, waivers and amendments of those policies may be made, if at all, only by the Audit Committee of the Board of Directors, and, in the event any such exceptions, waivers or amendments are granted, a description of the change or event will be posted on Ferro's Web site (www.ferro.com) within four business days. Ferro maintains a worldwide hotline that allows employees throughout the world to report confidentially any detected violations of these legal and ethical conduct policies consistent with local legal requirements and subject to local legal limitations.

Item 11 — *Executive Compensation*

The information on executive compensation is contained under the headings "Executive Compensation Discussion & Analysis" and "2017 Executive Compensation" of the Proxy Statement for Ferro Corporation's 2018 Annual Meeting of Shareholders and is incorporated here by reference.

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

The information on security ownership of certain beneficial owners and management is contained under the headings “Security Ownership of Certain Beneficial Owners and Management — Stock Ownership by Other Major Shareholders” and “Security Ownership of Certain Beneficial Owners and Management — Stock Ownership by Director and Executive Officers” of the Proxy Statement for Ferro Corporation’s 2018 Annual Meeting of Shareholders and is incorporated here by reference.

The numbers of shares issued and available for issuance under Ferro’s equity compensation plans as of December 31, 2017, were as follows:

<u>Equity Compensation Plan</u>	<u>Number of Shares to Be Issued on Exercise of Outstanding Options, and Other Awards</u>	<u>Weighted-Average Exercise Price of Outstanding Options, and Other Awards</u>	<u>Number of Shares Remaining Available for Future Issuance Under Equity Compensation Plans⁽¹⁾</u>
Approved by Ferro Shareholders	3,020,969 ⁽²⁾	\$5.23	1,928,132 ⁽³⁾
Not Approved by Ferro Shareholders	158,227	—	—
Total	3,179,196	\$5.23⁽⁴⁾	1,928,132

- (1) Excludes shares listed under “Number of Shares to Be Issued on Exercise of Outstanding Options and Other Awards.”
- (2) Includes options and other awards issued under the Company’s 2013 Omnibus Incentive Compensation Plan and prior equity compensation plans.
- (3) Shares are only available under the 2013 Omnibus Incentive Plan and may be issued as stock options, stock appreciation rights, restricted shares or units, performance shares or units, and other common stock-based awards.
- (4) Weighted-average exercise price of outstanding options and other awards; excludes phantom units.

A description follows of the material features of each plan that was not approved by Ferro shareholders:

- *Executive Employee Deferred Compensation Plan.* The Executive Employee Deferred Compensation Plan allows participants to defer up to 75% of annual base salary and up to 100% of incentive cash bonus awards and cash performance share payouts. Participants may elect to have all or a portion of their deferred compensation accounts deemed to be invested in shares of Ferro Common Stock and credited with hypothetical appreciation, depreciation, and dividends. When distributions are made from this Plan in respect of such shares, the distributions are made in actual shares of Ferro Common Stock.
- *Supplemental Executive Defined Contribution Plan.* The Supplemental Executive Defined Contribution Plan allows participants to be credited annually with matching and basic pension contributions that they would have received under the Company’s 401(k) plan except for the applicable IRS limitations on compensation and contributions. Contributions vest at 20% for each year of service, are deemed invested in Ferro Common Stock and earn dividends. Distributions are made in Ferro Common Stock or in cash.

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

There are no relationships or transactions that are required to be reported. The information about director independence is contained under the heading “Corporate Governance — Director Independence” of the Proxy Statement for Ferro Corporation’s 2018 Annual Meeting of Shareholders and is incorporated here by reference.

Item 14 — Principal Accountant Fees and Services

The information contained under the heading “Accounting Firm Information — Fees” of the Proxy Statement for Ferro Corporation’s 2018 Annual Meeting of Shareholders is incorporated here by reference.

PART IV

Item 15 — *Exhibits and Financial Statement Schedules*

The following documents are filed as part of this Annual Report on Form 10-K:

- (a) The consolidated financial statements of Ferro Corporation and subsidiaries contained in Part II, Item 8 of this Annual Report on Form 10-K:
 - Consolidated Statements of Operations for the years ended December 31, 2017, 2016 and 2015;
 - Consolidated Statements of Comprehensive Income (Loss) for the years ended December 31, 2017, 2016 and 2015;
 - Consolidated Balance Sheets at December 31, 2017 and 2016;
 - Consolidated Statements of Equity for the years ended December 31, 2017, 2016 and 2015;
 - Consolidated Statements of Cash Flows for the years ended December 31, 2017, 2016 and 2015; and
 - Notes to Consolidated Financial Statements
- (b) Schedule II — Valuation and Qualifying Accounts and Reserves for the years ended December 31, 2017, 2016 and 2015, contained on page 116 of this Annual Report on Form 10-K. All other schedules have been omitted because the material is not applicable or is not required as permitted by the rules and regulations of the U.S. Securities and Exchange Commission, or the required information is included in the consolidated financial statements.
- (c) The exhibits listed in the Exhibit Index beginning on page 117 of this Annual Report on Form 10-K.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this Annual Report on Form 10-K to be signed on its behalf by the undersigned, thereunto duly authorized.

FERRO CORPORATION

By /s/ Peter T. Thomas
Peter T. Thomas
Chairman, President and Chief Executive Officer

Date: February 28, 2018

Pursuant to the requirements of the Securities Exchange Act of 1934, this Annual Report on Form 10-K has been signed below by the following persons on behalf of the Registrant and in their indicated capacities as of the 28th day of February, 2018.

<u>/s/ Peter T. Thomas</u> Peter T. Thomas	Chairman, President and Chief Executive Officer (Principal Executive Officer)
<u>/s/ Benjamin J. Schlater</u> Benjamin J. Schlater	Vice President and Chief Financial Officer (Principal Financial Officer)
<u>/s/ James A. Barna</u> James A. Barna	Corporate Controller and Chief Accounting Officer (Principal Accounting Officer)
<u>/s/ Richard J. Hipple</u> Richard J. Hipple	Director
<u>Gregory E. Hyland</u>	Director
<u>/s/ David A. Lorber</u> David A. Lorber	Director
<u>/s/ Marran H. Ogilvie</u> Marran H. Ogilvie	Director
<u>/s/ Andrew M. Ross</u> Andrew M. Ross	Director
<u>/s/ Allen A. Spizzo</u> Allen A. Spizzo	Director
<u>/s/ Ronald P. Vargo</u> Ronald P. Vargo	Director

FERRO CORPORATION AND SUBSIDIARIES
SCHEDULE II — VALUATION AND QUALIFYING ACCOUNTS AND RESERVES
Years Ended December 31, 2017, 2016 and 2015

	<u>Balance at Beginning of Period</u>	<u>Additions Charged (Reductions Credited) to Costs and Expenses</u>	<u>Deductions</u>	<u>Adjustment for Differences in Exchange Rates</u>	<u>Balance at End of Period</u>
	(Dollars in thousands)				
Allowance for Possible Losses					
on Collection of Accounts					
Receivable:					
Year ended December 31, 2017	\$ 8,166	44	(1,253)	864	\$ 7,821
Year ended December 31, 2016	\$ 7,784	1,383	(820)	(181)	\$ 8,166
Year ended December 31, 2015	\$ 10,325	667	(1,802)	(1,406)	\$ 7,784
Valuation Allowance on Net					
Deferred Tax Assets:					
Year ended December 31, 2017	\$ 37,354	—	(5,648) ¹	873	\$32,579
Year ended December 31, 2016	\$ 55,043	—	(16,686) ¹	(1,003)	\$37,354
Year ended December 31, 2015	\$147,887	—	(86,597) ¹	(6,247)	\$55,043

(1) Included within this deduction is \$0.8 million, \$6.8 million and \$63.3 million for the years ended December 31, 2017, 2016, and 2015 respectively, of valuation allowance release, resulting from the conclusion that the underlying deferred tax assets are more likely than not to be realized.

EXHIBIT INDEX

The following exhibits are filed with this report or are incorporated here by reference to a prior filing in accordance with Rule 12b-32 under the Securities and Exchange Act of 1934.

Exhibit:

- 2 Plan of acquisition, reorganization, arrangement or successor:
- 2.1 Sale and Purchase Agreement, dated April 29, 2015, by and among Ferro Corporation, the sellers party thereto, Corporación Química Vhem, S.L. and Dibon USA, LLC (incorporated by reference to Exhibit 2.1 to Ferro Corporation's Current Report on Form 8-K filed July 9, 2015).
- 2.2 Addendum to Sale and Purchase Agreement, dated July 7, 2015, by and among Ferro Corporation, Ferro Spain Management Company, S.L.U., the sellers party thereto, Corporación Química Vhem, S.L. and Dibon USA, LLC (incorporated by reference to Exhibit 2.2 to Ferro Corporation's Current Report on Form 8-K filed July 9, 2015).
- 3 Articles of Incorporation and by-laws:
- 3.1 Eleventh Amended Articles of Incorporation of Ferro Corporation (incorporated by reference to Exhibit 4.1 to Ferro Corporation's Registration Statement on Form S-3, filed March 5, 2008).
- 3.2 Certificate of Amendment to the Eleventh Amended Articles of Incorporation of Ferro Corporation filed December 29, 1994 (incorporated by reference to Exhibit 4.2 to Ferro Corporation's Registration Statement on Form S-3, filed March 5, 2008).
- 3.3 Certificate of Amendment to the Eleventh Amended Articles of Incorporation of Ferro Corporation filed June 23, 1998 (incorporated by reference to Exhibit 4.3 to Ferro Corporation's Registration Statement on Form S-3, filed March 5, 2008).
- 3.4 Certificate of Amendment to the Eleventh Amended Articles of Incorporation of Ferro Corporation filed October 14, 2011 (incorporated by reference to Exhibit 3.1 to Ferro Corporation's Current Report on Form 8-K, filed October 17, 2011).
- 3.5 Certificate of Amendment to the Eleventh Amended Articles of Incorporation of Ferro Corporation filed on April 25, 2014 (incorporated by reference to Exhibit 3.5 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2014).
- 3.6 Ferro Corporation Amended and Restated Code of Regulations; Amended and Restated as of December 8, 2016 (incorporated by reference to Exhibit 3.1 to Ferro Corporation's Current Report on Form 8-K filed December 12, 2016).
- 4 Instruments defining rights of security holders, including indentures:

The Company agrees, upon request, to furnish to the U.S. Securities and Exchange Commission a copy of any instrument authorizing long-term debt that does not authorize debt in excess of 10% of the total assets of the Company and its subsidiaries on a consolidated basis.
- 10 Material Contracts:
- 10.1 Credit Agreement, dated as of February 14, 2017, among Ferro Corporation, the lenders party thereto, PNC Bank, National Association, as the administrative agent, collateral agent and a letter of credit issuer, Deutsche Bank AG New York Branch, as the syndication agent and as a letter of credit issuer, and the various financial institutions and other persons from time to time party thereto (incorporated by reference to Exhibit 10.1 to Ferro Corporation's current Report on Form 8-K, filed February 17, 2017).

- 10.2 Credit Agreement, dated as of July 31, 2014, among Ferro Corporation, the lenders party thereto, PNC Bank, National Association, as the administrative agent, collateral agent and a letter of credit issuer, JPMorgan Chase Bank N.A., as the syndication agent and as a letter of credit issuer, and the various financial institutions and other persons from time to time party hereto (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed August 5, 2014).
- 10.3 Incremental Assumption Agreement, dated January 25, 2016, by and among Ferro Corporation, PNC Bank, National Association, as the administrative agent, the collateral agent and as an issuer, JPMorgan Chase Bank, N.A., as an issuer, and various financial institutions as lenders (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K filed January 26, 2016).
- 10.4 Second Incremental Assumption Agreement, dated August 29, 2016, by and among Ferro Corporation, PNC Bank, National Association, as the administrative agent, the collateral agent and as an issuer, JPMorgan Chase Bank, N.A., as an issuer, and various financial institutions as lenders. (incorporated by reference to Exhibit 10.1 to Ferro Corporation's current Report on Form 8K, filed August 30, 2016).
- 10.5 Retention Agreement, dated September 1, 2016, by and between Jeffrey L. Rutherford and Ferro Corporation (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended September 30, 2016).*
- 10.6 Separation Agreement and Release, dated January 3, 2017, by and between Jeffrey L. Rutherford and Ferro Corporation. (incorporated by reference to Exhibit 10.4 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2017).*
- 10.7 Change in Control Agreement, dated September 1, 2016, by and between Benjamin Schlater and Ferro Corporation. (incorporated by reference to Exhibit 10.5 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2017).*
- 10.8 Second Amendment to Purchase and Contribution Agreement by and between Ferro Corporation and Ferro Finance Corporation (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Current Report on Form 8-K, filed April 3, 2013).
- 10.9 First Amendment to Purchase and Contribution Agreement, dated as of May 31, 2011, between Ferro Corporation and Ferro Finance Corporation (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Current Report on Form 8-K, filed June 3, 2011).
- 10.10 Purchase and Contribution Agreement, dated June 2, 2009, between Ferro Corporation and Ferro Finance Corporation (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Current Report on Form 8-K, filed June 3, 2009).
- 10.11 Fourth Amendment to Amended and Restated Receivables Purchase Agreement, dated as of September 20, 2013, by and among PNC Bank, National Association, Ferro Finance Corporation and Market Street Funding LLC (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Quarter Report on Form 10-Q for the quarter ended September 30, 2013).
- 10.12 Third Amendment to Amended and Restated Receivables Purchase Agreement, dated as of May 28, 2013, among Ferro Finance Corporation, Ferro Corporation, Market Street Funding LLC and PNC Bank, National Association (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 30, 2013).
- 10.13 Second Amendment to Amended and Restated Receivables Purchase Agreement among Ferro Finance Corporation, Ferro Corporation, Market Street Funding LLC and PNC Bank, National Association, as Agent and LC Bank (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed April 3, 2013).

- 10.14 First Amendment to Amended and Restated Receivables Purchase Agreement, dated as of May 29, 2012, among Ferro Finance Corporation, Ferro Corporation, Market Street Funding, LLC, and PNC Bank, National Association (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 31, 2012).
- 10.15 Amended and Restated Receivables Purchase Agreement, dated as of May 31, 2011, among Ferro Finance Corporation, Ferro Corporation, Market Street Funding, LLC, and PNC Bank, National Association (incorporated by reference to Exhibit 10.3 to Ferro Corporation's Current Report on Form 8-K, filed June 3, 2011).
- 10.16 Ferro Corporation 2006 Long-Term Incentive Plan (incorporated by reference to Exhibit 10.17 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2011).*
- 10.17 Form of Terms of Nonstatutory Stock Option Grants under the Ferro Corporation 2006 Long-Term Incentive Compensation Plan (incorporated by reference to Exhibit 10.21 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2008).*
- 10.18 Form of Terms of Performance Share Awards under the Ferro Corporation 2006 Long-Term Incentive Compensation Plan (incorporated by reference to Exhibit 10.22 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2008).*
- 10.19 Form of Terms of Restricted Share Awards under the Ferro Corporation 2006 Long-Term Incentive Compensation Plan (incorporated by reference to Exhibit 10.23 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2008).*
- 10.20 Form of Terms of Deferred Stock Unit Awards under the Ferro Corporation 2013 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2014).*
- 10.21 Form of Terms of Deferred Stock Unit Awards under the Ferro Corporation 2006 Long-Term Incentive Compensation Plan (incorporated by reference to Exhibit 10.24 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2008).*
- 10.22 Ferro Corporation 2010 Long-Term Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 6, 2010).*
- 10.23 Form of Terms of Nonstatutory Stock Option Grants under the Ferro Corporation 2010 Long-Term Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2012).*
- 10.24 Form of Terms of Performance Share Unit Awards under the Ferro Corporation 2010 Long-Term Incentive Plan (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2012).*
- 10.25 Form of Terms of Restricted Share Unit Awards under the Ferro Corporation 2010 Long-Term Incentive Plan (incorporated by reference to Exhibit 10.3 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2012).*
- 10.26 Ferro Corporation 2013 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 23, 2013).*
- 10.27 Form of Terms of Nonstatutory Stock Options Grants under the Ferro Corporation 2013 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.5 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2013).*
- 10.28 Form of Terms of Performance Share Unit Awards under the Ferro Corporation 2013 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.6 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2013).*

- 10.29 Form of Terms of Restricted Share Unit Awards under the Ferro Corporation 2013 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.7 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2013).*
- 10.30 Terms of Retention Restricted Stock Units Award for Mr. Peter T. Thomas (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed on December 30, 2014).*
- 10.31 Amendment to the Ferro Corporation Deferred Compensation Plan for Executive Employees (incorporated by reference to Exhibit 10.18 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2009).*
- 10.32 Ferro Corporation Deferred Compensation Plan for Executive Employees (incorporated by reference to Exhibit 10.28 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2012).*
- 10.33 Ferro Corporation Deferred Compensation Plan for Non-Employee Directors (incorporated by reference to Exhibit 10.29 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2012).*
- 10.34 Ferro Corporation Deferred Compensation Plan for Non-Employee Directors Trust Agreement (incorporated by reference to Exhibit 10.26 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2011).*
- 10.35 Ferro Corporation Supplemental Defined Benefit Plan for Executive Employees (incorporated by reference to Exhibit 10.31 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2012).*
- 10.36 Amendment to the Ferro Corporation Supplemental Defined Contribution Plan for Executive Employees (incorporated by reference to Exhibit 10.23 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2009).*
- 10.37 Ferro Corporation Supplemental Defined Contribution Plan for Executive Employees (incorporated by reference to Exhibit 10.33 to Ferro Corporation's Annual Report on Form 10-K for the year ended December 31, 2012).*
- 10.38 Form of Indemnification Agreement (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed June 26, 2013).*
- 10.39 Change in Control Agreement, dated March 22, 2013, between Peter T. Thomas and Ferro Corporation (incorporated by reference to Exhibit 10.5 to Ferro Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2013).*
- 10.40 Form of Change in Control Agreement, dated January 1, 2009, entered into by and between Mark H. Duesenberg, and Ferro Corporation (incorporated by reference to Exhibit 10.2 to Ferro Corporation's Current Report on Form 8-K, filed January 7, 2009).*
- 10.41 Ferro Corporation Executive Separation Policy (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed June 28, 2010).*
- 10.42 Letter Agreement, dated November 12, 2012, between Peter T. Thomas and Ferro Corporation (incorporated by reference to Exhibit 10.41 to Ferro Corporation's Form 10-K for the year ended December 31, 2012).*
- 10.43 Letter Agreement, dated November 12, 2012, between Jeffrey L. Rutherford and Ferro Corporation (incorporated by reference to Exhibit 10.42 to Ferro Corporation's Form 10-K for the year ended December 31, 2012).*
- 21 List of Subsidiaries.

23.1	Consent of Independent Registered Public Accounting Firm.
31.1	Certification of Principal Executive Officer Pursuant to Rule 13a-14(a)/15d-14(a).
31.2	Certification of Principal Financial Officer Pursuant to Rule 13a-14(a)/15d-14(a).
32.1	Certification of Principal Executive Officer Pursuant to 18 U.S.C. 1350.
32.2	Certification of Principal Financial Officer Pursuant to 18 U.S.C. 1350.
101	XBRL Documents:
101.INS	XBRL Instance Document.**

* Indicates management contract or compensatory plan, contract or arrangement in which one or more Directors and/or executives of Ferro Corporation may be participants.

** In accordance with Rule 406T of Regulation S-T, the XBRL related information in Exhibit 101 to this Annual Report on Form 10-K shall not be deemed to be “filed” for purposes of Section 18 of the Securities Exchange Act of 1934, or otherwise subject to the liability of that section, and shall not be part of any registration statement or other document filed under the Securities Act of 1933 or the Securities Exchange Act of 1934, except as shall be expressly set forth by specific reference in such filing.

To supplement the consolidated financial statements presented in accordance with U.S. GAAP in this Annual Report on Form 10-K, certain non-GAAP financial measures as defined by SEC rules are used in the Shareholders Letter. The non-GAAP measures included in this Annual Report have been reconciled to the comparable U.S. GAAP measures within the tables shown on the following pages.

Ferro Corporation and Subsidiaries
Reconciliation of Reported to Adjusted Financials
For the Twelve Months Ended December 31, 2017, 2016, 2015, 2014 and 2013
(Unaudited)

(Dollars in millions)	Net Sales				Gross Profit					Gross Margin	
	PCG	CS	PC	Ferro Total	PCG	CS	PC	Other	Ferro Total	Ferro Total	
	2017										
As Reported from Continuing Operations (GAAP)	\$ 444.7	\$ 358.1	\$ 594.0	\$ 1,396.7	\$ 157.5	\$ 113.7	\$ 145.8	\$ (0.8)	\$ 416.2	29.8%	
Special Items:											
Non-GAAP Adjustments ¹					2.1	2.8	3.1	0.2	8.2		
Total Special Items	—	—	—	—	2.1	2.8	3.1	0.2	8.2		
Constant Currency FX Impact ²				—					—		
As Adjusted from Continuing Operations (Non-GAAP measure)	\$ 444.7	\$ 358.1	\$ 594.0	\$ 1,396.7	\$ 159.6	\$ 116.5	\$ 148.9	\$ (0.6)	\$ 424.4	30.4%	
	2016										
As Reported from Continuing Operations (GAAP)	\$ 371.5	\$ 246.8	\$ 527.0	\$ 1,145.3	\$ 133.7	\$ 84.3	\$ 139.5	\$ (6.2)	\$ 351.2	30.7%	
Special Items:											
Non-GAAP Adjustments ¹					2.6	0.2	—	5.5	8.3		
Total Special Items	—	—	—	—	2.6	0.2	—	5.5	8.3		
Constant Currency FX Impact ²	2.6	1.2	(4.7)	(0.8)	0.8	0.1	(0.6)	(0.0)	0.3		
As Adjusted from Continuing Operations (Non-GAAP measure)	\$ 374.1	\$ 248.1	\$ 522.3	\$ 1,144.4	\$ 137.1	\$ 84.6	\$ 138.9	\$ (0.7)	\$ 359.9	31.4%	
	2015										
As Reported from Continuing Operations (GAAP)	\$ 376.8	\$ 165.2	\$ 533.4	\$ 1,075.3	\$ 128.2	\$ 45.7	\$ 126.9	\$ 0.8	\$ 301.7	28.1%	
Special Items:											
Sold Business Venezuela			(8.4)	(8.4)			0.7		0.7		
Nubiola Purchase Price Adj ("PPA")						5.8			5.8		
Non-GAAP Adjustments ¹								(1.8)	(1.8)		
Total Special Items	—	—	(8.4)	(8.4)	—	5.8	0.7	(1.8)	4.7		
Constant Currency FX Impact ²	(2.3)	1.0	(32.6)	(33.9)	(0.9)	0.2	(6.2)	(0.0)	(6.9)		
As Adjusted from Continuing Operations (Non-GAAP measure)	\$ 374.4	\$ 166.2	\$ 492.3	\$ 1,033.0	\$ 127.3	\$ 51.7	\$ 121.4	\$ (1.0)	\$ 299.5	29.0%	
	2014										
As Reported from Continuing Operations (GAAP)	\$ 407.7	\$ 115.4	\$ 588.5	\$ 1,111.6	\$ 135.0	\$ 28.5	\$ 131.0	\$ (9.4)	\$ 285.1	25.6%	
Special Items:											
Sold Business Venezuela			(19.8)	(19.8)			(3.4)		(3.4)		
Non-GAAP Adjustments ¹								5.7	5.7		
Total Special Items	—	—	(19.8)	(19.8)	—	—	(3.4)	5.7	2.3		
Constant Currency FX Impact ²	(37.1)	(4.9)	(98.0)	(140.0)	(11.9)	(1.0)	(20.8)	(0.1)	(33.7)		
As Adjusted from Continuing Operations (Non-GAAP measure)	\$ 370.6	\$ 110.5	\$ 470.7	\$ 951.8	\$ 123.1	\$ 27.6	\$ 106.9	\$ (3.8)	\$ 253.7	26.6%	
	2013										
As Reported from Continuing Operations (GAAP)	\$ 390.0	\$ 198.2	\$ 600.4	\$ 1,188.6	\$ 112.8	\$ 36.2	\$ 134.1	\$ (5.5)	\$ 277.7	23.4%	
Special Items:											
Sold Business Venezuela and Metal Powders & Solar product lines		(83.0)	(19.0)	(102.0)		(6.0)	(3.6)		(9.6)		
Non GAAP Adjustments ¹								4.0	4.0		
Total Special Items	—	(83.0)	(19.0)	(102.0)	—	(6.0)	(3.6)	4.0	(5.6)		
Constant Currency FX Impact ²	(43.6)	(5.5)	(109.3)	(158.4)	(11.5)	(0.6)	(21.8)	(0.1)	(34.0)		
As Adjusted from Continuing Operations (Non GAAP measure)	\$ 346.4	\$ 109.7	\$ 472.1	\$ 928.2	\$ 101.3	\$ 29.7	\$ 108.7	\$ (1.6)	\$ 238.1	25.7%	

- Non-GAAP adjustments are associated with several different types of non-recurring items that were recorded in "Cost of Sales" during the five years covered in the table above. For 2017 and 2016, the adjustments to "Cost of Sales" primarily include the amortization of purchase accounting adjustments related to our recent acquisitions, other acquisition costs, and pension and other post-retirement mark-to-market adjustments and settlements. For 2015, 2014 and 2013, the adjustments to "Cost of Sales" primarily relate to pension and other post-retirement mark-to-market adjustments and settlements.
- Reflects the remeasurement of 2016, 2015, 2014 and 2013 reported and adjusted results using 2017 average exchange rates, resulting in a constant currency comparative figures to 2017 reported and adjusted results.

It should be noted that adjusted net sales and adjusted gross profit referred to above are financial measures not required by, or presented in accordance with, accounting principles generally accepted in the United States (U.S. GAAP). These non-GAAP financial measures should be considered as a supplement to, and not as a substitute for, the financial measures prepared in accordance with U.S. GAAP and a reconciliation of these financial measures to the most comparable U.S. GAAP financial measures is presented. We believe this data provides investors with additional information on the underlying operations and trends of the business and enables period-to-period comparability of financial performance.

Ferro Corporation and Subsidiaries
Reconciliation of Adjusted EBITDA from Continuing Operations
For the Twelve Months Ended December 31, 2017, 2016, 2015, 2014 and 2013
(Unaudited)

(Dollars in millions)	<u>2017</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>
Net income (loss) attributable to Ferro Corporation common shareholders (GAAP)	\$ 57.1	\$ (20.8)	\$ 64.1	\$ 86.1	\$ 71.9
Net income (loss) attributable to noncontrolling interests	0.7	0.9	(1.0)	0.2	0.5
Loss (income) from discontinued operations, net of income taxes	—	64.5	36.8	(94.8)	(8.5)
Restructuring and impairment charges	11.4	15.9	9.7	8.8	40.9
Other expense, net	7.9	9.6	5.2	16.0	(12.4)
Interest expense	27.8	21.5	15.2	16.3	20.2
Income tax expense (benefit)	52.8	17.9	(45.1)	(34.2)	14.3
Depreciation and amortization	53.6	48.2	42.2	34.3	37.7
Less: interest amortization expense and other	(3.5)	(1.4)	(1.1)	(3.1)	(2.9)
Cost of sales Non-GAAP adjustments	8.2	4.7	0.8	5.7	4.0
SG&A Non-GAAP adjustments	18.3	33.6	28.1	94.6	(62.4)
Sold Business Venezuela	—	—	(1.8)	(1.7)	(2.4)
Adjusted EBITDA (Non-GAAP measure) from continuing operations¹	\$ 234.2	\$ 194.6	\$ 152.9	\$ 128.1	\$ 100.8

1. Adjusted EBITDA from continuing operations is net income (loss) attributable to Ferro Corporation common shareholders before the effects of income (loss) attributable to noncontrolling interest, loss (income) from discontinued operations, net of income taxes, restructuring and impairment charges, other expense net, interest expense, income tax expense (benefit), depreciation and amortization, non-GAAP adjustments to cost of sales and non-GAAP adjustments to SG&A.

It should be noted that Adjusted EBITDA from continuing operations is a financial measure not required by, or presented in accordance with, accounting principles generally accepted in the United States (U.S. GAAP). This non-GAAP financial measure should be considered as a supplement to, and not as a substitute for, the financial measures prepared in accordance with U.S. GAAP and a reconciliation of this financial measure to the most comparable U.S. GAAP financial measure is presented. We believe this data provides investors with additional information on the underlying operations and trends of the business and enables period-to-period comparability of financial performance.

Ferro Corporation and Subsidiaries
Reconciliation of Adjusted Cash Flow from Continuing Operations
For the Twelve Months Ended December 31, 2017, 2016, 2015, 2014 and 2013
(Unaudited)

(Dollars in millions)	<u>2017</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>
Net income (loss) attributable to Ferro Corporation common shareholders (GAAP)	\$ 57.1	\$ (20.8)	\$ 64.1	\$ 86.1	\$ 71.9
Net income (loss) attributable to noncontrolling interests	0.7	0.9	(1.0)	0.2	0.5
Loss (income) from discontinued operations, net of income taxes	—	64.5	36.8	(94.8)	(8.5)
Restructuring and impairment charges	11.4	15.9	9.7	8.8	40.9
Other expense, net	7.9	9.6	5.2	16.0	(12.4)
Interest expense	27.8	21.5	15.2	16.3	20.2
Income tax expense (benefit)	52.8	17.9	(45.1)	(34.2)	14.3
Depreciation and amortization	53.6	48.2	42.2	34.3	37.7
Less: interest amortization expense and other	(3.5)	(1.4)	(1.1)	(3.1)	(2.9)
Cost of sales Non-GAAP adjustments	8.2	4.7	0.8	5.7	4.0
SG&A Non-GAAP adjustments	18.3	33.6	28.1	94.6	(62.4)
Adjusted EBITDA (Non-GAAP measure)	234.2	194.6	154.7	129.8	103.2
Capital expenditures	(34.2)	(24.0)	(20.3)	(14.1)	(22.3)
Working capital	(42.8)	(33.3)	(5.4)	(4.8)	38.8
Cash income taxes	(25.7)	(19.7)	(21.4)	(9.4)	(5.8)
Cash interest	(26.9)	(17.5)	(16.2)	(28.5)	(26.8)
Pension	(4.5)	(5.3)	(4.1)	(28.8)	(29.1)
Incentive compensation	(12.2)	(8.8)	(14.6)	(21.6)	(0.7)
Other	2.2	(0.6)	2.7	14.4	(29.8)
Sold Business Venezuela	—	—	0.9	0.4	(1.5)
Adjusted Cash Flow from Continuing Operations (Non-GAAP measure)¹	\$ 90.1	\$ 85.4	\$ 76.4	\$ 37.4	\$ 26.0

1. Adjusted cash flow from continuing operations is Adjusted EBITDA less capital expenditures, changes in working capital, cash income taxes, cash interest, pension contributions, incentive compensation payments and other continuing operating cash items.

It should be noted that adjusted cash flow from continuing operations is a financial measure not required by, or presented in accordance with, accounting principles generally accepted in the United States (U.S. GAAP). This non-GAAP financial measure should be considered as a supplement to, and not as a substitute for, the financial measure prepared in accordance with U.S. GAAP, and a reconciliation of this financial measure to the most comparable U.S. GAAP financial measure is presented. We believe this data provides investors with additional information on the underlying operations and trends of the business and enables period-to-period comparability of financial performance.

Ferro Corporation and Subsidiaries
Reconciliation of Adjusted Diluted Earnings per Share
For the Twelve Months Ended December 31, 2017, 2016, 2015, 2014 and 2013
(Unaudited)

	<u>2017</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>
Diluted earnings (loss) per share (GAAP)	\$ 0.67	\$(0.25)	\$ 0.72	\$ 0.99	\$ 0.82
Special items:					
Impairment	—	—	—	—	0.07
Restructuring	0.10	0.18	0.07	0.06	0.23
Pension ¹	(0.03)	0.16	0.10	0.63	(0.51)
Other ²	0.55	0.25	(0.45)	0.23	(0.02)
Taxes ³	—	—	—	(0.21)	(0.16)
Discontinued operations	—	0.76	0.42	(1.08)	(0.10)
Noncontrolling interest	—	—	(0.02)	—	—
Total special items⁴	0.62	1.34	0.12	(0.37)	(0.49)
Adjusted diluted earnings per share from continuing operations (Non GAAP measure)	\$ 1.29	\$ 1.09	\$ 0.85	\$ 0.62	\$ 0.33

1. Pension and other post-retirement benefit mark-to-market adjustments and settlements.
2. For 2017, the adjustments to “Other” relates to the amortization of purchase accounting adjustments related to our recent acquisitions, other acquisition costs, legal, professional and other expenses related to certain business development activities, FX loss incurred on our Euro-denominated term loan, a loss on an equity method investment, gains and losses on asset sales, debt extinguishment charges, a gain on adjustment of a liability related to a divested business in Argentina, and the gain recognized on increasing our ownership interest in Gardenia. In addition to the tax impacts to adjustments at statutory rates in note 3 below, an adjustment has also been made to adjust for the impact associated with the Tax Cut and Jobs Act that was recorded in the fourth quarter. For 2016, the adjustments to “Other” relates to the amortization of purchase accounting adjustments related to our recent acquisitions, legal, professional and other expenses related to certain business development activities, the gain on an asset sale that was recognized during the year, the finalization of the purchase price for the acquisition of Vettriceramici, impacts of currency-related items in Egypt and the impact of the loss on a foreign currency contract associated with the purchase of Cappelle. For 2015, the adjustments to “Other” relates to currency related items in Venezuela, legal, professional and other expenses related to certain business development activities and the loss on a foreign currency contract associated with the purchase of Nubiola. For 2014 and 2013, the adjustments to “Other” relates to certain severance costs, ongoing costs at facilities that have been idled, gain/loss on divestitures, proxy contest related costs, certain business development activities, and certain costs related to divested assets and product lines.
3. For 2017, 2016 and 2015, the tax rate reflects the reported tax rate, adjusted for non-GAAP adjustments being tax effected at the respective statutory rate where the item originated. For 2014 and 2013, adjustment of reported income and of special items to a normalized 36% tax rate.
4. Due to rounding, total earnings per share related to special items does not always add to the total adjusted earnings per share.

Officers and Board of Directors



Leadership Team (left to right)

Julio Garcia

Vice President, Europe & Performance Coatings

Joseph Vitale

Vice President, Corporate Development

Lori P. Saviers

Vice President, Global Sourcing and Supply Chain

Pepe Tortajada

Vice President, Human Resources

Mark H. Duesenberg

Vice President, General Counsel and Secretary

Dieter Binder

Vice President, Europe & Performance Colors and Glass

Peter T. Thomas

Chairman, President and Chief Executive Officer

Matthias Bell

Vice President, Americas & Color Solutions

Benjamin Schlater

Vice President and Chief Financial Officer

Barry Misquitta

Vice President, Asia Pacific



Peter T. Thomas

Chairman
Director since 2013



David A. Lorber

Lead Director
Director since 2013



Richard J. Hipple*

Director since 2007



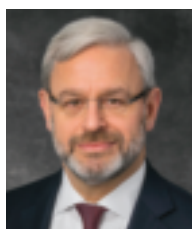
Gregory E. Hyland

Director since 2009



Marran Ogilvie

Director since 2017



Andrew M. Ross

Director since 2016



Allen A. Spizzo

Director since 2016



Ronald P. Vargo

Director since 2009

Shareholder Information

Exchange Listing

New York Stock Exchange Common Stock
Stock symbol: FOE

Executive Offices

Ferro Corporation, 6060 Parkland Boulevard,
Suite 250, Mayfield Heights, OH 44124
216-875-5600

Investor Contact

Kevin Cornelius Grant
Head of Investor Relations
216-875-5451 investor@ferro.com

Form 10-K

Ferro Corporation's Form 10-K report filed with the Securities and Exchange Commission for the year ended December 31, 2017, is available to shareholders at no cost at the Company's website (ferro.com) or upon request.

Automatic Dividend Reinvestment and Stock Purchase Plan

This Plan provides an opportunity for shareholders to purchase additional shares of Ferro common stock by automatic reinvestment of dividends and by optional periodic cash payments. The Plan is administered by Computershare. Any questions or correspondence about the Plan should be addressed to:

Computershare

P.O. Box 30170, College Station, TX 77842-3170
800-622-6757 (U.S., Canada, Puerto Rico)
781-575-4735 (Non-U.S.)
web.queries@computershare.com

Brokerage Accounts

To reduce communication delays that exist for some Ferro shareholders who hold their stock in brokerage accounts, the Company will send its various printed communications directly to such shareholders. If you would like to take advantage of this service, please write to:

Treasury Department

Ferro Corporation, 6060 Parkland Boulevard,
Suite 250, Mayfield Heights, OH 44124, U.S.A.

Please indicate the number of Ferro shares owned and the name and address of the brokerage firm that administers your account.

Stock Transfer Agent/Registrar and Dividend Disbursing Agent

Computershare
P.O. Box 30170, College Station, TX 77842-3170
800-622-6757 (U.S., Canada, Puerto Rico)
781-575-4735 (Non-U.S.)
web.queries@computershare.com

Independent Registered Public Accounting Firm

Deloitte & Touche LLP
127 Public Square, Suite 3300
Cleveland, OH 44114

*Director through 2018 Annual Meeting of Shareholders



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