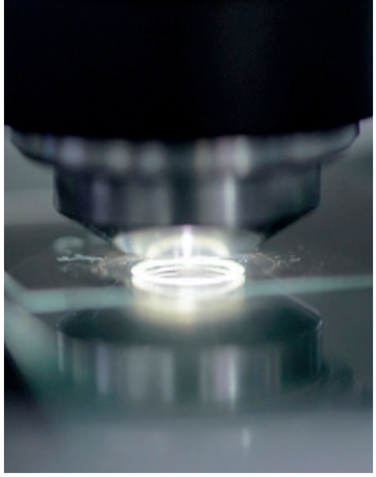
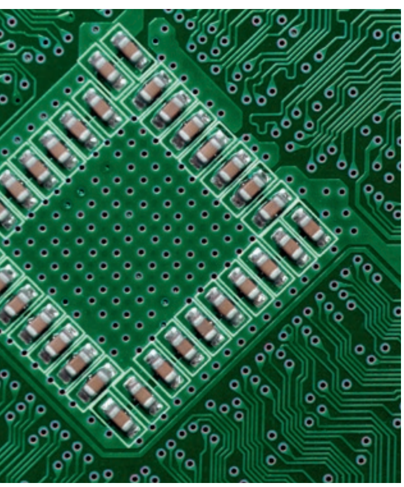


FERRO

Ferro now has a more resilient, high-margin and coherent portfolio with technology-driven innovation as the catalyst for sustainable value creation.



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A GENESIS OF GREATER VALUE CREATION

ANNUAL REPORT 2020 AND FORM 10-K

Peer set based on companies disclosed in Ferro 2020 proxy statement including Compass, HB Fuller, Hexcel, Innospec, Koppers Holding, Kraton Performance Polymers, Minerals Technology, NewMarket, Quaker, Rayonier, Sensient Technologies, Stepan, Tronox.
Source: CapitalIQ

ABOUT FERRO CORPORATION

Ferro Corporation (www.ferro.com) 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 are: Functional Coatings and Color Solutions. Headquartered in Mayfield Heights, Ohio, the Company currently has approximately 3,500 associates globally and reported 2020 sales of $959 million.

The Genesis phase of our value creation strategy reflects Ferro's transformation into a nimble technology-led and innovation-driven functional coatings and color solutions company focused on specialty materials used in high-growth markets. In this phase of our strategy, Ferro is focused on three strategic priorities.

GROWTH

Growth as a specialty materials company, with our portfolio of niche, high-value, high-margin products in high-growth markets. This includes broadening the scope of functional coatings and color solutions into new, attractive areas.

INNOVATION

Heightened focus on innovation to further strengthen Ferro's market leadership positions with new functional coatings and color solutions products and applications that address customer needs with creative solutions and market-leading products.

OPTIMIZATION

Ongoing optimization initiatives to drive efficiency and deliver overall margin enhancement across our global operations.

FELLOW SHAREHOLDERS:

As I reflect on 2020, I find many reasons to be proud of how the Ferro team adapted to the challenges of economic uncertainty and a global pandemic, while continuing to execute on our strategic priorities. Our commitment to the safety of our associates and service to our customers never wavered, and our financial performance strengthened through the year.

We have transformed Ferro into a more agile company with a focused, yet diverse portfolio of functional coatings and color solutions products and services. And we have entered 2021 fully focused on seizing opportunities to accelerate growth and create additional value.

Our financial performance through 2020 demonstrated the quality of our business. After the initial impact of the pandemic, we experienced a "V-shaped" recovery, with growing sales and gross profit. In the second half of the year we experienced growing demand across multiple product lines, especially for products sold into growing industries where the pandemic accelerated behavior changes, such as mobility, smart products and consumer technology. The breadth of both our product portfolio and our markets helped protect Ferro from the more precipitous and enduring declines in demand experienced by some companies.

ACCELERATING FORWARD

In this phase of our value creation strategy, following the successful sale of the Tile Coatings business, Ferro is capitalizing on the strategic actions we have taken in earlier phases to invest in technology platforms, align product innovation with macrotrends and intensify our focus on higher margin, higher growth markets. We have changed the structure of our commercial organization to enhance coordination and efficiency across sales, marketing and R&D. This should enable us to further strengthen our market leadership positions and to develop new products and new applications that make next-generation products smarter, more efficient and more sustainable.

Ferro now has a more balanced end market and regional presence and targets markets with stronger

underlying growth potential. We have a less cyclical, more technology-led and innovation-driven business with a more streamlined global footprint.

Our strategic priorities for 2021 include driving technology-led innovation in high-margin, high-growth markets, expanding our market leadership positions and continuing to invest in R&D to support our customers and enter new markets. We also are focused on continuing to remove stranded costs following the sale of the Tile Coatings business and optimizing our global operations.

Safety will continue to be a paramount priority.

LOOKING AHEAD

Functional coatings and color solutions are the core of our business. The quality of Ferro's products, along with our technical expertise and customer partnerships, provides exciting opportunities in markets including digital printing, smart cars, IoT, 5G applications, next-generation LED lighting, environmental chemistry, energy efficiency and the healthcare industry. Inorganic growth remains a strategic priority. We anticipate selectively evaluating bolt-on acquisitions to complement and expand our product portfolio in high-margin, high-growth areas.

While there are still uncertainties in the global economy, Ferro is well-positioned for attractive, sustainable growth and profitability. I would like to thank our shareholders, our employees, our customers and all our stakeholders for their confidence and support.

Peter T. Thomas
Chairman, President and
Chief Executive Officer

March 19, 2021

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, 2020

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	**34-0217820**
(State or Other Jurisdiction of Incorporation or Organization)	*(IRS Employer Identification No.)*

6060 Parkland Blvd. **Suite 250** **Mayfield Heights, OH**	**44124**
(Address of Principal Executive Offices)	*(Zip Code)*

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

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

Title of Each Class	Trading Symbol(s)	Name of Each Exchange on Which Registered
Common Stock, par value $1.00	FOE	NYSE

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

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

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

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

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

Large accelerated filer ☒ Accelerated filer ☐ Non-accelerated filer ☐ Smaller reporting company ☐ Emerging growth company ☐

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

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(c)) by the registered public accounting firm that prepared or issued its audit report. ☒

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the 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, 2020, was approximately $964,203,000.

On January 31, 2021, there were 82,384,177 shares of Ferro Corporation Common Stock, par value $1.00 outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Proxy Statement for Ferro Corporation's 2021 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 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 end products and manufacturing processes of our customers; and color solutions, which provide performance and aesthetic characteristics to our customers’ products. Our products are manufactured in approximately 48 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 have proven expertise in dispersing 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 our Company in our industry by innovation, development of new products and services, 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 two reportable segments, listed below:

- Tile Coating Systems(1)
- Porcelain Enamel(2)
- Functional Coatings
- Color Solutions

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(1) Tile Coating Systems was historically a part of Performance Coatings reportable segment. As of December 31, 2019, the results of the Tile Coatings business portion of Tile Coating Systems are reported as discontinued operations, for financial reporting purposes.

(2) Porcelain Enamel, previously a part of the Performance Coatings reportable segment, is integrated into the Functional Coatings reportable segment, for financial reporting purposes.

During the fourth quarter of 2019, we entered into a definitive agreement to sell substantially all of the assets and liabilities of the Tile Coating Systems business unit (the “Tile Coatings business”). The related assets and liabilities of our Tile Coatings business were classified as held-for-sale in the accompanying consolidated balance sheets. Therefore, the associated operating results, net of income tax, have been classified as discontinued operations in the accompanying consolidated statements of operations for all periods presented. Refer to Note 4 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K for a discussion of the potential sale of the Tile Coatings business. Throughout this Annual Report on Form 10-K, unless otherwise indicated, amounts and activity are presented on a continuing operations basis.

On February 25, 2021, we completed the sale of our Tile Coatings business to Pigments Spain, S.L., a company of the Esmalglass-Itaca-Fritta group, which is a portfolio company of certain Lone Star Funds, for $460.0 million in cash, subject to post-closing adjustments. The transaction resulted in net proceeds of approximately $420.0 million after expenses.

Financial information about our segments is included herein in Note 21 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 applications, within the following markets:

- Appliances
- Automotive
- Building and renovation
- Consumer products
- Electronics
- 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 and concrete. Other products are used to manufacture electronic components and other technology products. Still other products are added during our customers' manufacturing processes to provide desired properties to their end product. Often, Ferro materials are a small portion of the total cost of our customers' products, but they can be critical to the functionality or appearance 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 2020, 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.

Seasonality

Although not seasonal, in certain of our technology-driven markets, our customers' business is often characterized by product campaigns with defined life cycles, which can result in uneven demand as product ramp-up periods are followed by down-cycle periods. As our innovation activity increases in line with our value creation strategy, we expect this type of business also to increase. This type of market operates on a different cycle from the majority of our business. We 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 has also normally been 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 specialty coatings and enamels for 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 oxide(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)
- Vanadium(1)

Energy:

- Electricity
- Natural gas

(1) Primarily used by the Functional Coatings and the Color Solutions reportable segments.

(2) Primarily used by the Tile Coating Systems and Porcelain Enamel business. As of December 31, 2019, Tile Coating Systems results are reported as discontinued operations and Porcelain Enamel has been integrated into the Functional Coatings reportable 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 raw material cost increases to our customers.

We have a broad supplier base and, in many instances, multiple sources of essential raw materials are available worldwide if problems arise with any particular supplier. We maintain many comprehensive supplier agreements for strategic and critical raw materials. We did not encounter raw material shortages in 2020 that significantly affected our manufacturing operations, but we are subject to volatile raw material costs or material availability that can affect our results of operations.

Environmental Matters

We handle, process, use and store hazardous materials as part of the production of some of our products. As a result, we operate production facilities that are subject to a broad array of environmental laws and regulations in the countries in which we operate, particularly for wastes, wastewater discharges and air emissions. In addition, some of our products are subject to restrictions under laws or regulations, such as California's Proposition 65, the Toxic Substances and Control Act and the European Union's ("EU") chemical substances directive. The costs to comply with the complex environmental laws and regulations applicable to our operations 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 laws and regulations applicable to our operations. We also believe that, to the extent that we may not be in compliance with such regulations, such 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 and health and safety protection and improvements in a timely manner consistent with available technology. Although we cannot precisely predict future environmental, health and safety 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, health and safety protection were \$2.6 million in 2020, \$4.5 million in 2019, and \$5.8 million in 2018. 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 or circumstances, changing governmental regulations and legal standards regarding liability, and evolving technologies. We adjust these liabilities periodically as remediation-related 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 \$35.6 million in 2020, \$41.0 million in 2019, and \$40.1 million in 2018.

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 2039. 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.

Human Capital

We provide employee benefits and programs in recruiting, retention, performance management, and training that aim to enable us to develop, create and fully leverage the strengths of our workforce to help exceed customer expectations and ongoing growth objectives.

At December 31, 2020, we employed 5,615 full-time employees, including 5,120 employees in our foreign consolidated subsidiaries and 495 in the United States ("U.S."). At December 31, 2020, 2,031 of our employees in our foreign consolidated subsidiaries were associated with the Tile Coatings business. Total employment decreased by 151 in our foreign subsidiaries and decreased by 156 in the U.S. from the prior year end primarily due to our cost optimization initiatives.

Collective bargaining agreements cover 4.2% of our U.S. workforce. Approximately 1.4% of all U.S. employees are affected by a labor agreement that expires in 2024. 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
- Australia
- Belgium
- Brazil
- Canada
- China
- Colombia
- Egypt[(1)]
- France
- Germany
- India
- Indonesia
- Ireland
- Israel
- Italy
- Japan
- Malaysia[(1)]
- Mexico
- Netherlands
- Poland[(1)]
- Portugal
- Romania
- Russia
- Spain
- Taiwan
- Thailand
- Turkey
- United Kingdom
- United States
- Vietnam[(1)]

Unconsolidated Affiliates:

- China
- Ecuador[(1)]
- Egypt[(1)]
- Spain
- South Korea

(1) Indicates operations associated with the Tile Coatings business which were discontinued with the completion of the sale during the first quarter of 2021.

Financial information for geographic areas is included in Note 21 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K. More than 60% of our net sales are outside of the U.S. We sell products into approximately 98 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:

Risks Related to Our Business and Strategy

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 may change and is difficult to accurately forecast. Change in demand and incorrect forecasts of demand or unforeseen reductions in demand can adversely affect costs and profitability due to factors, including but not limited to underused manufacturing capacity, excess inventory, or working capital needs. Our sales and operations planning processes and 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, new products, 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, increasing economies of scale, raising prices, introducing new products, improving manufacturing processes, reformulating products, reducing the use of raw materials, and adopting purchasing techniques that lower costs or provide increased cost predictability. However, these activities depend on a combination of factors, including 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. Likewise, 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 60% of our net sales during 2020 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 multiple and changing economic, regulatory, social and political conditions 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;
- Challenges related to obtaining export licenses, import or export duties or import quotas, export controls and restrictions administered by, for example, the Office of Foreign Assets Control or other trade restrictions or barriers;
- Increased costs, and decreased availability, of transportation or shipping;
- Credit risks and financial conditions of local customers and distributors;
- Risk of nationalization of private enterprises by 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 political instability and organized crime in certain countries, the possibility of hyperinflationary conditions and deflation and public health crises, such as pandemics and epidemics.

We have subsidiaries in Israel, Turkey, Mexico and Colombia, which are located in or near regions that are politically volatile or subject to high levels of crime and violence. Such conditions could potentially impact our ability to operate and to recover both the cost of our investments and earnings from those investments. While we attempt to anticipate these circumstances and manage our business appropriately in each location where we do business, these circumstances 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.

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 continually developing and introducing new and improved products and services. Customers 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 respond 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.

We may not be able to complete or successfully integrate previous or 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, information systems, 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 results of operations.

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.

We are subject to a number of restrictive covenants under our credit facilities, 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 Amended Credit Facility, entered into on April 25, 2018, contains a number of restrictive covenants, including those described in more detail in Note 9 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 Amended 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 2018 Revolving 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 Amended Credit Facility may be accelerated and become immediately due and payable. The Amended Credit Facility is described in more detail in Note 9 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

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.

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 and practice of some countries may not protect our interests to the same extent as the laws and practices 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.

We may not be successful in implementing our strategies to increase our return on invested capital, internal rate of return, or other return metrics.

We are taking steps to generate a higher return on our investments. 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.

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 9 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

The divestiture of our Tile Coatings business may have material adverse effects on our financial condition, results of operations or cash flows.

In December 2019, we announced that we had entered into an asset and stock purchase agreement pursuant to which Ferro has agreed to sell Ferro's global tile coating systems business (the "Tile Coatings business") to Pigments Spain S.L. The consummation of the sale of the Tile Coatings business involves risks, including difficulties in the separation of operations, services, products, IT systems and personnel, the diversion of management's attention from other business matters, the disruption of our business, the potential loss of key employees and the retention of uncertain contingent liabilities related to the divested business, any of which could result in a material adverse effect to our financial condition, results of operations or cash flows. We cannot be certain that we will be successful in managing these or any other significant risks that we encounter as a result of divesting the Tile Coatings business.

Risks Related to Our Operations

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 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.

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, the divestiture of certain assets, 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 requalification 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.

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, due to events including but not limited to programming errors, aging information systems infrastructure and software 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. We may incur significant costs to implement the security measures that we feel are necessary to protect our information systems. However, our information systems may remain vulnerable to damage despite our implementation of security measures that we deem to be appropriate.

In addition, third-party service providers are responsible for managing a significant portion of our information systems, and we are subject to risk because of possible information privacy and security breaches of those third parties. Any system failure, accident or security breach involving our or a third-party's information system could result in disruptions to our operations. A breach in the security of our information systems could include the theft of our intellectual property or trade secrets, negatively impact our manufacturing operations, or result in the compromise of personal information of our employees, customers or suppliers. While we have, from time to time, experienced system failures, accidents and security breaches involving our information systems, these incidents have not had a material impact on our operations. To the extent that any system failure, accident or security breach results in material disruptions to our operations or the theft, loss or disclosure of, or damage to, material data or confidential information, our reputation, business, financial condition, and results of operations could be materially adversely affected.

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 attract and retain key personnel, our business could be materially adversely affected.

Our business substantially depends on the continued service of key members of our management. The loss of the services of a key member of our management could have a material adverse effect on our business. Our future success will also depend on our ability to attract and retain highly skilled personnel, such as engineering, marketing and senior management professionals. Competition for these employees is intense, and we could experience difficulty from time to time in hiring and retaining the personnel necessary to support our business. If we do not succeed in retaining our current employees and attracting new skilled employees, our business could be materially adversely affected.

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.

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.

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.

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

We implement and operate 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.

Legal and Regulatory Risks

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 markets such as, the People's Republic of China, Latin America, the Asia Pacific region, India 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.

Regulatory authorities in the U.S., European Union and elsewhere are taking a 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 and 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.

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 that they affect us 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.

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

We may be impacted by and may not be able to adequately address safety, human health, social, 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 current or past products, their respective life cycles, and production processes could impact product acceptance and influence the regulatory environment in which we operate.

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 and elsewhere, including but not limited to the California Consumer Privacy Act and the General Data Protection Regulation (the "GDPR"), are uncertain, evolving and may be inconsistent among jurisdictions. Complying with these various laws may be 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.

Changes in U.S. and other governments' trade policies and other factors beyond our control may adversely impact our business, financial condition and results of operations.

Tariffs, retaliatory tariffs or other trade restrictions on products and materials that we or our customers and suppliers export or import could affect demand for our products. Direct or indirect consequences of tariffs, retaliatory tariffs or other trade restrictions may also alter the competitive landscape of our products in one or more regions of the world. Trade tensions or other governmental action related to tariffs or international trade agreements or policies has the potential to negatively impact our business, financial condition and results of operations.

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 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.

We are exposed to lawsuits, governmental investigations and proceedings 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, environmental compliance, hazardous materials, infringement of intellectual property rights of third parties, work place safety, employment 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. 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, financial condition, or results of operations.

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 4.2% of our U.S. employees as of December 31, 2020, are subject to collective bargaining arrangements or similar arrangements. Approximately 1.4% of all U.S. employees are affected by a labor agreement that expires in 2024. 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.

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.

General Risks

The impact of the novel coronavirus ("COVID-19") may exacerbate the risks discussed therein, any of which could have a material effect on the Company.

Since the first quarter of 2020, there has been a world-wide impact from the COVID-19 pandemic, including in Asia, Europe, the Middle East, and North and South America, all of which are regions in which Ferro has operations. Authorities have implemented numerous measures to try to contain the virus, such as travel bans and restrictions, quarantines, shelter in place orders, and business shutdowns. The measures taken by the authorities have impacted and may further impact certain of our workforce and operations, the operations of our customers, and those of our vendors and suppliers. Although certain jurisdictions have eased restrictions, because of recurring outbreaks and new strain of the virus there still is considerable uncertainty regarding measures that authorities may implement in the future, which may restrict our operations and those of our suppliers and customers and disrupt logistics and other supply and distribution service providers. The spread of COVID-19 has caused us to modify certain of our business practices with respect to certain products (including site operations, employee workplace practices, travel, and participation in meetings, events, and conferences), and we may take further actions as required or recommended by authorities or deemed to be in the best interests of our employees and business partners. There is no certainty that such measures will be sufficient to mitigate the risks posed by the virus, and our ability to perform critical functions could be adversely affected. These circumstances could negatively impact our business, results of operations, financial condition and cash flows.

The degree to which COVID-19 will impact our results in the future depends on many factors, which are highly uncertain and cannot be predicted, including, but not limited to, the duration of the pandemic, actions to contain the virus or limit its impact, the availability, administration and effectiveness of vaccines, and the speed and extent to which normal economic and operating conditions resume. Even after the COVID-19 outbreak has subsided, we may experience material adverse impacts to our business as a result of the potential sustained economic impact and any recession or other macroeconomic weakness that may occur.

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, 2020, we had approximately $800.3 million of short-term and long-term debt with varying maturities and approximately $92.3 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, interest rates, 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 9 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

In addition, on July 27, 2017, the Financial Conduct Authority (FCA) in the U.K. announced that it would phase out LIBOR as a benchmark by the end of calendar year 2021. The expected discontinuation of LIBOR may require us to amend certain agreements governing our debt and, although the U.S. and other jurisdictions are working to replace LIBOR with alternative reference rates, we cannot predict what alternative index, margin adjustments and related terms would be negotiated with our counterparties. As a result, our interest expense could increase.

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, 2020, that a one percent increase in interest rates would cause interest expense to increase by $2.6 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 9 to the consolidated financial statements under Item 8 of this Form 10-K.

Employee benefit costs, including 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 obligations. 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 13 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

We are exposed to intangible asset risk, and a write down of our intangible assets could have an adverse impact on 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 8 to the consolidated financial statements under Item 8 of this 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, which is 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 700,000 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 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 and Spain.

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

In addition, we lease manufacturing facilities for the Functional Coatings reportable segment in the United Kingdom; Germany; Japan; Israel; and Turkey. We also lease manufacturing facilities in Taiwan for Color Solutions. Manufacturing plants in Argentina, Egypt, Indonesia, Italy, Poland and Thailand, which were historically reported in the legacy Performance Coatings reportable segment, are considered held-for-sale as of December 31, 2020. 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*

In November 2017, Suffolk County Water Authority filed a complaint, Suffolk County Water Authority v. The Dow Chemical Company et al., against the Company and a number of other companies in the U.S. Federal Court for the Eastern District of New York with regard to the product 1,4 dioxane. The plaintiff alleges, among other things, that the Suffolk County water supply is contaminated with 1,4 dioxane and that the defendants are liable for unspecified costs of cleanup and remediation of the water supply, among other damages. The Company has not manufactured 1,4 dioxane since 2008, denies the allegations related to liability for the plaintiff's claims, and is vigorously defending this proceeding. Since December 2018, additional complaints were filed in the same court by 25 other New York water suppliers against the Company and others making substantially similar allegations regarding the contamination of their respective water supplies with 1,4 dioxane. An additional complaint also was filed by the Hicksville Water District against the Company and others in New York State Supreme Court making substantially similar allegations and seeking damages of $900 million. The Company is likewise vigorously defending these additional actions. The Company currently does not expect the outcome of these proceedings to have a material adverse impact on its consolidated financial condition, results of operations, or cash flows, net of any insurance coverage. However, it is not possible to predict the ultimate outcome of these proceedings due to the unpredictable nature of litigation.

In addition to the proceedings described above, the Company and its consolidated subsidiaries are subject from time to time to various claims, lawsuits, investigations, and proceedings related to products, services, contracts, environmental, health and safety, employment, intellectual property, and other matters, including with respect to divested businesses. The outcome of such matters is unpredictable, our assessment of them may change, and resolution of them could have a material adverse effect on the Company's consolidated financial position, results of operations, or cash flows. 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.

Information about our Executive Officers

The executive officers of the Company as of February 24, 2021, 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 — 65

Chairman of the Board of Directors, 2014

President and Chief Executive Officer, 2013

Mark H. Duesenberg — 59

Vice President, General Counsel and Secretary, 2008

Benjamin J. Schlater — 45

Group Vice President and Chief Financial Officer, 2019

Vice President and Chief Financial Officer, 2016

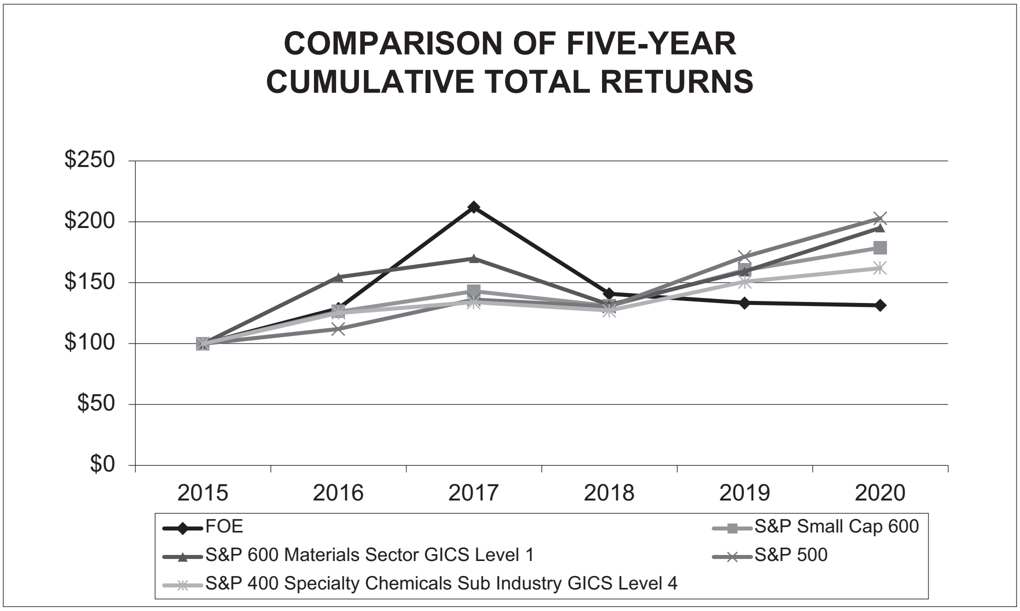
Vice President, Corporate Development and Strategy, 2015

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, 2021, we had 793 shareholders of record for our common stock, and the closing price of the common stock was $13.79 per share.

The chart below compares Ferro's cumulative total shareholder return for the five years ended December 31, 2020, to that of the Standard & Poor's 500 and Standard & Poor's 400 Specialty Chemicals Indexes, on which the Company was formerly listed, and the Standard & Poor's 600 Material Sector and Standard & Poor's Small Cap 600 Indexes, on which the Company is currently listed. In all cases, the information is presented on a dividend-reinvested basis and assumes investment of $100.00 on December 31, 2015. At December 31, 2020, the closing price of our common stock was $14.63 per share.



Our Board of Directors has not declared any dividends on common stock during 2020 or 2019. The Company's Amended Credit Facility restricts the amount of dividends we can pay on our common stock. Any future dividends declared would be at the discretion of our Board of Directors and would depend on our financial condition, results of operations, cash flows, contractual obligations, the terms of our financing agreements at the time a dividend is considered, and other relevant factors. 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.

In October 2018, the Company's Board of Directors approved a new share repurchase program under which the Company is authorized to repurchase up to an additional $50 million of the Company's outstanding common stock on the open market, including through Rule 10b5-1 plans, in privately negotiated transactions, or otherwise. This new program is in addition to the $100 million of authorization previously approved and announced.

The Company made no repurchases during 2020. The Company repurchased 1,440,678 shares of common stock at an average price of $17.35 per share for a total cost of $25.0 million during 2019. As of December 31, 2020, $46.2 million remains authorized under the program for the repurchase of common stock.

The following table summarizes purchases of our common stock by the Company and affiliated purchasers during the three months ended December 31, 2020:

(Dollars in thousands, except for per share amounts)	Total Number of Shares Purchased	Average Price Paid per Share	Total Number of Share Purchased as Part of Publicly Announced Plans or Programs	Maximum Dollar Amount that May Yet Be Purchased Under the Plans or Programs
October 1, 2020 to October 31, 2020	—	$—	—	$46,192,535
November 1, 2020 to November 30, 2020	—	$—	—	$46,192,535
December 1, 2020 to December 31, 2020	—	$—	—	$46,192,535
Total	—		—	

Item 6 — *Selected Financial Data*

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

(Dollars in thousands, except for per share data)	2020	2019	2018	2017[(1)]	2016[(1)]
Net sales	$ 958,954	$ 1,014,457	$ 1,074,696	$ 996,382	$ 794,465
Income from continuing operations	30,040	34,826	56,050	35,659	38,123
Basic earnings per share from continuing operations attributable to Ferro Corporation common shareholders	0.35	0.41	0.66	0.45	0.44
Diluted earnings per share from continuing operations attributable to Ferro Corporation common shareholders	0.35	0.41	0.65	0.44	0.43
Cash dividends declared per common shares	—	—	—	—	—
Total assets[(2)]	1,960,933	1,834,621	1,866,076	1,682,202	1,283,769
Long-term debt, including current portion	800,348	807,565	815,002	735,267	563,033

(1) Long-term debt, including current portion for indicated years include portions attributable to discontinued operations. Refer to Note 4 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K for additional details related to the sale of our Tile Coatings business.

(2) Total assets for 2020, 2019 and 2018 include loans receivables of $55.1 million, $23.7 million and $53.6 million, respectively, which were previously eliminated as certain intercompany amounts are expected to be assumed by the Tile Coatings business buyer. The related liabilities are classified as current and non-current liabilities held-for-sale in the consolidated financial statements.

In 2019, we adopted the provisions of the Financial Accounting Standards Board ("FASB") Accounting Standards Update ("ASU") 2016-02. The ASU requires the recognition of a lease asset on the balance sheet for operating leases with a term greater than one year. The adoption resulted in $28.6 million recognized as total right-of-use assets and total lease liabilities on our consolidated balance sheet as of January 1, 2019.

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

Overview

During the year ended December 31, 2020, net sales decreased $55.5 million, or 5.5%, compared with 2019. Net sales decreased by $36.6 million and $18.9 million in Functional Coatings and Color Solutions, respectively. Gross profit decreased $14.2 million compared with 2019; as a percentage of net sales, it increased approximately 20 basis points to 30.6%, from 30.4% in the prior year. The decrease in gross profit was primarily attributable to a decrease in Functional Coatings of $17.1 million, partially mitigated by an increase in Color Solutions of $4.1 million.

For the year ended December 31, 2020, selling, general and administrative ("SG&A") expenses decreased $10.0 million, or 4.7%, compared with 2019. As a percentage of net sales, SG&A expenses increased 20 basis points from 20.9% in 2019 to 21.1% in 2020.

For the year ended December 31, 2020, net income was $44.0 million, compared with net income of $7.4 million in 2019, and net income attributable to common shareholders was $42.8 million, compared with net income attributable to common shareholders of $6.0 million in 2019. Income from continuing operations was $30.0 million for the year ended December 31, 2020, compared with $34.8 million in 2019.

As previously disclosed on January 17, 2019, the Company has been expanding its production facility in Villagran, Mexico, which will become the Company's Manufacturing Center of Excellence for the Americas. The expansion of the Villagran facility is expected to significantly increase the revenue generated from products manufactured at that facility. With the expanded capacity in Villagran, the Company plans to (i) discontinue the production of glass enamels, other industrial specialty products, such as architectural glass coatings, and pigments at its Washington, Pennsylvania facility over the course of 2021 and (ii) discontinued production of porcelain enamel products at its Cleveland, Ohio facility. As part of this optimization initiative, the Company expanded its King of Prussia, Pennsylvania facility. Conductive glass coatings production was discontinued at the Washington, Pennsylvania facility and will be produced at the King of Prussia, Pennsylvania facility, and the Company's operations at its Vista, California facility have been transferred to the King of Prussia, Pennsylvania facility. In addition, the Company is moving its Americas research and development center for glass products to its technology center in Independence, Ohio, where the Company is investing in expanded laboratory facilities. The Washington, Pennsylvania facility is expected to remain in operation until sometime in 2021. Production of specialty glasses for electronics applications will continue at the Cleveland, Ohio facility, and the Company is investing in the facility to equip it to serve as a logistics center. The Cleveland, Ohio facility also will serve as the Americas research and development center for the porcelain enamel business.

2019 Transactional Activity

During the fourth quarter of 2019, we entered into a definitive agreement to sell our Tile Coatings business which has historically been a part of our Performance Coatings reportable segment. As further discussed in Note 4 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K, substantially all of the assets and liabilities of our Tile Coatings business were classified as held-for-sale in the accompanying consolidated balance sheets and the associated operating results, net of income tax, have been classified as discontinued operations in the accompanying consolidated statements of operations for all periods presented.

Outlook

Global economic conditions, primarily resulting from impacts of the global pandemic, affected many businesses in 2020, reducing performance when compared to the prior year. Ferro also experienced the effects of the pandemic, however the strategic actions we have taken to optimize our business, invest in technology platforms, align with macrotrends and focus on higher margin, higher-growth markets led to gross margin expansion in 2020 relative to 2019.

We provide products and services that are essential to our customers as they innovate to address trends in their markets and develop next-generation products. We sell our products and services in multiple markets and geographies around the world, which limits exposure to any one industry or region. In addition, we serve a diverse set of industries, including automotive, construction, appliances, healthcare, food and beverage, information technology, energy and defense. Many of our products and services support critical industries, which governments around the world generally allowed to operate during the pandemic. Ferro also has leading positions in the market niches it serves and competition is generally fragmented.

While global economic conditions were uncertain and customers were cautious in the first half of 2020, many of our customers began ramping up their businesses in the second half of the year, preparing for and experiencing recovery in their markets. In high-growth markets, the product cycle is often elongated, which gives confidence in continued expansion.

Throughout the year, Ferro maintained protocols for the safety and well-being of our personnel. We also continued to execute on our strategic priorities, including investing in R&D and innovation and optimizing our operations.

In 2021, following the completion of the sale of our Tile Coatings Business, we are transitioning to a smaller, more agile and more streamlined global business with a more coherent and focused portfolio aligned with evolving megatrends. COVID-related behavior changes are accelerating demand for certain products, especially those in industries supporting mobility, entertainment and personal technology, smart appliances, construction and sustainable product packaging.

Looking ahead, we will continue to refine our manufacturing footprint, optimize logistics and streamline sourcing and procurement in our operations around the world.

Functional coatings and color solutions will remain the core of our business. Inorganic growth remains a strategic priority, as we selectively evaluate bolt-on acquisitions to fill technology gaps and complement and expand our product portfolio in high-margin, high-growth areas.

We continue to monitor the impact of the outbreak of COVID-19 on our business, including how it may impact our customers, employees, supply chain and distribution network and to take action, as appropriate, to address these circumstances. In some areas around the world, government mandates have been lifted and economic conditions have improved in certain sectors of the economy relative to 2020. Meanwhile, some regions have experienced increasing numbers of COVID-19 cases, and if this continues and if public authorities intensify efforts to contain the spread of COVID-19, normal business activity may be further disrupted, and economic conditions could weaken.

Foreign currency rates may continue to be volatile through 2021 and changes in interest rates could adversely impact reported results. We expect cash flow from operating activities to continue to be positive for 2021.

Ferro is well-positioned with existing products and technology expertise and continues to invest in R&D to support our customers.

Factors that could adversely affect our future performance include those described under the heading “Risk Factors” in Item 1A of Part I of this Annual Report on Form 10-K for the year ended December 31, 2020.

Results of Operations — Consolidated

Comparison of the years ended December 31, 2020 and 2019

For the year ended December 31, 2020, net income from continuing operations was $30.0 million, compared with $34.8 million in 2019. For the year ended December 31, 2020, net income attributable to common shareholders was $42.8 million, or $0.52 earnings per share, compared with $6.0 million, or $0.07 earnings per share in 2019. The increase in net income attributable to shareholders is primarily due to impairment charges of $42.5 million associated with the Tile Coatings business, recorded within net income (loss) from discontinued operations, during the prior year.

Net Sales

(Dollars in thousands)	2020	2019	$ Change	% Change
Net sales	$ 958,954	$ 1,014,457	$ (55,503)	(5.5)%
Cost of sales	665,198	706,481	(41,283)	(5.8)%
Gross profit	$ 293,756	$ 307,976	$ (14,220)	(4.6)%
Gross profit as a % of net sales	30.6%	30.4%		

Net sales decreased by $55.5 million, or 5.5%, in the year ended December 31, 2020, compared with 2019, with decreased sales in Functional Coatings and Color Solutions of $36.6 million and $18.9 million, respectively.

Gross Profit

Gross profit decreased $14.2 million, or 4.6%, in 2020 to $293.8 million, compared with $308.0 million in 2019 and, as a percentage of net sales, it increased 20 basis points to 30.6%. The decrease in gross profit was attributable to a decrease in Functional Coatings of $17.1 million, partially mitigated by an increase in Color Solutions of $4.1 million. The decrease in gross profit was primarily attributable to lower sales volumes and mix of $30.8 million, unfavorable foreign currency impacts of $2.1 million and higher manufacturing and product costs of $1.1 million, partially mitigated by lower raw material costs of $15.7 million and favorable product pricing of $4.1 million.

Geographic Revenues

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

(Dollars in thousands)	2020	2019	$ Change	% Change
Geographic Revenues on a sales origination basis				
EMEA	$ 396,263	$ 432,132	$ (35,869)	(8.3)%
United States	341,461	359,267	(17,806)	(5.0)%
Asia Pacific	140,948	139,006	1,942	1.4%
Latin America	80,282	84,052	(3,770)	(4.5)%
Net sales	$ 958,954	$ 1,014,457	$ (55,503)	(5.5)%

The decrease in net sales of $55.5 million, compared with 2019, was driven by lower sales in the EMEA, United States and Latin America regions, partially mitigated by higher sales in the Asia Pacific region. The decrease in sales from EMEA was attributable to lower sales in Functional Coatings and Color Solutions of $28.1 million and $7.7 million, respectively. The decrease in sales from the United States was attributable to lower sales in Color Solutions and Functional Coatings of $15.3 million and $2.5 million, respectively. The decrease in sales from Latin America was attributable to lower sales in Functional Coatings of $5.2 million, partially mitigated by higher sales in Color Solutions of $1.4 million. The increase in sales from Asia Pacific was attributable to higher sales in Color Solutions of $2.7 million, partially offset by lower sales in Functional Coatings of $0.8 million.

Selling, General and Administrative Expense

The following table includes SG&A components with significant changes between 2020 and 2019:

(Dollars in thousands)	2020	2019	$ Change	% Change
Personnel expenses (excluding R&D personnel expenses)	$ 81,852	$ 94,544	$ (12,692)	(13.4)%
Research and development expenses	35,616	40,962	(5,346)	(13.1)%
Business development	9,051	4,989	4,062	81.4%
Incentive compensation	7,379	2,459	4,920	200.1%
Stock-based compensation	7,998	7,406	592	8.0%
Intangible asset amortization	5,926	6,949	(1,023)	(14.7)%
Pension and other postretirement benefits	2,094	1,422	672	47.3%
Bad debt	255	455	(200)	(44.0)%
All other expenses	52,242	53,179	(937)	(1.8)%
Selling, general and administrative expenses	$ 202,413	$ 212,365	$ (9,952)	(4.7)%

SG&A expenses were $10.0 million lower in 2020 compared with 2019. As a percentage of net sales, SG&A expenses increased 20 basis points from 20.9% in 2019 to 21.1% in 2020. The lower SG&A expenses compared with the prior year were primarily driven by lower personnel and research and development expenses, partially offset by higher incentive compensation and business development expenses.

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.

(Dollars in thousands)	2020	2019	$ Change	% Change
Strategic services	$ 92,679	$ 103,603	$ (10,924)	(10.5)%
Functional services	94,357	98,897	(4,540)	(4.6)%
Incentive compensation	7,379	2,459	4,920	200.1%
Stock-based compensation	7,998	7,406	592	8.0%
Selling, general and administrative expenses	$ 202,413	$ 212,365	$ (9,952)	(4.7)%

Restructuring and Impairment Charges

(Dollars in thousands)	2020	2019	$ Change	% Change
Employee severance	$ 9,690	$ 7,163	$ 2,527	35.3%
Other restructuring costs	7,735	3,792	3,943	104.0%
Restructuring and impairment charges	$ 17,425	$ 10,955	$ 6,470	59.1%

Restructuring and impairment charges increased $6.5 million in 2020, compared with 2019. The increase primarily relates to costs associated with our Global Optimization and Organizational Optimization Plans, compared with the prior-year same period. Refer to Note 15 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K for a discussion of our optimization plans and related costs.

Interest Expense

(Dollars in thousands)	2020	2019	$ Change	% Change
Interest expense	$ 22,303	$ 24,888	$ (2,585)	(10.4)%
Amortization of bank fees	3,974	3,755	219	5.8%
Interest swap amortization	(1,263)	(1,263)	—	—%
Interest capitalization	(3,134)	(3,078)	(56)	1.8%
Interest expense	$ 21,880	$ 24,302	$ (2,422)	(10.0)%

Interest expense in 2020 decreased $2.4 million compared with 2019. The decrease in interest expense was primarily due to a decrease in the average interest rate, partially offset by an increase in the average long-term debt balance during 2020.

Income Tax Expense

In 2020, we recorded an income tax expense of $14.9 million, or 33.1% of income before income taxes, compared to an income tax expense of $8.0 million, or 18.6% of income before income taxes in 2019. The 2020 effective tax rate is greater than the statutory income tax rate of 21% primarily as a result of the net effect of a $3.2 million expense related to foreign tax rate differences and a $2.0 million expense related to disallowed expenses. The 2019 effective tax rate is less than the statutory income tax rate of 21% primarily as a result of a net effect of a $7.6 million net benefit related to the release of valuation allowances related to deferred tax assets that were utilized in the current year and which are deemed no longer necessary based upon changes in the current and expected future years of operating profits and a $4.3 million net expense related to foreign tax rate differences.

Comparison of the years ended December 31, 2019 and 2018

For the year ended December 31, 2019, net income from continuing operations was $34.8 million, compared with $56.1 million in 2018. For the year ended December 31, 2019, net income attributable to common shareholders was $6.0 million, or $0.07 earnings per share, compared with $80.1 million, or $0.95 earnings per share in 2018.

Net Sales

(Dollars in thousands)	**2019**	**2018**	**$ Change**	**% Change**
Net sales	$ 1,014,457	$ 1,074,696	$ (60,239)	(5.6)%
Cost of sales	706,481	736,307	(29,826)	(4.1)%
Gross profit	$ 307,976	$ 338,389	$ (30,413)	(9.0)%
Gross profit as a % of net sales	30.4%	31.5%		

Net sales decreased by $60.2 million, or 5.6%, in the year ended December 31, 2019, compared with 2018, with decreased sales in Functional Coatings and Color Solutions of $38.9 million and $21.3 million, respectively.

Gross Profit

Gross profit decreased $30.4 million, or 9.0%, in 2019 to $308.0 million, compared with $338.4 million in 2018 and, as a percentage of net sales, it decreased 110 basis points to 30.4%. The decrease in gross profit was attributable to decreases in both of our segments, with decreases in Functional Coatings and Color Solutions of $18.4 million and $9.9 million, respectively. The decrease in gross profit was primarily attributable to lower sales volumes and mix of $31.4 million, higher manufacturing and product costs of $15.7 million and unfavorable foreign currency impacts of $8.9 million, partially offset by lower raw material costs of $13.5 million, gross profit from acquisitions of $6.6 million and favorable product pricing of $5.5 million.

Geographic Revenues

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

(Dollars in thousands)	**2019**	**2018**	**$ Change**	**% Change**
Geographic Revenues on a sales origination basis				
EMEA	$ 432,132	$ 466,194	$ (34,062)	(7.3)%
United States	359,267	379,913	(20,646)	(5.4)%
Asia Pacific	139,006	141,971	(2,965)	(2.1)%
Latin America	84,052	86,618	(2,566)	(3.0)%
Net sales	$ 1,014,457	$ 1,074,696	$ (60,239)	(5.6)%

The decrease in net sales of $60.2 million, compared with 2018, was driven by lower sales across all regions. The decrease in sales from EMEA was attributable to lower sales in Functional Coatings and Color Solutions of $28.9 million and $5.2 million, respectively. The decrease in sales from the United States was attributable to lower sales in Color Solutions and Functional Coatings of $11.1 million and $9.5 million, respectively. The decrease in sales from Asia Pacific was attributable to lower sales in Color Solutions of $4.1 million, which was partially mitigated by higher sales in Functional Coatings of $1.2 million. The decrease in sales from Latin America was attributable to lower sales in Functional Coatings and Color Solutions of $1.7 million and $0.9 million, respectively.

Selling, General and Administrative Expense

The following table includes SG&A components with significant changes between 2019 and 2018.

(Dollars in thousands)	2019	2018	$ Change	% Change
Personnel expenses (excluding R&D personnel expenses)	$ 94,544	$ 94,927	$ (383)	(0.4)%
Research and development expenses	40,962	40,097	865	2.2%
Business development	4,989	6,441	(1,452)	(22.5)%
Incentive compensation	2,459	7,391	(4,932)	(66.7)%
Stock-based compensation	7,406	8,441	(1,035)	(12.3)%
Intangible asset amortization	6,949	6,244	705	11.3%
Pension and other postretirement benefits	1,422	1,403	19	1.4%
Bad debt	455	843	(388)	(46.0)%
All other expenses	53,179	53,921	(742)	(1.4)%
Selling, general and administrative expenses	$ 212,365	$ 219,708	$ (7,343)	(3.3)%

SG&A expenses were $7.3 million lower in 2019 compared with 2018. As a percentage of net sales, SG&A expenses increased 50 basis points from 20.4% in 2018 to 20.9% in 2019. The lower SG&A expenses compared with the prior year were primarily driven by lower incentive and stock-based compensation. The decrease in incentive compensation is the result of the Company's performance relative to targets for certain awards compared to 2018 and the decrease in stock-based compensation expense of $1.0 million is the result of the Company's performance relative to targets for certain awards compared with the prior year, as well as decreases 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.

(Dollars in thousands)	2019	2018	$ Change	% Change
Strategic services	$ 103,603	$ 110,491	$ (6,888)	(6.2)%
Functional services	98,897	93,385	5,512	5.9%
Incentive compensation	2,459	7,391	(4,932)	(66.7)%
Stock-based compensation	7,406	8,441	(1,035)	(12.3)%
Selling, general and administrative expenses	$ 212,365	$ 219,708	$ (7,343)	(3.3)%

Restructuring and Impairment Charges

(Dollars in thousands)	2019	2018	$ Change	% Change
Employee severance	$ 7,163	$ 3,560	$ 3,603	101.2%
Other restructuring costs	3,792	3,556	236	6.6%
Restructuring and impairment charges	$ 10,955	$ 7,116	$ 3,839	53.9%

Restructuring and impairment charges increased $3.8 million in 2019, compared with 2018. The increase primarily relates to higher employee costs associated with our recent optimization programs in 2019. During the second and third quarters of 2019, the Company recorded $9.0 million of goodwill impairment charges related to our Tile Coatings business, which was historically recorded within our Performance Coatings reportable segment. The goodwill impairment charge recorded was a result of the finalization of purchase accounting of the recent Quimicer, FMU, and Gardenia acquisitions that changed the carrying amount of net assets attributable to the reporting unit that represented an impairment indicator. Based on our 2019 annual impairment test performed as of October 31, 2019, the Company recorded additional goodwill impairment charges of $33.5 million associated with the Tile Coatings business. The impairment charge and related assets are recorded within discontinued operations and as assets held-for-sale, respectively, in our consolidated financial statements as of December 31, 2019.

Interest Expense

(Dollars in thousands)	2019	2018	$ Change	% Change
Interest expense	$ 24,888	$ 22,540	$ 2,348	10.4%
Amortization of bank fees	3,755	3,577	178	5.0%
Interest swap amortization	(1,263)	(762)	(501)	65.7%
Interest capitalization	(3,078)	(1,696)	(1,382)	81.5%
Interest expense	$ 24,302	$ 23,659	$ 643	2.7%

Interest expense in 2019 increased $0.6 million compared with 2018. The increase in interest expense was primarily due to an increase in the average long-term debt balance during 2019, compared with 2018, partially offset by increased interest capitalization during 2019 and interest swap amortization.

Income Tax Expense

In 2019, we recorded an income tax expense of $8.0 million, or 18.6% of income before income taxes, compared to an income tax expense of $13.9 million, or 19.9% of income before income taxes in 2018. The 2019 effective tax rate is less than the statutory income tax rate of 21% primarily as a result of a net effect of a $7.6 million net benefit related to the release of valuation allowances related to deferred tax assets that were utilized in the current year and which are deemed no longer necessary based upon changes in the current and expected future years of operating profits and a $4.3 million net expense related to foreign tax rate differences. The 2018 effective tax rate is less than the statutory income tax rate of 21% primarily as a result of a net effect of a $4.3 million net benefit related to the release of valuation allowances related to deferred tax assets that were utilized in the current year and which are deemed no longer necessary based upon changes in the current and expected future years of operating profits and a $5.3 million net expense related to foreign tax rate differences.

Results of Operations — Segment Information

Comparison of the years ended December 31, 2020 and 2019

Functional Coatings

					Change due to				
(Dollars in thousands)	2020	2019	$ Change	% Change	Price	Volume / Mix	Currency	Acquisitions	Other
Segment net sales	$ 608,192	$ 644,783	$ (36,591)	(5.7)%	$ 4,280	$ (37,771)	$ (3,100)	$—	$ —
Segment gross profit	175,601	192,668	(17,067)	(8.9)%	4,280	(16,544)	(2,172)	—	(2,631)
Gross profit as a % of segment net sales	28.9%	29.9%							

Net sales decreased $36.6 million compared with the prior year, primarily driven by lower sales in industrial, decoration and automotive products of $18.9 million, $15.8 million, and $13.3 million, respectively, partially mitigated by higher sales of electronics products of $18.7 million. The decrease in net sales was driven by unfavorable volume and mix of $37.8 million and unfavorable foreign currency impacts of $3.1 million, partially offset by higher product pricing of $4.3 million. Gross profit decreased from the prior year, primarily due to lower sales volume and mix of $16.5 million, unfavorable manufacturing costs of $12.1 million and unfavorable foreign currency impacts of $2.2 million, partially offset by lower raw material costs of $9.4 million, higher product pricing of $4.3 million.

(Dollars in thousands)	2020	2019	$ Change	% Change
Segment net sales by Region				
EMEA	$ 267,041	$ 295,198	$ (28,157)	(9.5)%
United States	195,027	197,494	(2,467)	(1.2)%
Asia Pacific	100,727	101,521	(794)	(0.8)%
Latin America	45,397	50,570	(5,173)	(10.2)%
Net sales	$ 608,192	$ 644,783	$ (36,591)	(5.7)%

The net sales decrease of $36.6 million was driven by lower sales from all regions. The decrease in sales from EMEA was primarily attributable to lower sales of industrial, decoration and automotive products of $19.2 million, $10.7 million and $4.7 million, respectively, partially mitigated by higher sales of electronic products of $5.5 million. The decrease in sales from the United States was primarily attributable to lower sales of automotive, porcelain enamel, industrial and decoration products of $5.3 million, $4.9 million, $4.0 million and $1.0 million, respectively, partially offset by an increase in sales of electronic products of $12.7 million. The decrease in sales from Latin America was attributable to a decrease in sales of automotive products. The decrease in sales from Asia Pacific was primarily attributable to lower sales of decoration and automotive products of $4.0 million and $1.7 million, respectively, partially mitigated by higher sales of industrial products of $4.8 million.

Color Solutions

					Change due to				
(Dollars in thousands)	**2020**	**2019**	**$ Change**	**% Change**	**Price**	**Volume / Mix**	**Currency**	**Acquisitions**	**Other**
Segment net sales	$ 350,762	$ 369,674	$ (18,912)	(5.1)%	$ (217)	$ (18,429)	$ (266)	$ —	$ —
Segment gross profit	119,071	114,939	4,132	3.6%	(217)	(13,019)	82	—	17,286
Gross profit as a % of segment net sales	33.9%	31.1%							

Net sales decreased $18.9 million compared with the prior year primarily due to lower sales of surface technology products of $12.7 million, pigment products of $5.2 million and dispersions and colorants of $1.0 million. The decrease in net sales was driven by lower volume and mix of $18.4 million and unfavorable foreign currency impacts. Gross profit increased from the prior year primarily due to lower manufacturing costs of $11.0 million and lower raw material costs of $6.3 million, partially offset by unfavorable sales volume and mix of $13.0 million and lower product pricing of $0.2 million.

(Dollars in thousands)	**2020**	**2019**	**$ Change**	**% Change**
Segment net sales by Region				
United States	$ 146,434	$ 161,773	$ (15,339)	(9.5)%
EMEA	129,222	136,934	(7,712)	(5.6)%
Asia Pacific	40,221	37,485	2,736	7.3%
Latin America	34,885	33,482	1,403	4.2%
Net sales	$ 350,762	$ 369,674	$ (18,912)	(5.1)%

The net sales decrease of $18.9 million was driven by lower sales from the United States and EMEA regions, partially mitigated by higher sales from the Asia Pacific and Latin America regions. The decrease in sales from the United States was primarily driven by lower sales of surface technology products of $12.7 million and pigment products of $2.9 million, partially mitigated by higher sales of dispersions and colorants of $0.3 million. The decrease in sales from EMEA was primarily attributable to lower sales of pigment products of $6.5 million and dispersions and colorants of $1.2 million. The increase in sales from Asia Pacific was primarily attributable to higher sales of pigment products of $2.7 million. The increase in sales from Latin America was primarily attributable to higher sales of pigment products of $1.5 million, partially offset by lower sales of dispersions and colorants of $0.1 million.

Comparison of the years ended December 31, 2019 and 2018

Functional Coatings

(Dollars in thousands)	2019	2018	$ Change	% Change	Change due to Price	Volume / Mix	Currency	Acquisitions	Other
Segment net sales	$ 644,783	$ 683,669	$ (38,886)	(5.7)%	$ 5,067	$ (30,299)	$ (19,361)	$5,707	$ —
Segment gross profit	192,668	211,018	(18,350)	(8.7)%	5,067	(19,561)	(6,250)	2,121	273
Gross profit as a % of segment net sales	29.9%	30.9%							

Net sales decreased $38.9 million compared with the prior year, primarily driven by lower sales in decoration, porcelain enamels and automotive products of $13.3 million, $12.9 million, and $9.5 million, respectively. The decrease in net sales was driven by unfavorable volume and mix of $30.3 million and unfavorable foreign currency impacts of $19.4 million, partially offset by sales from acquisitions of $5.7 million and higher product pricing of $5.1 million. Gross profit decreased from the prior year, primarily due to lower sales volume and mix of $19.6 million, unfavorable manufacturing costs of $8.9 million and unfavorable foreign currency impacts of $6.3 million, partially offset by lower raw material costs of $9.2 million, higher product pricing of $5.1 million and gross profit from acquisitions of $2.1 million.

(Dollars in thousands)	2019	2018	$ Change	% Change
Segment net sales by Region				
EMEA	$ 295,198	$ 324,092	$ (28,894)	(8.9)%
United States	197,494	207,012	(9,518)	(4.6)%
Asia Pacific	101,521	100,329	1,192	1.2%
Latin America	50,570	52,236	(1,666)	(3.2)%
Net sales	$ 644,783	$ 683,669	$ (38,886)	(5.7)%

The net sales decrease of $38.9 million was driven by lower sales from the EMEA, United States and Latin America regions, partially mitigated by higher sales from the Asia Pacific region. The decrease in sales from EMEA was primarily attributable to lower sales of decoration, industrial, automotive, electronic, and porcelain enamel products of $9.0 million, $8.3 million, $4.2 million, $4.0 million and $3.4 million, respectively. The decrease in sales from the United States was primarily attributable to lower sales of porcelain enamel, automotive and decoration products of $9.1 million, $4.4 million, and $3.5 million, respectively, partially offset by an increase in sales of electronic products of $9.1 million.

Color Solutions

(Dollars in thousands)	2019	2018	$ Change	% Change	Change due to Price	Volume / Mix	Currency	Acquisitions	Other
Segment net sales	$ 369,674	$ 391,027	$ (21,353)	(5.5)%	$482	$ (22,364)	$ (9,791)	$ 10,320	$ —
Segment gross profit	114,939	124,852	(9,913)	(7.9)%	482	(9,803)	(2,658)	4,507	(2,441)
Gross profit as a % of segment net sales	31.1%	31.9%							

Net sales decreased $21.3 million compared with the prior year, primarily due to lower sales of pigment products of $22.1 million, inclusive of decreased sales from our Nubiola business of $12.5 million, and lower sales of surface technology products of $4.6 million, partially mitigated by higher sales of Dispersions and Colorants of $5.4 million. The decrease in net sales was driven by lower volume and mix of $22.4 million and unfavorable foreign currency impacts of $9.8 million partially offset by sales from acquisitions of $10.3 million. Gross profit decreased from the prior year, primarily due to unfavorable sales volume and mix of $9.8 million, higher manufacturing costs of $6.7 million and unfavorable foreign currency impacts of $2.7 million, partially offset by gross profit from acquisitions of $4.5 million and lower raw material costs of $4.3 million.

	2019	2018	$ Change	% Change
Segment net sales by Region				
United States	$ 161,773	$ 172,901	$ (11,128)	(6.4)%
EMEA	136,934	142,102	(5,168)	(3.6)%
Asia Pacific	37,485	41,642	(4,157)	(10.0)%
Latin America	33,482	34,382	(900)	(2.6)%
Net sales	$ 369,674	$ 391,027	$ (21,353)	(5.5)%

The net sales decrease of $21.3 million was driven by lower sales from all regions. The decrease in sales from the United States was primarily driven by lower sales of surface technology products of $9.7 million and pigment products of $1.9 million. The decrease in sales from EMEA was primarily attributable to lower sales of pigment products of $10.0 million, inclusive of decreased sales from our Nubiola business of $5.5 million, partially mitigated by higher sales of Dispersions and Colorants of $4.8 million. The decrease in sales from Asia Pacific was primarily attributable to lower sales of pigment products of $9.2 million, inclusive of decreased sales from our Nubiola business of $6.5 million, partially mitigated by higher sales of surface technology products of $5.1 million.

Summary of Cash Flows for the years ended December 31, 2020, 2019, and 2018

(Dollars in thousands)	2020	2019	2018
Net cash provided by (used for) operating activities	$ (13,192)	$ 17,710	$ 182,793
Net cash provided by (used for) investing activities	98,993	21,303	(148,516)
Net cash provided by (used for) financing activities	(10,048)	(39,195)	9,367
Effect of exchange rate changes on cash and cash equivalents	2,122	283	(2,894)
Increase in cash and cash equivalents	$ 77,875	$ 101	$ 40,750

Operating activities. Cash flows from operating activities decreased $30.9 million in 2020 compared to 2019. The decrease was primarily due to higher cash outflows for net working capital of $36.4 million which was offset by lower cash payments for incentive compensation of $5.1 million and lower pension contributions of $2.4 million.

Cash flows from operating activities decreased $165.1 million in 2019 compared to 2018. The decrease was primarily due to higher cash outflows for net working capital of $116.9 million and a fourth quarter goodwill impairment charge of $33.5 million related to the Tile Coatings business.

Investing activities. Cash flows from investing activities increased $77.7 million in 2020 compared to 2019. The increase was primarily due to higher collections of financing receivables of $45.4 million and lower cash outflows for capital expenditures of $33.2 million.

Cash flows from investing activities increased $169.8 million in 2019 compared to 2018. The increase was primarily due to higher collections of financing receivables of $77.5 million, lower cash outflows related to business acquisitions of $74.7 million and lower cash outflows for capital expenditures of $15.6 million.

Financing activities. Cash flows from financing activities increased $29.1 million in 2020 compared with 2019. The increase is primarily attributable to decreased cash outflows for the purchase of treasury stock of $25.0 million and decreased cash outflows for acquisition-related contingency payments of $5.2 million.

Cash flows from financing activities decreased $48.6 million in 2019 compared with 2018. The decrease is primarily attributable to a decreased use of the Company’s financing instruments related to the prior year termination of the Credit Facility and acquisition of the Amended Credit Facility.

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

Capital Resources and Liquidity

Refer to Note 9 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K for a discussion of major debt instruments that were outstanding during 2020.

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 $2.9 million, $3.1 million and $2.1 million for 2020, 2019, and 2018, respectively. We had on hand precious metals owned by participants in our precious metals consignment program of $87.2 million at December 31, 2020 and $66.2 million at December 31, 2019, 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, 2020 or December 31, 2019, 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, 2020, the Company and its subsidiaries had bank guarantees and standby letters of credit issued by financial institutions that totaled $5.1 million. These agreements primarily relate to Ferro's insurance programs, foreign energy purchase contracts and foreign tax payments.

Liquidity Requirements

Our primary sources of liquidity are available cash and cash equivalents, available lines of credit under the Amended Credit Facility, and cash flows from operating activities. As of December 31, 2020, we had $174.1 million of cash and cash equivalents. Cash generated in the U.S. is generally used to pay down amounts outstanding under our 2018 Revolving 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.

During the fourth quarter of 2019, we entered into a definitive agreement to sell our Tile Coatings business which has historically been a part of our Performance Coatings reportable segment. We expect to use the proceeds of the sale to settle long-term obligations. On February 25, 2021, we completed the sale of our Tile Coatings business to Pigments Spain, S.L., a company of the Esmalglass-Itaca-Fritta group, which is a portfolio company of certain Lone Star Funds. Proceeds from the close of the transaction, in addition to current cash balances, were used to pay down our term loan facility in the amount of $435.0 million on February 25, 2021.

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. Additionally, we used the borrowings available under the Amended Credit Facility for other general business purposes. We had additional borrowing capacity of $525.0 million at December 31, 2020, available under various credit facilities, primarily our revolving credit facility.

Our Amended Credit Facility contains customary restrictive covenants, including those described in more detail in Note 9 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 2018 Revolving Facility, we are subject to a financial covenant regarding the Company's maximum leverage ratio. This covenant under our Amended 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 Note 9 to the consolidated financial statements under Item 8 of this Annual Report on Form 10-K.

As of December 31, 2020, we were in compliance with our maximum leverage ratio covenant of 4.00x as our actual ratio was 2.80, providing $79.2 million of EBITDA cushion on the leverage ratio, as defined within the Amended 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 $184 million for a rolling four quarters, based on reasonably consistent net debt levels with those as of December 31, 2020, 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 2018. 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:

(Dollars in thousands)	2021	2022	2023	2024	2025	Thereafter	Totals
Long-term debt[1]	$ 9,116	$ 9,095	8,957	$ 773,652	$ 691	$ 3,309	$ 804,820
Interest[2]	254	254	254	254	254	3,039	4,309
Operating lease obligations	6,967	4,167	2,222	1,183	933	1,778	17,250
Purchase commitments[3]	585	382	157	84	86	88	1,382
Taxes[4]	16,047	—	—	—	—	—	16,047
Retirement and other postemployment benefits[5]	21,980	—	—	—	—	—	21,980
	$ 54,949	$ 13,898	$ 11,590	$ 775,173	$ 1,964	$ 8,214	$ 865,788

(1) Long-term debt excludes imputed interest and executory costs on capitalized lease obligations and unamortized issuance costs on the term loan facility.

(2) Interest represents only contractual payments for fixed-rate debt.

(3) Purchase commitments are noncancelable contractual obligations for raw materials and energy, and exclude capital expenditures for property, plant and equipment.

(4) We have not projected payments past 2021 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, 2020. We have $20.3 million in gross liabilities related to unrecognized tax benefits, including $2.9 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.

(5) 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 2021 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 revenues in accordance with ASC 606.

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.

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 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 recognize an impairment for the difference between fair value and carrying value.

The significant assumptions we used in our impairment analyses of goodwill at October 31, 2020 and 2019 are the weighted average cost of capital and revenue growth rates.

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.

During the second and third quarters of 2019, the Company recorded $9.0 million of goodwill impairment charges related to our Tile Coatings business, which was historically recorded within our Performance Coatings reportable segment. The goodwill impairment charge recorded was a result of the finalization of purchase accounting of the recent Quimicer, FMU, and Gardenia acquisitions that changed the carrying amount of net assets attributable to the reporting unit that represented an impairment indicator. Based on our 2019 annual impairment test performed as of October 31, 2019, the Company recorded additional goodwill impairment charges of $33.5 million associated with a reporting unit within the Tile Coatings business. The impairment charge and related assets are recorded within discontinued operations and as assets held-for-sale, respectively, in our consolidated financial statements as of December 31, 2019.

Future potential impairments are possible for any of the Company's remaining 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.

Lease Accounting

The Company determines if a contract is a lease at inception. The Company has leases for equipment, office space, plant sites and distribution centers. Certain of these leases include options to extend the lease and some include options to terminate the lease early. Leases with an initial term of 12 months or less are not recorded on the balance sheet and the related lease expense is recognized on a straight-line basis over the lease term.

The right-of-use asset represents the right to use an underlying asset for the lease term and the lease liabilities represent the Company's obligation to make lease payments arising from the lease. Right-of-use assets and lease liabilities are recognized as of the commencement date based on the present value of the lease payments over the lease term. The lease term may include options to extend or terminate the lease when it is reasonably certain that the Company will exercise the applicable option.

The Company's lease payments consist of both fixed and variable lease payments. Residual value guarantees are not common within the Company's lease agreements nor are restrictions or covenants imposed by leases. The Company has elected the practical expedient to combine lease and non-lease components. The Company determined the discount rate to be used in measuring lease liabilities at a portfolio level using a collateralized rate. Specifically, we segregated our lease portfolio into different populations based on (1) lease currency, (2) lease term, and (3) creditworthiness of the lessee and security structure. There are no leases that have not yet commenced that create significant rights and obligations for the Company.

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 change, 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 counter-party 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.

We have executed cross currency interest rate swaps to minimize our exposure to floating rate debt agreements denominated in a currency other than functional currency. These swaps are settled in cash, and the net interest paid or received is effectively recognized as interest expense as the interest on the debt is accrued. These swaps are designated as cash flows hedges and 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, from time-to-time, uses non-derivative financial instruments, such as its foreign currency denominated debt, as economic hedges of its net investments in certain foreign subsidiaries. In addition, we have executed cross currency interest rate swaps to help protect the value of the Company's net investment in European operations. 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 cumulative translation adjustments (a component of other comprehensive income).

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 Egyptian Pound, the Turkish Lira, the Taiwan Dollar, the Colombian Peso, the Australian Dollar, the Indian Rupee, 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 may enter into a forward purchase arrangement with a precious metals supplier to completely cover the value of the precious metals content. Our current precious metals 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.

Transfer of Financial Assets

The Company accounts for transfers of financial assets as sales when it has surrendered control over the related assets. Whether control has been relinquished requires, among other things, an evaluation of relevant legal considerations and an assessment of the nature and extent of the Company's continuing involvement with the assets transferred.

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 84% of pension plan assets, 70% of benefit obligations and 26% of net periodic pension expense as of December 31, 2020.

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. Non-U.S. plan allocations are primarily comprised of fixed income securities. In 2020, our pension plan assets incurred gains of approximately 11% within the U.S. plans and 7% within non-U.S. plans. In 2019, our pension plan assets incurred gains of approximately 17% within the U.S. plans and 13% within non-U.S. plans. 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:

(Dollars in thousands)	25 Basis Point Decrease in Discount Rate	25 Basis Point Decrease in Asset Return Assumption
U.S. pension plans	$ (564)	$ 571
U.S. retiree medical plan	(41)	N/A
Non-U.S. pension plans	(156)	27
Total	$ (761)	$ 598

The following table provides the rates used in the assumptions and the changes between 2020 and 2019:

	2020	2019	Change
Discount rate used to measure the benefit cost:			
U.S. pension plans	3.35%	4.40%	(1.05)%
U.S. retiree medical plan	3.25%	4.30%	(1.05)%
Non-U.S. pension plans	1.76%	2.61%	(0.85)%
Discount rate used to measure the benefit obligation:			
U.S. pension plans	2.55%	3.35%	(0.80)%
U.S. retiree medical plan	2.40%	3.25%	(0.85)%
Non-U.S. pension plans	1.29%	1.76%	(0.47)%
Expected return on plan assets:			
U.S. pension plans	7.70%	7.70%	—%
Non-U.S. pension plans	2.04%	2.74%	(0.70)%

In the U.S., the net periodic benefit cost for all defined benefit plans was $2.2 million in 2020 and 2019. This is primarily caused by the decrease in discount rates being offset by higher asset returns in 2020 and the plan change to the U.S. retiree medical plan. In non-U.S. countries, the net periodic benefit cost for all defined benefit plans was $6.3 million in 2020 and $12.5 million in 2019. This decrease in 2020 compared to 2019 is primarily caused by the smaller reduction in discount rate in 2020 and the subsequent reduction in the applicable marked-to-market losses in 2020.

For 2021, assuming expected returns on plan assets and no actuarial gains or losses, we expect our overall net periodic benefit income to be approximately $4.9 million, compared with income of approximately $6.0 million in 2020 on a comparable basis.

Inventories

We value inventory at the lower of cost or net realizable value, 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-rate 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 $0.2 million at December 31, 2020. 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 $1.4 million at December 31, 2020.

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:

(Dollars in thousands)	December 31, 2020	December 31, 2019
Variable-rate debt:		
Carrying amount(1)	$ 793,731	$ 801,764
Fair value(1)	783,143	799,750
Increase in annual interest expense from 1% increase in interest rates	2,626	2,656
Decrease in annual interest expense from 1% decrease in interest rates	(2,626)	(2,656)
Fixed-rate debt:		
Carrying amount	3,706	3,496
Fair value	1,887	1,557
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	311,220	314,412
Carrying amount and fair value	(24,694)	(14,698)
Change in fair value from 1% increase in interest rates	8,407	11,399
Change in fair value from 1% decrease in interest rates	(3,131)	(10,676)
Cross currency swaps:		
Notional amount	223,675	341,419
Carrying amount and fair value	(5,162)	22,111
Change in fair value from 10% increase	(24,475)	(34,975)
Change in fair value from 10% decrease	24,475	34,975
Foreign currency forward contracts:		
Notional amount	494,187	291,997
Carrying amount and fair value	2,019	601
Change in fair value from 10% appreciation of U.S. dollar	(2,810)	3,540
Change in fair value from 10% depreciation of U.S. dollar	3,435	(4,144)

(1) The carrying values of the term loan facilities are net of unamortized debt issuance costs of $3.7 million and $3.9 million for the period ended December 31, 2020, and December 31, 2019, respectively.

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, 2020 and 2019, the related consolidated statements of operations, comprehensive income, equity, and cash flows for each of the three years in the period ended December 31, 2020, 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, 2020 and 2019, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2020, 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, 2020, 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 March 1, 2021, 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 Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

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

Critical Audit Matter

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

Goodwill — Reporting Unit within Color Solutions business — Refer to Notes 2 and 8 to the financial statements.

Critical Audit Matter Description

The Company's evaluation of goodwill for impairment involves the comparison of the fair value of each reporting unit to its carrying value. The Company estimates the fair value of its reporting units using the average of both the income approach and the market approach. The market approach estimates a price reasonably expected to be paid by a market participant in the purchase of similar businesses. The income approach uses projected cash flows attributable to reporting units. Projecting cash flows requires management to make significant estimates and assumptions. Changes to these assumptions could have a significant impact on either the fair value of the reporting unit, the amount of any goodwill impairment, or both. The goodwill balance was $175.4 million as of December 31, 2020, of which $51.8 million was allocated to the Color Solutions reporting unit, which exhibits more sensitivity to changes in estimates and assumptions, most significantly related to forecasts of future revenues and the weighted-average cost of capital used to discount the cash flow projections. The estimated fair value of the Color Solutions reporting unit exceeded its carrying value by 67% as of the measurement date of October 31, 2020 and, therefore, no impairment is recorded.

We identified goodwill for the Color Solutions reporting unit as a critical audit matter because of the significant judgments made by management to estimate the fair value of the reporting unit and the difference between its fair value and carrying value. Obtaining sufficient audit evidence related to these assumptions required a high degree of auditor judgment and an increased extent of effort, including the need to involve our fair value specialists, when performing audit procedures to evaluate the reasonableness of management's estimates and assumptions related to selection of the discount rate and forecasts of future revenue.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to the discount rate and forecasts of future revenue used by management to estimate the fair value of this reporting unit included the following, among others:

- We tested the effectiveness of controls over management's goodwill impairment evaluation, including those over the determination of the fair value of the reporting unit, such as controls related to management's selection of the discount rate and forecasts of future revenue.

- We evaluated management's ability to accurately forecast future revenues by comparing actual results to management's historical forecasts.

- We evaluated the reasonableness of management's revenue forecasts by comparing the forecasts to:
  - Historical revenues.
  - Internal communications to management and the Board of Directors.
  - Forecasted information included in industry reports that the reporting unit operates in.

- With the assistance of our fair value specialists, we evaluated the reasonableness of the (1) valuation methodology and (2) discount rate by:
  - Testing the source information underlying the determination of the discount rate and the mathematical accuracy of the calculation.
  - Developing a range of independent estimates and comparing those to the discount rate selected by management.

- We considered the impact of changes in management's projections from the October 31, 2020, annual assessment date to December 31, 2020 by comparing actual results for the period to management projections within the original valuation model.

/s/ Deloitte & Touche LLP

Cleveland, Ohio
March 1, 2021

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

FERRO CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF OPERATIONS

(Dollars in thousands, except per share amounts)	Years Ended December 31, 2020	2019	2018
Net sales	$ 958,954	$ 1,014,457	$ 1,074,696
Cost of sales	665,198	706,481	736,307
Gross profit	293,756	307,976	338,389
Selling, general and administrative expenses	202,413	212,365	219,708
Restructuring and impairment charges	17,425	10,955	7,116
Other expense (income):			
Interest expense	21,880	24,302	23,659
Interest earned	(1,995)	(3,325)	(3,672)
Foreign currency losses, net	3,627	9,166	6,335
Loss on extinguishment of debt	—	—	3,226
Miscellaneous expense, net	5,505	11,722	12,074
Income before income taxes	44,901	42,791	69,943
Income tax expense	14,861	7,965	13,893
Income from continuing operations	30,040	34,826	56,050
Income (loss) from discontinued operations, net of income taxes	14,003	(27,411)	24,896
Net income	44,043	7,415	80,946
Less: Net income attributable to noncontrolling interests	1,244	1,377	853
Net income attributable to Ferro Corporation common shareholders	$ 42,799	$ 6,038	$ 80,093
Amounts attributable to Ferro Corporation:			
Net income attributable to Ferro Corporation from continuing operations, net of income tax	28,967	33,739	55,199
Net income (loss) attributable to Ferro Corporation from discontinued operations, net of income tax	13,832	(27,701)	24,894
Income attributable to Ferro Corporation	$ 42,799	$ 6,038	$ 80,093
Weighted-average common shares outstanding	82,232	82,083	83,940
Incremental common shares attributable to performance shares, deferred stock units, restricted stock units, and stock options	792	808	1,145
Weighted-average diluted shares outstanding	83,024	82,891	85,085
Earnings (loss) per share attributable to Ferro Corporation common shareholders:			
Basic earnings (loss):			
Continuing operations	$ 0.35	$ 0.41	$ 0.66
Discontinued operations	0.17	(0.34)	0.29
	$ 0.52	$ 0.07	$ 0.95
Diluted earnings (loss):			
Continuing operations	$ 0.35	$ 0.41	$ 0.65
Discontinued operations	0.17	(0.34)	0.29
	$ 0.52	$ 0.07	$ 0.94

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Years Ended December 31,		
(Dollars in thousands)	**2020**	**2019**	**2018**
Net income	$ 44,043	$ 7,415	$ 80,946
Other comprehensive income (loss), net of income tax:			
Foreign currency translation income (loss)	26,991	5,500	(26,113)
Cash flow hedging instruments unrealized loss	(9,420)	(9,710)	(4,242)
Postretirement benefit liabilities gain (loss)	1,993	80	(39)
Other comprehensive income (loss), net of income tax	19,564	(4,130)	(30,394)
Total comprehensive income	63,607	3,285	50,552
Less: Comprehensive income attributable to noncontrolling interests	1,142	1,262	352
Comprehensive income attributable to Ferro Corporation	$ 62,465	$ 2,023	$ 50,200

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES

CONSOLIDATED BALANCE SHEETS

(Dollars in thousands)	December 31, 2020	December 31, 2019
ASSETS		
Current assets		
Cash and cash equivalents	$ 174,077	$ 96,202
Accounts receivable, net	137,008	139,333
Inventories	260,332	264,476
Other receivables	72,272	69,365
Other current assets	18,261	22,373
Current assets held-for-sale	307,854	291,420
Total current assets	969,804	883,169
Other assets		
Property, plant and equipment, net	315,330	302,672
Goodwill	175,351	172,212
Intangible assets, net	119,500	127,815
Deferred income taxes	115,962	98,714
Operating leased assets	15,446	20,088
Other non-current assets	80,618	72,020
Non-current assets held-for-sale	168,922	157,931
Total assets	$ 1,960,933	$ 1,834,621
LIABILITIES AND EQUITY		
Current liabilities		
Loans payable and current portion of long-term debt	$ 8,839	$ 8,703
Accounts payable	135,296	138,799
Accrued payrolls	27,166	27,447
Accrued expenses and other current liabilities	124,770	73,016
Current liabilities held-for-sale	107,545	133,780
Total current liabilities	403,616	381,745
Other liabilities		
Long-term debt, less current portion	791,509	798,862
Postretirement and pension liabilities	181,610	174,021
Operating leased non-current liabilities	10,064	14,474
Other non-current liabilities	62,050	56,976
Non-current liabilities held-for-sale	71,149	38,341
Total liabilities	1,519,998	1,464,419
Equity		
Ferro Corporation shareholders' equity:		
Common stock, par value $1 per share; 300.0 million shares authorized; 93.4 million shares issued; 82.4 million and 82.0 million shares outstanding at December 31, 2020 and December 31, 2019, respectively	93,436	93,436
Paid-in capital	293,682	294,543
Retained earnings	304,815	262,016
Accumulated other comprehensive loss	(89,710)	(109,376)
Common shares in treasury, at cost	(172,256)	(180,243)
Total Ferro Corporation shareholders' equity	429,967	360,376
Noncontrolling interests	10,968	9,826
Total equity	440,935	370,202
Total liabilities and equity	$ 1,960,933	$ 1,834,621

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF EQUITY

	Ferro Corporation Shareholders							
	Common Shares in Treasury							
(In thousands)	Shares	Amount	Common Stock	Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Non-controlling Interests	Total Equity
Balances at December 31, 2017	9,386	$(147,056)	$ 93,436	$ 302,158	$ 171,744	$ (75,468)	$ 11,866	$ 356,680
Net income	—	—	—	—	80,093	—	853	80,946
Other comprehensive loss	—	—	—	—	—	(29,893)	(501)	(30,394)
Purchase of treasury stock	1,471	(28,807)	—	—	—	—	—	(28,807)
Stock-based compensation transactions	(424)	10,318	—	(4,824)	—	—	—	5,494
Change in ownership interest	—	—	—	789	—	—	(2,228)	(1,439)
Distributions to noncontrolling interests	—	—	—	—	—	—	(772)	(772)
Adjustments for accounting standard update 2016-16	—	—	—	—	4,141	—	—	4,141
Balances at December 31, 2018	10,433	(165,545)	93,436	298,123	255,978	(105,361)	9,218	385,849
Net income	—	—	—	—	6,038	—	1,377	7,415
Other comprehensive loss	—	—	—	—	—	(4,015)	(115)	(4,130)
Purchase of treasury stock	1,441	(25,000)	—	—	—	—	—	(25,000)
Stock-based compensation transactions	(443)	10,302	—	(3,580)	—	—	—	6,722
Distributions to noncontrolling interests	—	—	—	—	—	—	(654)	(654)
Balances at December 31, 2019	11,431	(180,243)	93,436	294,543	262,016	(109,376)	9,826	370,202
Net income	—	—	—	—	42,799	—	1,244	44,043
Other comprehensive loss	—	—	—	—	—	19,666	(102)	19,564
Stock-based compensation transactions	(366)	7,987	—	(861)	—	—	—	7,126
Balances at December 31, 2020	11,065	$ (172,256)	$ 93,436	$ 293,682	$ 304,815	$ (89,710)	$ 10,968	$ 440,935

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF CASH FLOWS

(Dollars in thousands)	2020	2019	2018
Cash flows from operating activities			
Net income	$ 44,043	$ 7,415	$ 80,946
Adjustments to reconcile net income to net cash provided by (used in) operating activities:			
Loss (gain) on sale of assets and businesses	246	(916)	164
Depreciation and amortization	40,289	55,879	53,974
Interest amortization	3,974	3,755	3,577
Restructuring and impairment charges	9,787	44,702	4,084
Loss on extinguishment of debt	—	—	3,226
Provision for allowance for doubtful accounts	530	1,086	681
Retirement benefits	4,646	9,063	9,221
Deferred income taxes	(11,640)	(11,826)	(3,720)
Stock-based compensation	7,998	7,406	8,441
Changes in current assets and liabilities, net of effects of acquisitions:			
Accounts receivable	(141,330)	(74,444)	19,885
Inventories	36,485	(10,578)	(33,922)
Accounts payable	(26,671)	(10,075)	35,887
Other current asset, liabilities and adjustments, net	18,451	(3,757)	349
Net cash provided by (used in) operating activities	(13,192)	17,710	182,793
Cash flows from investing activities			
Capital expenditures for property, plant and equipment and other long-lived assets	(31,783)	(64,970)	(80,619)
Collections of financing receivables	129,969	84,567	7,020
Business acquisitions, net of cash acquired	—	(251)	(74,954)
Other investing activities	807	1,957	37
Net cash provided by (used in) investing activities	98,993	21,303	(148,516)
Cash flows from financing activities			
Net borrowings (repayments) under loans payable	(709)	45	(19,077)
Principal payments on term loan facility—Credit Facility	—	—	(304,060)
Principal payments on term loan facility—Amended Credit Facility	(8,200)	(8,200)	(6,150)
Proceeds from term loan facility—Amended Credit Facility	—	—	466,075
Proceeds from revolving credit facility—Credit Facility	—	—	134,950
Principal payments on revolving credit facility—Credit Facility	—	—	(212,950)
Proceeds from revolving credit facility—Amended Credit Facility	399,110	227,101	240,035
Principal payments on revolving credit facility—Amended Credit Facility	(399,110)	(227,101)	(240,035)
Payment of debt issuance costs	—	—	(3,466)
Acquisition related contingent consideration payment	—	(5,200)	(9,464)
Proceeds from exercise of stock options	756	1,052	764
Purchase of treasury stock	—	(25,000)	(28,807)
Other financing activities	(1,895)	(1,892)	(8,448)
Net cash provided by (used in) financing activities	(10,048)	(39,195)	9,367
Effect of exchange rate changes on cash and cash equivalents	2,122	283	(2,894)
Increase in cash and cash equivalents	77,875	101	40,750
Cash and cash equivalents at beginning of period	104,402	104,301	63,551
Cash and cash equivalents at end of period	182,277	104,402	104,301
Less: Cash and cash equivalents of discontinued operations at end of period	8,200	8,200	8,200
Cash and cash equivalents of continuing operations at end of period	$ 174,077	$ 96,202	$ 96,101
Cash paid during the period for:			
Interest	$ 31,285	$ 33,429	$ 33,910
Income taxes	$ 19,648	$ 21,682	$ 36,789

See accompanying notes to consolidated financial statements.

FERRO CORPORATION AND SUBSIDIARIES

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
Years ended December 31, 2020, 2019 and 2018

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(2)
- Functional Coatings
- Color Solutions

(1) Tile Coating Systems was historically a part of the Performance Coatings reportable segment. As of December 31, 2019, the results of the Tile Coatings business portion of Tile Coating Systems are reported as discontinued operations, for financial reporting purposes.

(2) Porcelain Enamel, previously a part of the Performance Coatings reportable segment, is integrated into the Functional Coatings reportable segment, for financial reporting purposes.

We produce our products primarily in the Europe, Middle East and Africa ("EMEA") region, the United States ("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 the EMEA 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 sanitation.

During the fourth quarter of 2019, substantially all of the assets and liabilities of our Tile Coatings business were classified as held-for-sale in the accompanying consolidated balance sheets. As further discussed in Note 4, we entered into a definitive agreement to sell our Tile Coatings business which has historically been included in the Performance Coatings reportable segment. Therefore, the associated operating results, net of income tax, have been classified as discontinued operations in the accompanying consolidated statements of operations for all periods presented.

Certain reclassifications have been made to the prior year financial statements to conform to current year classifications. The reclassification relates to the balance sheet presentation of assets and liabilities as held for sale and statement of operations presentation of results classified as discontinued operations in relation to the Tile Coatings business transaction.

On February 25, 2021, we completed the sale of our Tile Coatings business to Pigments Spain, S.L., a company of the Esmalglass-Itaca-Fritta group, which is a portfolio company of certain Lone Star Funds.

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 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 Other non-current assets on our consolidated balance sheet. We consolidate financial results for five 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 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

Under Accounting Standards Codification ("ASC") 606, revenues are recognized when control of the promised goods is transferred to our customers, in an amount that reflects the consideration we expect to be entitled to in exchange for those goods. In order to achieve that core principle, the Company applies the following five-step approach: 1) identify the contract with a customer; 2) identify the performance obligations; 3) determine the transaction price; 4) allocate the transaction price to the performance obligations in the contract; and 5) recognize revenue when a performance obligation is satisfied.

The Company considers confirmed customer purchase orders, which in some cases are governed by master sales agreements, to be the contracts, from an accounting perspective, with customers. Under our standard contracts, the only performance obligation is the delivery of manufactured goods and the performance obligation is satisfied at a point in time, when the Company transfers control of the manufactured goods. The Company may receive orders for products to be delivered over multiple dates that may extend across several reporting periods. The Company invoices for each order and recognizes revenue for each distinct product upon shipment, once transfer of control has occurred. Payment terms are standard for the industry and jurisdiction in which we operate. In determining the transaction price, the Company evaluates whether the price is subject to refund or adjustment, to determine the net consideration to which the Company expects to be entitled. Discounts or rebates are specifically stated in customer contracts or invoices, and are recorded as a reduction of revenue in the period the related revenue is recognized. The product price as specified on the customer confirmed orders is considered the standalone selling price. The Company allocates the transaction price to each distinct product based on its relative standalone selling price. Revenue is recognized when control of the product is transferred to the customer (i.e., when the Company's performance obligation is satisfied), which generally occurs at shipment. We review material contracts to determine transfer of control based upon the business practices and legal requirements of each country. For sales of all products, including those containing precious metals, we report revenues on a gross basis, along with their corresponding cost of sales to arrive at gross profit.

The amount of shipping and handling fees invoiced to our customers at the time our product is shipped is included in net sales as we are the principal in those activities. Sales, valued-added and other taxes collected from our customers and remitted to governmental authorities are excluded from net sales. Credit memos issued to customers for sales returns and sales adjustments are recorded when they are incurred as a reduction of sales.

There were no changes in amounts previously reported in the Company's consolidated financial statements due to adopting ASC 606.

Practical Expedients and Exemptions

All material contracts have an original duration of one year or less and, as such, the Company uses the practical expedient applicable to such contracts, and has not disclosed the transaction price for the remaining performance obligations as of the end of each reporting period, or when the Company expects to recognize this revenue.

When the period of time between the transfer of control of the goods and the time the customer pays for the goods is one year or less, the Company uses the practical expedient allowed by ASC 606 that provides relief from adjusting the amount of promised consideration for the effects of a financing component.

We generally expense sales commissions when incurred because the amortization period is one year or less. These costs are recorded within Selling, general and administrative expenses

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 $35.6 million for 2020, $41.0 million for 2019 and $40.1 million for 2018.

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 and indefinite-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.

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, cross currency 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 Accumulated other comprehensive loss ("AOCL") and reclassified from AOCL into earnings when the hedged transaction affects earnings. For derivatives that are designated and qualify as net investment hedges, the gain or loss on the derivative is reported as a component of the currency translation in AOCL. Time value is excluded and the cash payments are recognized as an adjustment to interest expense. 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. All costs except the service cost component are recorded in Miscellaneous expense (income), net on the consolidated statement of operations.

Income Taxes

We account for income taxes in accordance with 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 statement 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:

(Dollars in thousands)	**2020**	**2019**	**2018**
Allowance for doubtful accounts	$ 2,502	$ 1,756	$ 1,343
Bad debt expense	255	455	843

Inventories

We value inventory at the lower of cost or net realizable value, 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. Inventory values have been reduced to the lower of cost or net realizable 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 from our 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 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.

The following section provides a description of new accounting pronouncements ("Accounting Standard Update" or "ASU") issued by the Financial Accounting Standards Board ("FASB") that are applicable to the Company.

Recently Adopted Accounting Pronouncement

This section provides a description of new accounting pronouncements issued by the FASB that are applicable to the Company.

The following ASUs were adopted as of January 1, 2020 and did not have a material impact on the consolidated financial statements:

Standard	Description
ASU No. 2019-12, *Income Taxes (Topic 740): Simplifying the Accounting for Income Taxes*, issued December, 2019	Simplifies the accounting for income taxes by removing certain exceptions and by: altering the recognition of franchise tax partially based on income; requiring evaluation of proper treatment of a step up in the tax basis of goodwill; specifying requirements regarding the allocation of tax expense to a legal entity that is not subject to tax; requiring the effect of an enacted change in tax laws or rates be reflected in the annual effective tax rate computation in the interim period that includes the enactment date, and; other minor codification improvements. ASU 2019-12 was early adopted by the Company.
ASU No. 2016-13, *Financial Instruments — Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments*, issued June 2016	Changes the way entities recognize impairment of financial assets by requiring immediate recognition of estimated credit losses expected to occur over the remaining life of the financial asset. Additional disclosures are required regarding an entity's assumptions, models and methods for estimating the expected credit loss.

New Accounting Standards Not Yet Adopted

We are currently evaluating the impact on our financial statements of the following ASUs:

Standard	Description
ASU No. 2020-04, *Reference Rate Reform (Topic 848): Facilitation of the Effects of Reference Rate Reform on Financial Reporting*, issued March, 2020	Along with ASU 2021-01, *Reference Rate Reform (Topic 848): Scope*, provide optional expedients and exceptions for applying GAAP to contracts, hedging relationships, and other transactions affected by reference rate reform if certain criteria are met. The amendments in these ASUs are effective for all entities through December 31, 2022.
ASU No. 2018-14, *Compensation-Retirement Benefits-Defined Benefit Plans-General (Subtopic 715-20): Disclosure Framework-Changes to the Disclosure Requirements for Defined Benefit Plans*, issued August, 2018	Modifies disclosure requirements for employers that sponsor defined benefit pension or other postretirement plans. This ASU is effective for fiscal years beginning after December 15, 2020 and is to be applied using a retrospective approach for all periods presented. Early adoption is permitted.

No other new accounting pronouncements issued had, or are expected to have, a material impact of the Company's consolidated financial statements.

3. Revenue

Revenues disaggregated by geography and reportable segment for the year ended December 31, 2020, follow:

(Dollars in thousands)	EMEA	United States	Asia Pacific	Latin America	Total
Functional Coatings	$267,041	$195,027	$100,727	$45,397	$608,192
Color Solutions	129,222	146,434	40,221	34,885	350,762
Total net sales	$396,263	$341,461	$140,948	$80,282	$958,954

Revenues disaggregated by geography and reportable segment for the year ended December 31, 2019, follow:

(Dollars in thousands)	EMEA	United States	Asia Pacific	Latin America	Total
Functional Coatings	$295,198	$197,494	$101,521	$50,570	$ 644,783
Color Solutions	136,934	161,773	37,485	33,482	369,674
Total net sales	$432,132	$359,267	$139,006	$84,052	$1,014,457

Revenues disaggregated by geography and reportable segment for the year ended December 31, 2018, follow:

(Dollars in thousands)	EMEA	United States	Asia Pacific	Latin America	Total
Functional Coatings	$324,092	$207,012	$100,329	$52,236	$ 683,669
Color Solutions	142,102	172,901	41,642	34,382	391,027
Total net sales	$466,194	$379,913	$141,971	$86,618	$1,074,696

4. Discontinued Operations

During the fourth quarter of 2019, substantially all of the assets and liabilities of our Tile Coatings business were classified as held-for-sale in the accompanying consolidated balance sheets. We entered into a definitive agreement to sell our Tile Coatings business which has historically been a part of our Performance Coatings reportable segment. Therefore, the associated operating results, net of income tax, have been classified as discontinued operations in the accompanying consolidated statements of operations for all periods presented.

On February 25, 2021, we completed the sale of our Tile Coatings business to Pigments Spain, S.L., a company of the Esmalglass-Itaca-Fritta group (the “Buyer”), which is a portfolio company of certain Lone Star Funds, for $460.0 million in cash, subject to post-closing adjustments. The transaction resulted in net proceeds of approximately $420.0 million after expenses. We entered into a Transition Services Agreement (“TSA”) with the Buyer, which is designed to facilitate an orderly transfer of business operations. The services provided under the TSA will terminate within at various times between six to twelve months. Except for customary post-closing adjustments and transition services, we have no continuing involvement with the Buyer subsequent to the completion of the sale.

The table below summarizes results for the Tile Coatings business for the year ended December 31, 2020, 2019 and 2018 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 the business to consolidated net assets excluding debt.

(Dollars in thousands)	2020	2019	2018
Net sales	$440,501	$491,493	$537,712
Cost of sales	327,505	388,959	420,168
Gross profit	112,996	102,534	117,544
Selling, general and administrative expenses	72,033	71,591	58,858
Restructuring and impairment charges	2,290	44,378	6,179
Interest expense	10,650	11,556	12,835
Interest earned	(184)	(122)	(125)
Foreign currency losses (gains), net	6,608	(2,397)	1,852
Miscellaneous expense, net	2,281	2,127	3,896
Income (loss) from discontinued operations before income taxes	19,318	(24,599)	34,049
Income tax expense	5,315	2,812	9,153
Income (loss) from discontinued operations, net of income taxes	14,003	(27,411)	24,896
Less: Net income attributable to noncontrolling interests	171	290	2
Net income (loss) attributable to Tile Coatings business	$ 13,832	$ (27,701)	$ 24,894

The following table summarizes the assets and liabilities which are classified as held-for-sale at December 31, 2020 and 2019:

(Dollars in thousands)	December 31, 2020	December 31, 2019
Cash and cash equivalents	$ 8,200	$ 8,200
Accounts receivable, net	211,548	156,645
Inventories	84,239	101,127
Other receivables	1,630	22,442
Other current assets	2,237	3,006
Current assets held-for-sale	307,854	291,420
Property, plant and equipment, net	108,145	96,762
Amortizable intangible assets, net	42,126	39,692
Deferred income taxes	12,267	14,425
Other non-current assets	6,384	7,052
Non-current assets held-for-sale	168,922	157,931
Total assets held-for-sale	$476,776	$449,351
Loans payable and current portion of long-term debt	$ 3,927	$ 3,678
Accounts payable	85,308	96,998
Accrued payrolls	5,946	4,838
Accrued expenses and other current liabilities	12,364	28,266
Current liabilities held-for-sale	107,545	133,780
Long-term debt, less current portion	56,359	25,805
Postretirement and pension liabilities	8,119	7,473
Other non-current liabilities	6,671	5,063
Non-current liabilities held-for-sale	71,149	38,341
Total liabilities held-for-sale	$178,694	$172,121

The following table summarizes cash flow data relating to discontinued operations for the years ended December 31, 2020, 2019 and 2018:

(Dollars in thousands)	2020	2019	2018
Depreciation	$ —	$11,264	$10,778
Amortization of intangible assets	—	3,192	3,219
Capital expenditures	(4,713)	(9,965)	(5,830)
Non-cash operating activities-fixed asset impairment	—	—	—
Non-cash operating activities-goodwill impairment	—	42,515	—
Non-cash operating activities-restructuring	1,080	127	—
Non-cash investing activities-capital expenditures, consisting of unpaid capital expenditure liabilities at year end	1,493	1,087	5,926

5. Acquisitions

Quimicer, S.A.

On October 1, 2018, the Company acquired 100% of the equity interests of Quimicer, S.A. (“Quimicer”), for €32.2 million (approximately $37.4 million), including the assumption of debt of €5.2 million (approximately $6.1 million). Its products include frits, varnishes, silk-screen printing pastes, crushed frits, pellets, atomized varnishes, and ceramic colors, as well as pigmented inks for digital printing on ceramic tiles within the legacy Performance Coatings reportable segment. The information included herein has been prepared based on the allocation of the purchase price using 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 $21.5 million of personal and real property, $15.9 million of net working capital, $3.0 million of goodwill and $3.0 million of deferred tax liability on the consolidated balance sheets. During the third quarter of 2019, the Company recorded a goodwill impairment charge of $3.0 million as a result of the finalization of purchase accounting. During the fourth quarter of 2019, substantially all of the assets and liabilities of Quimicer were classified as held-for-sale in the accompanying consolidated balance sheets and associated operating results, net of income tax, classified as discontinued operations in the accompanying consolidated statements of operations in conjunction with the planned sale of the Tile Coatings business discussed in Note 4.

UWiZ Technology Co., Ltd.

On September 25, 2018, the Company acquired 100% of the equity interests of UWiZ Technology Co., Ltd. (“UWiZ”) for TWD 823.4 million (approximately $26.9 million) in cash. Its products include a range of slurry-based polishing products for the semiconductor and optoelectronics industry within the Color Solutions reportable segment. The information included herein has been prepared based on the allocation of the purchase price using 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 $12.5 million of net working capital, $7.1 million of goodwill, $6.6 million of amortizable intangible assets, $2.4 million of personal and real property and $1.7 million of deferred tax liability on the consolidated balance sheets.

Ernst Diegel GmbH

On August 31, 2018, the Company acquired 100% of the equity interests of Ernst Diegel GmbH (“Diegel”), including the real property of a related party, for 12.1 million euros (approximately $14.0 million) in cash. Its products include decorative coatings for glass and high-performance plastics coatings, primarily in automotive applications within the Functional Coatings reportable segment. 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 $7.0 million of personal and real property, $4.8 million of net working capital, $2.0 million of amortizable intangible assets, $1.7 million of goodwill and $1.5 million of deferred tax liability on the consolidated balance sheets.

MRA Laboratories, Inc.

On July 12, 2018, the Company acquired 100% of the equity interests of MRA Laboratories, Inc. ("MRA") for $16.0 million in cash. Its products include dielectrics and electronic ink products for passive component applications within the Functional Coatings reportable segment. 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 $7.2 million of goodwill, $6.7 million of amortizable intangible assets, $3.4 million of net working capital, $1.6 million of deferred tax liability and $0.3 million of personal and real property on the consolidated balance sheets.

PT Ferro Materials Utama

On June 29, 2018, the Company acquired 66% of the equity interests of PT Ferro Materials Utama ("FMU") for $2.7 million in cash, in addition to the forgiveness of debt of $9.2 million, bringing our total ownership to 100%. Its products include additives and ceramics color products within the legacy Performance Coatings reportable segment. The Company previously recorded its investment in FMU as an equity method investment, and following this transaction, the Company fully consolidates FMU. Due to the change of control that occurred, the Company recorded a gain on purchase of $2.6 million, which is recorded in Miscellaneous expense (income), net, related to the difference between the Company's carrying value and fair value of the previously held equity method investment during the second quarter of 2018. During the fourth quarter of 2019, substantially all of the assets and liabilities of FMU were classified as held-for-sale in the accompanying consolidated balance sheets and associated operating results, net of income tax, classified as discontinued operations in the accompanying consolidated statements of operations in conjunction with the planned sale of the Tile Coatings business discussed in Note 4.

6. Inventories

Inventory at December 31 consisted of the following:

(Dollars in thousands)	2020	2019
Raw materials	$ 81,344	$ 80,176
Work in process	48,770	49,717
Finished goods	130,218	134,583
Total inventories	$260,332	$264,476

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 $2.9 million for 2020, $3.1 million for 2019, and $2.1 million for 2018. We had on hand precious metals owned by participants in our precious metals consignment program of $87.2 million at December 31, 2020 and $66.2 million at December 31, 2019, measured at fair value based on market prices for identical assets.

7. Property, Plant and Equipment

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

(Dollars in thousands)	2020	2019
Land	$ 38,283	$ 36,628
Buildings	176,306	157,862
Machinery and equipment	472,323	431,189
Construction in progress	76,800	92,460
Total property, plant and equipment	763,712	718,139
Total accumulated depreciation	(448,382)	(415,467)
Property, plant and equipment, net	$ 315,330	$ 302,672

Depreciation expense was $27.8 million for 2020, $28.3 million for 2019, and $27.3 million for 2018. Additional depreciation expense of $11.3 million for 2019, and $10.8 million for 2018 were classified within Income (loss) from discontinued operations, net of income taxes.

Noncash investing activities for capital expenditures, consisting of new capital leases during the year and unpaid capital expenditure liabilities at year end, were $5.3 million for 2020, $3.5 million for 2019, and $7.7 million for 2018.

As discussed in Note 4, the assets of our Tile Coatings business have been classified as held-for-sale under ASC Topic 360; *Property, Plant and Equipment*; until the ultimate sale of the business. 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 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 exceeded the carrying value. As a result, we recorded no impairment charges related to property, plant and equipment as a result of the analysis.

8. Goodwill and Other Intangible Assets

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

(Dollars in thousands)	Functional Coatings	Color Solutions	Total
Goodwill, net at December 31, 2018	$122,411	$50,545	$172,956
Foreign currency adjustments	(506)	(238)	(744)
Goodwill, net at December 31, 2019	$121,905	$50,307	$172,212
Foreign currency adjustments	1,665	1,474	3,139
Goodwill, net at December 31, 2020	$123,570	$51,781	$175,351

(Dollars in thousands)	December 31, 2020	December 31, 2019
Goodwill, gross	$233,818	$230,679
Accumulated impairment losses	(58,467)	(58,467)
Goodwill, net	$175,351	$172,212

During the fourth quarter of 2020 and 2019, 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, 2020 and October 31, 2019, respectively. We performed step 1 of the annual impairment test as defined in ASC Topic 350, *Intangibles — Goodwill and Other*. We estimate fair values of the reporting units 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 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. As a result of the 2020 assessment, there were no impairment indicators.

The significant assumptions used in our impairment analysis of goodwill are the weighted-average cost of capital and revenue growth rates.

During our 2020 and 2019 assessments, the result of the goodwill impairment test was that there were no indicators of impairment associated with our continuing operations. The Company is not aware of any events or circumstances that occurred between the annual assessment date and December 31, 2020, which would require further testing of goodwill for impairment.

During 2019, the assets pertaining to our Tile Coatings business were classified as held-for-sale and the goodwill was immaterial at December 31, 2020 and 2019. At December 31, 2018, $43.5 million of goodwill, net was classified as Non-current assets held-for-sale. Refer to Note 4 for additional information on our Tile Coatings business classified as held-for-sale. During 2019, the Company recorded goodwill impairment charges of $42.5 million within our Tile Coatings business, which is included in Net income from discontinued operations, net of taxes. The fair value of the assets within the Tile Coatings business was valued below its carrying value, resulting in a $33.5 million goodwill impairment charge in the fourth quarter of 2019. There were additional $5.9 million and $3.1 million of goodwill impairment charges in the second and third quarter of 2019, respectively, which was a result of the finalization of purchase accounting of the Quimicer, FMU, and Gardenia acquisitions.

Amortizable intangible assets at December 31 consisted of the following:

(Dollars in thousands)	Estimated Economic Life	2020	2019
Gross amortizable intangible assets:			
Patents	10 -16 years	$ 5,589	$ 5,434
Land rights	20 - 40 years	3,173	2,900
Technology/know-how and other	1 - 30 years	116,015	112,940
Customer relationships	10 - 20 years	68,142	66,454
Total gross amortizable intangible assets		192,919	187,728
Accumulated amortization:			
Patents		(5,566)	(5,413)
Land rights		(1,630)	(1,378)
Technology/know-how and other		(61,104)	(50,973)
Customer relationships		(18,317)	(14,831)
Total accumulated amortization		(86,617)	(72,595)
Amortizable intangible assets, net		$ 106,302	$ 115,133

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 $12.0 million for 2020, $13.0 million for 2019, and $12.6 million for 2018. Amortization expense for amortizable intangible assets is expected to be approximately $12.7 million for 2021, $11.4 million for 2022, $11.3 million for 2023, $11.1 million for 2024, and $11.0 million for 2025.

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

(Dollars in thousands)	2020	2019
Indefinite-lived intangibles assets:		
Trade names and trademarks	$ 13,198	$ 12,682

9. Debt and Other Financing

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

(Dollars in thousands)	2020	2019
Current portion of long-term debt	$ 8,839	$ 8,703
Loans payable and current portion of long-term debt	$ 8,839	$ 8,703

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

(Dollars in thousands)	2020	2019
Term loan facility, net of unamortized issuance costs, maturing 2024[1]	$ 793,731	$ 801,764
Capital lease obligations	2,911	2,305
Other notes	3,706	3,496
Total long-term debt	800,348	807,565
Current portion of long-term debt	(8,839)	(8,703)
Long-term debt, less current portion	$ 791,509	$ 798,862

(1) The carrying value of the term loan facility, maturing 2024, is net of unamortized debt issuance costs of $3.7 million at December 31, 2020 and $3.9 million at December 31, 2019.

The annual maturities of long-term debt for each of the five years after December 31, 2020, are as follows (in thousands):

2021	$ 9,116
2022	9,095
2023	8,957
2024	773,652
2025	691
Thereafter	3,309
Total maturities of long-term debt	804,820
Unamortized issuance costs on Term loan facility	(3,719)
Imputed interest and executory costs on capitalized lease obligations	(753)
Total long-term debt	$ 800,348

Amended Credit Facility

On April 25, 2018, the Company entered into an amendment (the "Amended Credit Facility") to its existing credit facility (the "Credit Facility"), which Amended Credit Facility (a) provided a new revolving facility (the "2018 Revolving Facility"), which replaced the Company's existing revolving facility, (b) repriced the ("Tranche B-1 Loans"), and (c) provided new tranches of term loans ("Tranche B-2 Loans" and "Tranche B-3 Loans") denominated in U.S. dollars. The Amended Credit Facility will be used for ongoing working capital requirements and general corporate purposes. The Tranche B-2 Loans are borrowed by the Company and the Tranche B-3 Loans are borrowed on a joint and several basis by Ferro GmbH and Ferro Europe Holdings LLC.

The Amended Credit Facility consists of a $500 million secured revolving line of credit with a maturity of February 14, 2023, a $355 million secured term loan facility with a maturity of February 14, 2024, a $235 million secured term loan facility with a maturity of February 14, 2024 and a $230 million secured term loan facility with a maturity of February 14, 2024. 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 in an amount equal to a portion of the Company's excess cash flow, as calculated pursuant to the Amended Credit Facility, which prepayment will be applied first to the term loans until they are paid in full, and then to the revolving loans.

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 Amended 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. The Tranche B-3 Loans are guaranteed by the Company, the U.S. subsidiary guarantors and a cross-guaranty by the borrowers of the Tranche B-3 Loans, and are secured by the collateral securing the revolving loans and the other term loans, in addition to a pledge of the equity interests of Ferro GmbH.

Interest Rate – Term Loans: The interest rates applicable to the 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 base rate for term loans will be the highest of (i) the federal funds rate plus 0.50%, (ii) syndication agent's prime rate, (iii) the daily LIBOR rate plus 1.00% or (iv) 0.00%. The applicable margin for base rate loans is 1.25%.
- The LIBOR rate for term loans shall not be less than 0.0% and the applicable margin for LIBOR rate term loans is 2.25%.
- For LIBOR 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 for the corresponding duration.

At December 31, 2020, the Company had borrowed $345.2 million under the Tranche B-1 Loans at an interest rate of 2.50%, $228.5 million under the Tranche B-2 Loans at an interest rate of 2.50%, and $223.7 million under the Tranche B-3 Loans at an interest rate of 2.50%. At December 31, 2020, there were no additional borrowings available under the Tranche B-1 Loans, Tranche B-2 Loans, and Tranche B-3 Loans. In connection with these borrowings, we entered into swap agreements in the second quarter of 2018. At December 31, 2020, the effective interest rate for the Tranche B-1 Loans, Tranche B-2 Loans, and Tranche B-3 Loans, after adjusting for the interest rate swap, was 4.93%, 2.50%, and 2.48%, respectively.

At December 31, 2019, the Company had borrowed $348.8 million under the Tranche B-1 Loans at an interest rate of 4.19%, $230.9 million under the Tranche B-2 Loans at an interest rate of 4.19%, and $226.0 million under the Tranche B-3 Loans at an interest rate of 4.19%. At December 31, 2019, there were no additional borrowings available under the Tranche B-1 Loans, Tranche B-2 Loans, and Tranche B-3 Loans. In connection with these borrowings, we entered into swap agreements in the second quarter of 2018. At December 31, 2019, the effective interest rate for the Tranche B-1 Loans, Tranche B-2 Loans, and Tranche B-3 Loans, after adjusting for the interest rate swap, was 5.10%, 2.96%, and 2.48%, respectively.

Interest Rate – Revolving Credit Line: The interest rates applicable to loans under the 2018 Revolving Credit Facility 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 (as defined in the Amended Credit Agreement) at such time to (b) the Company's consolidated EBITDA (as defined in the Amended Credit Agreement) 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) the syndication agent's prime rate, (iii) the daily LIBOR rate plus 1.00% or (iv) 0.00%. The applicable margin for base rate loans will vary between 0.50% to 1.50%.
- The LIBOR rate for revolving loans shall not be less than 0% and the applicable margin for LIBOR rate revolving loans will vary between 1.50% and 2.50%.
- 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, 2020, there were no borrowings under the 2018 Revolving Credit Facility. After reductions for outstanding letters of credit secured by these facilities, we had $495.8 million of borrowings available under the revolving credit facilities at December 31, 2020.

The Amended 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 Amended 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 2018 Revolving 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 Amended Credit Facility agreement may be accelerated and become immediately due and payable. At December 31, 2020, we were in compliance with the covenants of the Amended Credit Facility.

As noted in Note 4, on February 25, 2021, we completed the sale of our Tile Coatings business. Proceeds from the close of the transaction, in addition to current cash balances, were used to pay down our term loan facility in the amount of $435.0 million on February 25, 2021. The debt pay-down reduced outstanding amounts of the Tranche B-1 Loans, Tranche B-2 Loans, and Tranche B-3 Loans, by $188.3 million, $124.7 million and $122.0 million, respectively.

Credit Facility

On February 14, 2017, the Company entered into a 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 consisted 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 were 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 was required, on an annual basis, to make a prepayment of term loans until they were 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.

In conjunction with the refinancing of the Credit Facility in April, 2018, as discussed above, we recorded a charge of $3.2 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, 2018.

Receivable Sales Programs

We have several international programs to sell without recourse trade accounts receivable to financial institutions. During the third quarter of 2020, these programs were amended to include a domestic program. These transactions are treated as a sale and are accounted for as a reduction in accounts receivable because the agreements transfer effective control over and risk related to the receivables to the buyers. The Company continues to service the receivables sold in exchange for a fee. The servicing fee for the years ended December 31, 2020, 2019 and 2018, was immaterial. The program, whose maximum capacity is €85 million, is scheduled to expire on December 31, 2023. Generally, at the transfer date, the Company receives cash equal to approximately 85% of the value of the sold receivable. Cash proceeds at the transfer date from these arrangements are reflected in operating activities in our consolidated statement of cash flows. The proceeds from the deferred purchase price are reflected in investing activities.

The outstanding principal amount of receivables sold under this program, which has not yet been collected from the customer, was $24.5 million at December 31, 2020 and $19.3 million at December 31, 2019. The carrying amount of the deferred purchase was $9.8 million and $6.6 million at December 31, 2020 and December 31, 2019, respectively, and is recorded in Other receivables. As discussed in Note 4, during the fourth quarter of 2019, we entered into a definitive agreement to sell our Tile Coatings business. As such, our Tile Coatings business was classified as held-for-sale. At December 31, 2019, outstanding principal amount of receivables sold under this program, which has not yet been collected from the customer and which pertained to the Tile Coatings business, was $52.6 million. The carrying amount of the deferred purchase price at December 31, 2019 was $20.5 million, and, at December 31, 2020, no amount remained. Both are recorded in Current assets held-for-sale in our consolidated balance sheets.

(Dollars in thousands)	**2020**	**2019**
Trade accounts receivable sold to financial institutions	$340,516	$59,293
Cash proceeds from financial institutions(1)	241,937	39,958
Trade accounts receivable collected to be remitted(2)	35,982	12,817

(1) Excluded from the table above, in 2020 and 2019, our Tile Coatings business received cash proceeds from financial institutions of $47.3 million and $131.5 million, respectively. Refer to Note 4 for additional discussion of the Tile Coatings business and its classification as discontinued operations.

(2) Included in Accrued expense and other current liabilities. During 2019, trade accounts receivable collected to be remitted of $12.8 million, which pertained to the Tile Coatings business, was excluded from the table above and is included in Current liabilities held-for-sale in our consolidated balance sheets.

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 $28.1 million at December 31, 2020 and December 31, 2019. The unused portions of these lines provided additional liquidity of $25.0 million at December 31, 2020 and December 31, 2019.

10. 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, 2020				
	Carrying	Fair Value			
(Dollars in thousands)	Amount	Total	Level 1	Level 2	Level 3
Cash and cash equivalents	$ 174,077	$ 174,077	$ 174,077	$ —	$ —
Term loan facility — Amended Credit Facility[(1)]	(793,731)	(783,143)	—	(783,143)	—
Other long-term notes payable	(3,706)	(1,887)	—	(1,887)	—
Cross currency swaps	(5,162)	(5,162)	—	(5,162)	—
Interest rate swaps	(24,694)	(24,694)	—	(24,694)	—
Foreign currency forward contracts, net	2,019	2,019	—	2,019	—

	December 31, 2019				
	Carrying	Fair Value			
(Dollars in thousands)	Amount	Total	Level 1	Level 2	Level 3
Cash and cash equivalents	$ 96,202	$ 96,202	$ 96,202	$ —	$ —
Term loan facility — Credit Facility[(1)]	(801,764)	(799,750)	—	(799,750)	—
Other long-term notes payable	(3,496)	(1,557)	—	(1,557)	—
Cross currency swaps	22,111	22,111	—	22,111	—
Interest rate swaps	(14,698)	(14,698)	—	(14,698)	—
Foreign currency forward contracts, net	601	601	—	601	—

(1) The carrying values of the term loan facilities are net of unamortized debt issuance costs of $3.7 million and $3.9 million for the period ended December 31, 2020, and December 31, 2019, 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. 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. 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 and cross currency 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 partially offset 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

Cash Flow Hedges. For derivative instruments that are designated and qualify as cash flow hedges, the gain or loss on the derivative is recorded as a component of AOCL and reclassified into earnings in the same period during which the hedged transaction affects earnings.

The Company utilizes interest rate swaps to limit exposure to market fluctuations on floating-rate debt. During the second quarter of 2017, the Company entered into interest rate swap agreements that converted $150 million and €90 million of our term loans from variable interest rates to fixed interest rates. These swaps qualified for, and were designated as, cash flow hedges. The interest rate swap agreements were terminated in the second quarter of 2018 in connection with the refinancing of the Credit Facility.

During the second quarter of 2018, the Company entered into variable to fixed interest rate swaps with a maturity date of February 14, 2024. The notional amount was $311.2 million at December 31, 2020. These swaps are hedging risk associated with the Tranche B-1 Loans. These interest rate swaps are designated as cash flow hedges. As of December 31, 2020, the Company expects it will reclassify net losses of approximately $8.5 million, currently recorded in AOCL, into interest expense in earnings within the next twelve months. However, the actual amount reclassified could vary due to future changes in the fair value of these derivatives.

The Company has converted a U.S. dollar denominated, variable rate debt obligation into a Euro fixed rate obligation using receive-float, pay-fixed cross currency swaps in the second quarter of 2018. These swaps are hedging currency and interest rate risk associated with the Tranche B-3 Loans. These cross currency swaps are designated as cash flow hedges. The notional amount was $223.7 million at December 31, 2020, with a maturity date of February 14, 2024. The spot to spot change is recorded in Foreign currency losses, net, to offset the gain or loss recognized on the foreign denominated debt. As of December 31, 2020, the Company expects it will reclassify net losses of approximately $0.1 million, currently recorded in AOCL, into interest expense in earnings within the next twelve months. However, the actual amount reclassified could vary due to future changes in the fair value of these derivatives.

The amount of gain (loss) recognized in AOCL and the amount of loss (gain) reclassified into earnings for the year ended December 31, 2020 and 2019, follow:

	Amount of Gain (Loss) Recognized in AOCL		Amount of Loss (Gain) Reclassified from AOCL into Income		Location of Gain (Loss) Reclassified from AOCL into Income
(Dollars in thousands)	2020	2019	2020	2019	
Interest rate swaps	$ (16,274)	$ (11,050)	$ (4,757)	$ (441)	Interest expense
Cross currency swaps	(18,415)	8,319	2,137	5,844	Interest expense
			$ (2,620)	$ 5,403	Total Interest expense
Cross currency swaps			(19,845)	4,759	Foreign currency losses, net
			$ (19,845)	$ 4,759	Total Foreign currency losses, net

The total amounts of expense and the respective line items in which the effect of cash flow hedges is presented in the condensed consolidated statement of operations for the year ended December 31, 2020 and 2019, are as follows:

(Dollars in thousands)	2020	2019
Interest expense	$ 21,880	$ 24,302
Foreign currency losses, net	3,627	9,166

Net Investment Hedge. For derivatives that are designated and qualify as net investment hedges, the gain or loss on the derivative is reported as a component of the currency translation adjustment in AOCL. These cross currency swaps are designated as hedges of our net investment in European operations. Time value is excluded from the assessment of effectiveness and the amount of interest paid or received on the swaps will be recognized as an adjustment to interest expense in earnings over the life of the swaps.

In the second quarter of 2017, the Company designated a portion of its Euro denominated debt as a net investment hedge for accounting purposes. This net investment hedge was terminated in the second quarter of 2018.

In the second quarter of 2018, the Company entered into cross currency swap agreements where we pay variable rate interest in Euros and receive variable rate interest in U.S. dollars. This net investment hedge was terminated in the fourth quarter of 2020. These swaps were hedging risk associated with the net investment in Euro denominated operations due to fluctuating exchange rates and are designated as net investment hedges. The changes in the fair value of these designated cross-currency swaps were recognized in AOCL.

The amount of gain (loss) on net investment hedges recognized in AOCL, the amount reclassified into earnings and the amount of gain recognized in income on derivative (amount excluded from effectiveness testing) for the year ended December 31, 2020 and 2019, follow:

	Amount of Gain (Loss) Recognized in AOCL		Amount of Gain Recognized in Income on Derivative (Amount Excluded from Effectiveness Testing)		Location of Gain in Earnings
(Dollars in thousands)	2020	2019	2020	2019	
Cross currency swaps	$ (7,655)	$ 6,330	$ 1,468	$ 3,688	Interest expense

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 gains of $6.6 million in 2020, net losses of $2.5 million in 2019, and approximately zero in 2018, 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 $494.2 million at December 31, 2020 and $625.9 million at December 31, 2019.

The following table presents the effect on our consolidated statements of operations for the years ended December 31, 2020, 2019 and 2018, respectively, of foreign currency forward contracts:

	Amount of Gain (Loss) Recognized in Earnings			
(Dollars in thousands)	2020	2019	2018	Location of Gain (Loss) in Earnings
Foreign currency forward contracts	$ 6,589	$ (2,462)	$ (12)	Foreign currency losses, net

Location and Fair Value Amount of Derivative Instruments

The following table presents the fair values of our derivative instruments on our consolidated balance sheets at December 31, 2020 and 2019. All derivatives are reported on a gross basis.

(Dollars in thousands)	2020	2019	Balance Sheet Location
Cross currency swaps	$ 9	$ 6,711	Other current assets
Cross currency swaps	—	15,400	Other non-current assets
Foreign currency forward contracts	2,649	1,474	Other current assets
Liability derivatives:			
Interest rate swaps	$ (8,436)	$ (3,723)	Accrued expenses and other current liabilities
Interest rate swaps	(16,258)	(10,975)	Other non-current liabilities
Cross currency swaps	(67)	—	Accrued expenses and other current liabilities
Cross currency swaps	(5,104)	—	Other non-current liabilities
Foreign currency forward contracts	(630)	(873)	Accrued expenses and other current liabilities

11. Income Taxes

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

(Dollars in thousands)	2020	2019	2018
U.S.	$ 7,961	$ 18,709	$ 13,854
Foreign	36,940	24,082	56,089
Total	$ 44,901	$ 42,791	$ 69,943

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

(Dollars in thousands)	2020	2019	2018
Current:			
U.S. federal	$ (3,298)	$ 475	$ 449
Foreign	20,238	18,204	19,311
State and local	104	168	211
Total current	17,044	18,847	19,971
Deferred:			
U.S. federal	3,935	(3,832)	3,265
Foreign	(6,856)	(8,340)	(9,157)
State and local	738	1,290	(186)
Total deferred	(2,183)	(10,882)	(6,078)
Total income tax expense (benefit)	$ 14,861	$ 7,965	$ 13,893

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

(Dollars in thousands)	2020	2019	2018
Interest rate swaps	$ (2,848)	$ (3,210)	$ (1,529)
Postretirement benefit liability adjustments	153	11	(32)
Net investment hedge	(2,113)	654	954
Foreign currency translations	44	27	—
Total income tax (benefit) expense allocated to Ferro Corporation shareholders' equity	$(4,764)	$(2,518)	$ (607)

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

	2020	2019	2018
U.S. federal statutory income tax rate	21.0%	21.0%	21.0%
Foreign tax rate difference	7.2	9.8	7.4
Non-deductible expenses	4.5	4.4	2.9
Foreign currency	4.1	1.4	0.3
Global intangible low-taxed income, net	2.5	2.8	1.8
Tax rate changes	1.1	0.9	(3.0)
State taxes	1.0	1.3	0.7
Foreign withholding taxes	0.7	1.3	1.0
Net adjustment of prior year accrual	1.3	(5.0)	(4.2)
Goodwill dispositions, impairments and amortization	—	(1.2)	—
Foreign derived intangible income deduction	(0.7)	(3.2)	(1.6)
Adjustment of valuation allowances	(0.9)	(16.1)	(6.0)
Other	(1.7)	2.7	(2.5)
Uncertain tax positions, net of tax audit settlements	(2.6)	1.7	3.8
Tax credits	(4.4)	(3.2)	(1.7)
Effective tax rate	33.1%	18.6%	19.9%

We have refundable income taxes of $9.5 million at December 31, 2020 and $16.9 million at December 31, 2019, classified as Other receivables on our consolidated balance sheets. We also have income taxes payable of $16.0 million at December 31, 2020, and $8.4 million at December 31, 2019, classified as Accrued expenses and other current liabilities on our consolidated balance sheets.

The components of deferred tax assets and liabilities at December 31, 2020 and 2019 were:

(Dollars in thousands)	2020	2019
Deferred tax assets:		
Foreign operating loss carryforwards	$ 36,631	$ 35,394
Pension and other benefit programs	41,968	39,633
Foreign tax credit carryforwards	12,306	11,423
Accrued liabilities	12,883	10,726
Other credit carryforwards	8,639	6,707
Disallowed interest	7,692	2,633
Other	7,217	8,528
State and local operating loss carryforwards	1,900	2,058
Inventories	2,879	2,366
Allowance for doubtful accounts	589	746
Currency differences	5,605	1,407
Total deferred tax assets	138,309	121,621
Deferred tax liabilities:		
Property, plant and equipment and intangibles — depreciation and amortization	16,024	23,617
Unremitted earnings of foreign subsidiaries	1,903	1,594
Deferred gain	2,351	99
Other	2,030	2,016
Total deferred tax liabilities	22,308	27,326
Net deferred tax assets before valuation allowance	116,001	94,295
Valuation allowance	(10,872)	(10,447)
Net deferred tax assets	$ 105,129	$ 83,848

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.

At December 31, 2020, we had $28.1 million of state and local operating loss carryforwards and $167.1 million of foreign operating loss carryforwards, which can be carried forward indefinitely and others expire in 1 to 20 years. At December 31, 2020, we had $22.6 million in tax credit carryforwards, some of which can be carried forward indefinitely. These operating loss carryforwards and tax credit carryforwards expire as follows:

(Dollars in thousands)	Operating Loss Carryforwards	Tax Credit Carryforwards
Expiring in:		
2021	$ 3,612	$ 91
2022-2026	24,593	12,180
2027-2031	21,159	4,979
2032-2036	12,276	3,467
2037-2041	1,250	936
2042-Indefinitely	132,288	936
Total	$195,178	$22,589

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, 2020 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 as of December 31, 2020, the Company has recorded a valuation allowance of $10.9 million in order to measure only the portion of the deferred tax assets that more likely than not will be realized.

We classified net deferred income tax assets as of December 31, 2020 and 2019 as detailed in the following table:

(Dollars in thousands)	2020	2019
Non-current assets	$ 115,962	$ 98,714
Non-current liabilities	(10,833)	(14,866)
Net deferred tax assets	$ 105,129	$ 83,848

Activity and balances of unrecognized tax benefits are summarized below:

(Dollars in thousands)	2020	2019	2018
Balance at beginning of year	$ 26,000	$ 24,869	$ 28,470
Additions based on tax positions related to the current year	153	3,425	4,041
Additions for tax positions of prior years	260	—	24
Reductions for tax positions of prior years	(3,781)	—	(1,710)
Reductions as a results of expiring statutes of limitations	(1,394)	(688)	(420)
Foreign currency adjustments	1,245	(660)	(786)
Settlements with taxing authorities	—	(946)	(4,750)
Balance at end of year	$ 22,483	$ 26,000	$ 24,869

The total amount of unrecognized tax benefits that, if recognized, would affect the effective rate was $8.5 million at December 31, 2020, $8.7 million at December 31, 2019, and $9.2 million at December 31, 2018. The Company recognizes accrued interest and penalties related to unrecognized tax benefits as part of income tax expense. The Company recognized $0.6 million of expense in 2020, $0.5 million of expense in 2019, and $0.4 million of expense in 2018 for interest, net of tax, and related penalties. The Company accrued $2.9 million at December 31, 2020, $2.9 million at December 31, 2019, and $1.8 million at December 31, 2018 for payment of interest, net of tax, and penalties.

We anticipate that $7.0 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. 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, 2020, we provided $1.9 million for deferred income taxes on $13.8 million of undistributed earnings of foreign subsidiaries that are not considered to be indefinitely reinvested. For certain other of the Company's foreign subsidiaries, undistributed earnings of approximately $232.9 million are considered to be indefinitely reinvested, and we have not provided for deferred taxes on such earnings. We have not disclosed deferred income taxes on undistributed earnings of foreign subsidiaries where they are considered to be indefinitely reinvested, as it is not practicable to estimate the additional taxes that might be payable on the eventual remittance of such earnings, given the uncertain timing of when any such eventual remittance may occur, the significant number of foreign subsidiaries we have, the multiple layers within our legal entity structure, and the complexities of tax regulations across those foreign subsidiaries.

12. Contingent Liabilities

The Company had bank guarantees and standby letters of credit issued by financial institutions that totaled $5.1 million at December 31, 2020 and $4.8 million at December 31, 2019. 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.

We have recorded environmental liabilities of $5.7 million at December 31, 2020 and $7.2 million at December 31, 2019, for costs associated with the remediation of certain of our current or former properties that have been contaminated. The balance at December 31, 2020 and December 31, 2019, were 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. These costs include, but are not limited to, 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, the ultimate cost of required remediation and other circumstances.

In November 2017, Suffolk County Water Authority filed a complaint, Suffolk County Water Authority v. The Dow Chemical Company et al., against the Company and a number of other companies in the U.S. Federal Court for the Eastern District of New York with regard to the product 1,4 dioxane. The plaintiff alleges, among other things, that the Suffolk County water supply is contaminated with 1,4 dioxane and that the defendants are liable for unspecified costs of cleanup and remediation of the water supply, among other damages. The Company has not manufactured 1,4 dioxane since 2008, denies the allegations related to liability for the plaintiff's claims, and is vigorously defending this proceeding. Since December 2018, additional complaints were filed in the same court by 25 other New York municipal water suppliers and in New York State Supreme Court by one water supplier against the Company and others making substantially similar allegations regarding the contamination of their respective water supplies with 1,4 dioxane. The Company is likewise vigorously defending these additional actions. The Company currently does not expect the outcome of these proceedings to have a material adverse impact on its consolidated financial condition, results of operations, or cash flows, net of any insurance coverage. However, it is not possible to predict the ultimate outcome of these proceedings due to the unpredictable nature of litigation.

In addition to the proceedings described above, the Company and its consolidated subsidiaries are subject from time to time to various claims, lawsuits, investigations, and proceedings related to products, services, contracts, environmental, health and safety, employment, intellectual property, and other matters, including with respect to divested businesses. The outcome of such matters is unpredictable, our assessment of them may change, and resolution of them could have a material adverse effect on the Company's consolidated financial position, results of operations, or cash flows. 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.

13. Retirement Benefits

Defined Benefit Pension Plans

(Dollars in thousands)	U.S. Pension Plans			Non-U.S. Plans		
	2020	**2019**	**2018**	**2020**	**2019**	**2018**
Service cost	$ 10	$ 10	$ 11	$1,555	$ 1,410	$1,392
Interest cost	9,479	11,787	11,308	1,788	2,264	2,166
Expected return on plan assets	(14,782)	(12,622)	(15,982)	(601)	(758)	(755)
Amortization of prior service cost	—	—	—	13	7	6
Mark-to-market actuarial net losses	10,938	1,228	16,633	2,977	11,033	2,444
Curtailment and settlement effects losses (gains)	—	—	—	66	292	156
Special termination benefits	114	—	—	26	—	106
Net periodic benefit cost	$ 5,759	$ 403	$ 11,970	$5,824	$14,248	$5,515
Weighted-average assumptions:						
Discount rate	3.35%	4.40%	3.80%	1.76%	2.61%	2.35%
Rate of compensation increase	N/A	N/A	N/A	3.11%	3.19%	3.18%
Expected return on plan assets	7.70%	7.70%	7.70%	2.04%	2.74%	2.55%

For the majority of our U.S. defined benefit pension plans, the participants stopped accruing benefit service costs on or before January 1, 2011.

In 2020, the mark-to-market actuarial net loss on the U.S. pension plans of $10.9 million consisted of a charge of $23.0 million to remeasure the liability based on a lower discount rate compared with the prior year, partially offset by a gain of $10.7 million from actual returns on plan assets exceeding expected returns and a $1.4 million gain on demographic experience and actuarial assumptions. The mark-to-market actuarial net loss of $3.0 million for non-U.S. plans was primarily consisted of a charge of $5.9 million to remeasure the liability based on a lower discount rate compared with the prior year, partially offset by a $2.1 million gain on demographic experience and actuarial assumptions.

In 2019, the mark-to-market actuarial net loss on the U.S. pension plans of $1.2 million consisted of a charge of $28.3 million to remeasure the liability based on a lower discount rate compared with the prior year, partially offset by a gain of $23.3 million from actual returns on plan assets exceeding expected returns and a $3.8 million gain on demographic experience and actuarial assumptions. The mark-to-market actuarial net loss of $11.0 million for non-U.S. plans was primarily driven by remeasurement of the respective liabilities at lower discount rates.

In 2018, the mark-to-market actuarial net loss on the U.S. pension plans of $16.6 million was driven by a loss of $31.0 million from expected returns on plan assets being lower than actual returns, partially offset by a gain of $17.9 million from the change in the discount rate compared with the prior year. The mark-to-market actuarial net loss of $2.4 million for non-U.S. plans was primarily driven by expected returns on plan assets being lower than actual returns.

(Dollars in thousands)	U.S. Pension Plans 2020	U.S. Pension Plans 2019	Non-U.S. Pension Plans 2020	Non-U.S. Pension Plans 2019
Change in benefit obligation				
Benefit obligation at beginning of year	$ 296,181	$ 279,885	$ 116,698	$ 106,098
Service cost	10	10	1,555	1,410
Interest cost	9,479	11,787	1,788	2,264
Curtailments	—	—	—	(45)
Amendments	—	—	(714)	23
Settlements	—	—	(835)	(734)
Special termination benefits	114	—	26	—
Plan participants' contributions	—	—	—	14
Benefits paid	(21,119)	(19,978)	(3,145)	(5,367)
Actuarial loss	21,645	24,477	4,907	14,949
Exchange rate effect	—	—	9,852	(1,914)
Benefit obligation at end of year	$ 306,310	$ 296,181	$ 130,132	$ 116,698
Accumulated benefit obligation at end of year	$ 306,310	$ 296,181	$ 119,914	$ 107,332
Change in plan assets:				
Fair value of plan assets at beginning of year	$ 223,227	$ 204,425	$ 33,898	$ 32,979
Actual return on plan assets	25,489	35,871	2,465	4,336
Employer contributions	1,648	2,909	2,363	3,277
Plan participants' contributions	—	—	—	14
Benefits paid	(21,119)	(19,978)	(3,145)	(5,367)
Effect of settlements	—	—	(835)	(734)
Exchange rate effect	—	—	2,841	(607)
Fair value of plan assets at end of year	$ 229,245	$ 223,227	$ 37,587	$ 33,898
Amounts recognized in the balance sheet:				
Other non-current assets	$ —	$ —	$ 59	$ 44
Accrued expenses and other current liabilities	(389)	(410)	(2,575)	(2,589)
Postretirement and pension liabilities	(76,676)	(72,544)	(90,029)	(80,255)
Funded status	$ (77,065)	$ (72,954)	$ (92,545)	(82,800)

(Dollars in thousands)	U.S. Pension Plans 2020	U.S. Pension Plans 2019	Non-U.S. Pension Plans 2020	Non-U.S. Pension Plans 2019
Weighted-average assumptions as of December 31:				
Discount rate	2.55%	3.35%	1.29%	1.76%
Rate of compensation increase	N/A	N/A	2.98%	3.11%
Pension plans with benefit obligations in excess of plan assets:				
Benefit obligations	$ 306,310	$ 296,181	$ 94,567	$ 84,791
Plan assets	229,245	223,227	1,963	1,946
Pension plans with accumulated benefit obligations in excess of plan assets:				
Projected benefit obligations	$ 306,310	$ 296,181	$ 94,057	$ 84,338
Accumulated benefit obligations	306,310	296,181	83,923	75,073
Plan assets	229,245	223,227	1,518	1,553

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	
(Dollars in thousands)	2020	2019	2020	2019
Prior service (cost):				
Balance at beginning of year	$ —	$ —	$ (44)	$ (22)
Amounts recognized as net periodic benefit costs	—	—	(13)	(7)
Plan amendments	—	—	(604)	(14)
Exchange rate effects	—	—	(11)	(1)
Balance at end of year	$ —	$ —	$ (672)	$ (44)

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. Non-U.S. plan allocations are primarily comprised of fixed income securities. 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.

The fair values of our pension plan assets at December 31, 2020, by asset category are as follows:

(Dollars in thousands)	Level 1	Level 2	Level 3	Total
U.S. plans:				
Fixed income:				
Guaranteed deposits	$ —	$ 1,699	$ —	$ 1,699
Mutual funds	72,424	—	—	72,424
Commingled funds	—	423	182	605
Equities:				
U.S. common stocks	4,142	—	—	4,142
Mutual funds	135,791	—	—	135,791
Commingled funds	—	628	—	628
Total assets in the fair value hierarchy	$ 212,357	$ 2,750	$ 182	$ 215,289
Investments measured at net asset value	—	—	—	13,956
Investments at fair value	$ 212,357	$ 2,750	$ 182	$ 229,245
Non-U.S. plans				
Fixed income:				
Cash and cash equivalents	$ 183	$ —	$ —	$ 183
Guaranteed deposits	—	782	33,733	34,515
Mutual funds	1,519	1,093	—	2,612
Other	84	—	—	84
Equities:				
Mutual funds	193	—	—	193
Total	$ 1,979	$ 1,875	$ 33,733	$ 37,587

The fair values of our pension plan assets at December 31, 2019, by asset category are as follows:

(Dollars in thousands)	Level 1	Level 2	Level 3	Total
U.S. plans:				
Fixed income:				
Guaranteed deposits	$ —	$ 1,863	$ —	$ 1,863
Mutual funds	73,563	—	—	73,563
Commingled funds	—	434	244	678
Equities:				
U.S. common stocks	4,198	—	—	4,198
Mutual funds	128,546	—	—	128,546
Commingled funds	—	706	—	706
Total assets in the fair value hierarchy	$ 206,307	$ 3,003	$ 244	$ 209,554
Investments measured at net asset value	—	—	—	13,673
Investments at fair value	$ 206,307	$ 3,003	$ 244	$ 223,227
Non-U.S. plans				
Fixed income:				
Cash and cash equivalents	$ 10	$ —	$ —	$ 10
Guaranteed deposits	—	748	30,155	30,903
Mutual funds	2,352	—	—	2,352
Other	89	—	—	89
Equities:				
Mutual funds	544	—	—	544
Total	$ 2,995	$ 748	$ 30,155	$ 33,898

The Company's U.S. pension plans held 0.3 million shares of the Company's common stock with a market value of $4.1 million at December 31, 2020 and 0.3 million shares with a market value of $4.2 million at December 31, 2019.

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 $4.1 million in 2020 and unrealized gains included in earnings were $3.9 million in 2019.

(Dollars in thousands)	Guaranteed deposits	Commingled funds	Total
Balance at December 31, 2018	$ 27,318	$ 226	$ 27,544
Sales	(473)	—	(473)
Gains (losses) included in earnings	3,885	18	3,903
Exchange rate effect	(575)	—	(575)
Balance at December 31, 2019	$ 30,155	$ 244	$ 30,399
Sales	(616)	—	(616)
Gains (losses) included in earnings	4,194	(62)	4,132
Exchange rate effect	—	—	—
Balance at December 31, 2020	$ 33,733	$ 182	$ 33,915

We expect to contribute approximately $15.0 million to our U.S. pension plans and $2.6 million to our non-U.S. pension plans in 2021.

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

(Dollars in thousands)	U.S. Plans	Non-U.S. Plans
2021	$ 20,587	$ 4,040
2022	20,696	4,876
2023	20,262	4,063
2024	20,087	4,088
2025	20,004	4,266
2026-2030	93,327	24,858

Postretirement Health Care and Life Insurance Benefit Plans

(Dollars in thousands)	2020	2019	2018
Net periodic benefit cost:			
Interest expense	$ 529	$ 702	$ 732
Service cost	3	2	—
Amortization of prior service costs	(4,240)	—	—
Mark-to-market actuarial net loss (gain)	101	1,080	(2,580)
Total net periodic benefit cost (credit)	$(3,607)	$1,784	$(1,848)
Weighted-average assumptions:			
Discount rate	3.25%	4.30%	3.70%
Current trend rate for health care costs	6.10%	6.30%	6.40%
Ultimate trend rate for health care costs	4.50%	4.50%	4.50%
Year that ultimate trend rate is reached	2036	2036	2036

(Dollars in thousands)	2020	2019
Change in benefit obligation:		
Benefit obligation at beginning of year	$ 17,149	$ 17,198
Service cost	3	2
Interest cost	529	702
Plan amendments	(4,240)	—
Benefits paid	(1,688)	(1,833)
Actuarial loss (gain)	101	1,080
Benefit obligation at end of year	$ 11,854	$ 17,149
Change in plan assets:		
Fair value of plan assets at beginning of year	$ —	$ —
Employer contributions	1,688	1,836
Benefits paid	(1,688)	(1,836)
Fair value of plan assets at end of year	$ —	$ —
Amounts recognized in the balance sheet:		
Accrued expenses and other current liabilities	$ (1,047)	$ (1,945)
Postretirement and pension liabilities	(10,807)	(15,204)
Funded status	$ (11,854)	$ (17,149)
Weighted-average assumptions as of December 31:		
Discount rate	2.40%	3.25%
Current trend rate for health care costs	6.00%	6.10%
Ultimate trend rate for health care costs	4.50%	4.50%
Year that ultimate trend rate is reached	2036	2036

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:

(Dollars in thousands)	Before Medicare Subsidy	After Medicare Subsidy
2021	$ 1,046	$ 1,016
2022	1,001	971
2023	957	926
2024	918	889
2025	867	837
2026-2030	3,733	3,595

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 $3.2 million, $3.7 million, and $2.9 million in 2020, 2019, and 2018, respectively.

14. Stock-based Compensation

On May 3, 2018, our shareholders approved the 2018 Omnibus Incentive Plan (the "Plan"), which was adopted by the Board of Directors on February 22, 2018. 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, and thereby align their interests with those of the Company's shareholders. The Plan reserves 4,500,000 shares of common stock to be issued for grants of several different types of long-term incentives including stock options, stock appreciation rights, restricted awards, performance awards, other common stock-based awards, and dividend equivalent rights.

The 2013 Omnibus Incentive Plan (the "Previous Plan"), was replaced by the Plan, and no future grants may be 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, 2020. 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, 2020, 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 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:

Assumption	Estimation Method
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:

	2020	2019	2018
Weighted-average grant-date fair value	$ 5.28	$ 6.47	$ 8.91
Expected life, in years	5.2	5.6	5.4
Risk-free interest rate	1.4%	2.5%	2.7%
Expected volatility	35.1%	33.9%	39.7%
Expected dividend yield	—%	—%	—%

Stock Option Activity Information

A summary of stock option activity follows:

	Number of Options	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term	Aggregate Intrinsic Value
Outstanding at December 31, 2019	1,728,999	$12.49		
Granted	345,100	14.64		
Exercised	(115,033)	6.57		
Forfeited or expired	(25,167)	14.65		
Outstanding at December 31, 2020	1,933,899	$13.20	5.4	$4,959
Exercisable at December 31, 2020	1,381,365	$11.96	4.1	$4,916
Vested or expected to vest at December 31, 2020	1,933,899	$13.20	5.4	$4,959

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:

(Dollars in thousands)	2020	2019	2018
Proceeds from the exercise of stock options	$ 756	$ 1,052	$ 727
Intrinsic value of stock options exercised	867	750	1,590
Income tax benefit related to stock options exercised	182	158	334

Stock Options Expense Information

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

(Dollars in thousands)	2020	2019	2018
Compensation expense recorded in Selling, general and administrative expenses	$ 2,304	$ 1,801	$ 1,528
Deferred income tax benefits related to compensation expense	484	378	321
Total fair value of stock options vested	465	1,387	1,390
Unrecognized compensation cost	2,039	1,469	606
Expected weighted-average recognition period for unrecognized compensation, in years	1.8	2.2	2.7

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 2020, 2019 and 2018 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, 2020, we had 0.2 million and 0.2 million performance share units outstanding associated with our 2020 and 2019 grants, respectively.

The weighted average grant date fair value of our performance share units was $14.64 for shares granted in 2020, $17.61 for shares granted in 2019 and $22.92 for shares granted in 2018. 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:

	Number of Units	Weighted-Average Remaining Contractual Term
Outstanding at December 31, 2019	452,000	
Granted	284,894	
Earned	(243,394)	
Forfeited or expired	(11,502)	
Outstanding at December 31, 2020	481,998	1.2
Vested or expected to vest at December 31, 2020	481,998	1.2

Performance Share Unit Expense Information

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

(Dollars in thousands)	2020	2019	2018
Compensation expense recorded in Selling, general and administrative expenses	$3,270	$3,607	$4,152
Deferred income tax benefits related to compensation expense	773	757	872
Unrecognized compensation cost	3,417	2,730	3,599
Expected weighted-average recognition period for unrecognized compensation, in years	1.5	1.6	1.4

Restricted Stock Units

We granted 0.2 million, 0.2 million and 0.1 million restricted stock units in 2020, 2019, and 2018, 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 2020, 2019 and 2018 was $2.4 million, $1.7 million and $2.2 million, respectively. Total unrecognized compensation cost in 2020, 2019 and 2018 was $2.8 million, $2.8 million and $2.8 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, 2020, and 0.1 million shares, valued at $1.6 million, at December 31, 2019.

15. Restructuring and Cost Reduction Programs

Our restructuring and cost reduction programs have been developed with the objective of realigning the business and lowering our cost structure. Total restructuring charges resulting from these activities were $17.4 million in 2020, $11.0 million in 2019, and $7.1 million in 2018, which are reported in Restructuring and impairment charges in our consolidated statement of operations. As discussed in Note 4, our Tile Coatings business was classified as held-for-sale. As such, the restructuring costs pertaining to the Tile Coatings business of $2.3 million in 2020, $1.9 million in 2019, and $6.2 million in 2018 are reported in Income (loss) from discontinued operations, net of taxes.

Organizational Optimization Plan

In conjunction with the pending sale of the Tile Coatings business, discussed in Note 4, we developed our Organizational Optimization Plan and initiated a program across the organization with the objective of realigning the business and lowering our cost structure in anticipation of the pending sale. The remaining activities of the program are expected to be recognized throughout 2021.

Americas Manufacturing Optimization Plan

In the second quarter of 2019, we developed our Americas Manufacturing Optimization Plan and initiated a program across the organization with the objective of realigning the business and lowering our cost structure. The Americas Manufacturing Optimization Plan is focused on the construction of a new manufacturing center of excellence located in Villagran, Mexico. We are in the process of consolidating two plants located in the United States and two sites in Latin America into the expanded Villagran location. The remaining activities of the program are expected to be recognized within the next 12 months.

Global Optimization Plan

The program involves our global operations and certain functions and initiatives to increase operational efficiencies, some of which is associated with integration of our recent acquisitions. Actions associated with the Global Optimization Plan were substantially completed during 2020, and as such, we do not anticipate further material charges related to this plan.

The charges associated with these restructuring programs are summarized by major type below:

(Dollars in thousands)	**Employee Severance**	**Other Costs**	**Total**
Expected restructuring charges:			
Organizational Optimization Program	$ 3,883	$ —	$ 3,883
American Manufacturing Optimization Program	8,644	77	8,721
Global Optimization Program	—	—	—
Total expected restructuring charges	$12,527	$ 77	$12,604
Restructuring charges incurred:			
Global Optimization Program	$ 3,560	$ 3,556	$ 7,116
Charges incurred in 2018	3,560	3,556	7,116
Global Optimization Program	7,163	3,792	10,955
Charges incurred in 2019	7,163	3,792	10,955
Organizational Optimization Program	2,980	—	2,980
American Manufacturing Optimization Program	1,040	—	1,040
Global Optimization Program	5,670	7,735	13,405
Charges incurred in 2020	$ 9,690	$ 7,735	$17,425
Cumulative restructuring charges incurred:			
Organizational Optimization Program	$ 2,980	$ —	$ 2,980
American Manufacturing Optimization Program	7,617	77	7,694
Global Optimization Program	43,344	40,720	84,064
Cumulative restructuring charges incurred as of December 31, 2020	$53,941	$40,797	$94,738

The charges associated with the restructuring programs are summarized by segments below:

(Dollars in thousands)	**Total Expected Charges**	**2020**	**2019**	**2018**	**Cumulative Charges To Date**
Functional Coatings	$ 169	$ 27	$ (5)	$ 23	$26,954
Color Solutions	99	101	124	148	4,562
Segment Total	268	128	119	171	31,516
Corporate Restructuring Charges	12,336	17,297	10,836	6,945	63,222
Total Restructuring Charges	$12,604	$17,425	$10,955	$7,116	$94,738

The activities and accruals related to our global optimization programs are below:

(Dollars in thousands)	Employee Severance	Other Costs	Total
Balance at December 31, 2017	$ 1,309	$ 990	$ 2,299
Restructuring charges	3,560	3,556	7,116
Cash payments	(3,678)	(597)	(4,275)
Non-cash items	(180)	(3,117)	(3,297)
Balance at December 31, 2018	1,011	832	1,843
Restructuring charges	7,163	3,792	10,955
Cash payments	(6,987)	(1,831)	(8,818)
Non-cash items	(440)	(1,301)	(1,741)
Balance at December 31, 2019	747	1,492	2,239
Restructuring charges	9,690	7,735	17,425
Cash payments	(4,363)	(4,526)	(8,889)
Non-cash items	(564)	(241)	(805)
Balance aat December 31, 2020	$ 5,510	$ 4,460	$ 9,970

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

16. Leases

The Company has leases for equipment, office space, plant sites and distribution centers. Certain of these leases include options to extend the lease and some include options to terminate the lease early. Leases with an initial term of 12 months or less are not recorded on the balance sheet and the related lease expense is recognized on a straight-line basis over the lease term.

There are no leases that have not yet commenced that create significant rights and obligations for the Company.

The components of lease cost are shown below:

(Dollars in thousands)	2020	2019	Income Statement Location
Lease Cost			
Operating lease cost(1)	$ 4,716	$ 5,318	Selling, general and administrative expenses
Operating lease cost(2)	7,406	9,090	Cost of sales
Finance lease cost			
Amortization of right-of-use assets	298	233	Cost of sales
Interest of lease liabilities	33	17	Interest expense
Net lease cost	$12,453	$14,658	

(1) Included in operating lease cost is $0.9 million of short-term lease costs for the years ended December 31, 2020 and 2019, respectively, and $0.4 million of variable lease costs for the years ended December 31, 2020 and 2019, respectively.

(2) Included in operating lease cost is $2.7 million and $2.6 million of short-term lease costs for the years ended December 31, 2020 and 2019, respectively, and $0.7 million and $1.1 million of variable lease costs for the years ended December 31, 2020 and 2019, respectively.

Rent expense, as previously defined under ASC 840, for all operating leases was $12.7 million in 2018.

Supplemental balance sheet information related to leases are shown below:

(Dollars in thousands)	2020	2019	Balance Sheet Location
Assets			
Operating leased assets	$15,446	$20,088	Operating leased assets
Finance leased assets(1)	1,410	859	Property, plant and equipment, net
Total leased assets	$16,856	$20,947	
Liabilities			
Current			
Operating	$ 5,431	$ 6,515	Accrued expenses and other current liabilities
Finance	640	438	Loans payable and current portion of long-term debt
Noncurrent			
Operating	10,064	14,474	Operating lease non-current liabilities
Finance	2,271	1,867	Long-term debt, less current portion
Total lease liabilities	$18,406	$23,294	

(1) Finance leases are net of accumulated depreciation of $3.1 million and $3.4 million for December 31, 2020 and 2019, respectively.

Supplemental cash flow information related to leases are shown below:

(Dollars in thousands)	2020	2019
Cash paid for amounts included in the measurement of lease liabilities		
Operating cash flows from finance leases	$ 33	$ 17
Operating cash flows from operating leases	7,959	9,757
Financing cash flows from finance leases	331	229
Leased assets obtained in exchange for new finance lease liabilities	961	755
Leased assets obtained in exchange for new operating lease liabilities	4,686	30,411

	2020
Weighted-average remaining lease term (years)	
Operating leases	3.9
Finance leases	5.1
Weighted-average discount rate	
Operating leases	4.1%
Finance leases	4.7%

Maturities of lease liabilities are shown below as of December 31, 2020:

(Dollars in thousands)	Finance Leases	Operating Leases
2021	$ 773	$ 6,967
2022	752	4,167
2023	673	2,222
2024	560	1,183
2025	449	933
Thereafter	457	1,778
Net minimum lease payments	$3,664	$17,250
Less: interest	753	1,755
Present value of lease liabilities	$2,911	$15,495

17. Miscellaneous Expense (Income), Net

Components of Miscellaneous expense, net follow:

(Dollars in thousands)	2020	2019	2018
Pension expense	$ 6,425	$14,845	$14,142
Argentina export tax matter	—	217	507
Gain on change of control	—	—	(2,586)
Modification of debt	—	—	1,046
Dividends/royalty from affiliates, net	(264)	(529)	(720)
Loss (gain) on sale of assets	87	(1,412)	(514)
Contingent consideration adjustment	(67)	(2,723)	(1,637)
Bank fees	1,498	1,798	1,656
Other, net	(2,174)	(474)	180
Total Miscellaneous expense, net	$ 5,505	$11,722	$12,074

In 2018, we adopted ASU 2017-07, which requires all other components of net benefit costs (credit) besides service cost to be presented outside a subtotal of income from operations. As such, we recorded pension expense of $6.4 million in 2020, $14.8 million in 2019 and $14.1 million in 2018 related to these costs.

In 2018, the Company acquired 66% of the equity interests of FMU (Note 5), bringing our total ownership to 100%. 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.

18. Earnings per Share

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

(Dollars in thousands, except per share amounts)	2020	2019	2018
Basic earnings per share computation:			
Income from continuing operations	$ 30,040	$ 34,826	$ 56,050
Less: Net income attributable to noncontrolling interests from continuing operations	1,073	1,087	851
Net income attributable to Ferro Corporation from continuing operations	28,967	33,739	55,199
Income (loss) from discontinued operations, net of income taxes	14,003	(27,411)	24,896
Less: Net income attributable to noncontrolling interests from discontinued operations	171	290	2
Net income attributable to Ferro Corporation from discontinued operations	13,832	(27,701)	24,894
Total	$ 42,799	$ 6,038	$ 80,093
Weighted-average common shares outstanding	82,232	82,083	83,940
Basic earnings per share from continuing operations attributable to Ferro Corporation common shareholders	$ 0.35	$ 0.41	$ 0.66
Diluted earnings per share computation:			
Net income attributable to Ferro Corporation common shareholders	$ 28,967	$ 33,739	$ 55,199
Adjustment for income from discontinued operations	13,832	(27,701)	24,894
Total	$ 42,799	$ 6,038	$ 80,093
Weighted-average common shares outstanding	82,232	82,083	83,940
Assumed exercise of stock options	272	407	772
Assumed satisfaction of restricted stock unit conditions	362	369	301
Assumed satisfaction of performance stock unit conditions	158	32	72
Weighted-average diluted shares outstanding	83,024	82,891	85,085
Diluted earnings per share from continuing operations attributable to Ferro Corporation common shareholders	$ 0.35	$ 0.41	$ 0.65

The number of anti-dilutive shares were 2.5 million, 2.1 million, and 1.7 million for 2020, 2019, and 2018, respectively. These shares were excluded from the calculation of diluted earnings per share due to their anti-dilutive impact.

19. Share Repurchase Program

In October 2018, the Company's Board of Directors approved a new share repurchase program under which the Company is authorized to repurchase up to an additional $50 million of the Company's outstanding common stock on the open market, including through Rule 10b5-1 plans, in privately negotiated transactions, or otherwise. This new program is in addition to the $100 million of authorization previously approved and announced.

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 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 2020. The Company repurchased 1,440,678 shares of common stock at an average price of $17.35 per share for a total cost of $25.0 million during 2019. The Company repurchased 1,470,791 shares of common stock at an average price of $19.59 per share for a total cost of $28.8 million during 2018. As of December 31, 2020, $46.2 million of common stock could still be repurchased under the programs.

20. Accumulated Other Comprehensive Loss

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

(Dollars in thousands)	Postretirement Benefit Liability Adjustments	Foreign Currency Items	Net Gain (Loss) on Cash Flow Hedges	Total
Balance at December 31, 2017	$ 1,165	$ (77,578)	$ 945	$ (75,468)
Other comprehensive income (loss) before reclassifications, before tax	—	(24,658)	11,388	(13,270)
Reclassification to earnings:				
Cash flow hedge gain (loss), before tax	—	—	(17,159)	(17,159)
Postretirement benefit liabilities gain (loss), before tax	(55)	—	—	(55)
Current period other comprehensive income (loss), before tax	(55)	(24,658)	(5,771)	(30,484)
Tax effect	(16)	954	(1,529)	(591)
Current period other comprehensive income (loss), net of tax	(39)	(25,612)	(4,242)	(29,893)
Balance at December 31, 2018	$ 1,126	$ (103,190)	$ (3,297)	$ (105,361)
Other comprehensive income (loss) before reclassifications, before tax	—	6,269	(2,731)	3,538
Reclassification to earnings:				
Cash flow hedge gain (loss), before tax	—	—	(10,162)	(10,162)
Postretirement benefit liabilities gain (loss), before tax	91	—	—	91
Current period other comprehensive income (loss), before tax	91	6,269	(12,893)	(6,533)
Tax effect	11	654	(3,183)	(2,518)
Current period other comprehensive income (loss), net of tax	80	5,615	(9,710)	(4,015)
Balance at December 31, 2019	$ 1,206	$ (97,575)	$ (13,007)	$ (109,376)
Other comprehensive income (loss) before reclassifications, before tax	—	24,980	(34,689)	(9,709)
Reclassification to earnings:				
Cash flow hedge gain (loss), before tax	—	—	22,465	22,465
Postretirement benefit liabilities gain (loss), before tax	2,146	—	—	2,146
Current period other comprehensive income (loss), before tax	2,146	24,980	(12,224)	14,902
Tax effect	153	(2,113)	(2,804)	(4,764)
Current period other comprehensive income (loss), net of tax	1,993	27,093	(9,420)	19,666
Balance at December 31, 2020	$ 3,199	$ (70,482)	$ (22,427)	$ (89,710)

21. Reporting for Segments

As discussed in Note 4, during the fourth quarter of 2019, we entered into a definitive agreement to sell our Tile Coatings business which has historically been the majority of our Performance Coatings reportable segment. Substantially all of the assets and liabilities of our Tile Coatings business were classified as held-for-sale in the accompanying consolidated balance sheets and results are included within discontinued operations in the consolidated statement of operations for all years presented. The retained assets, liabilities and operations of the Performance Coatings reportable segment are reflected within our Functional Coatings reportable segment. The Company's reportable segments are Functional Coatings and Color Solutions.

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

(Dollars in thousands)	2020	2019	2018
Functional Coatings	$ 608,192	$ 644,783	$ 683,669
Color Solutions	350,762	369,674	391,027
Total net sales	$ 958,954	$ 1,014,457	$ 1,074,696

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. 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:

(Dollars in thousands)	2020	2019	2018
Functional Coatings	$ 175,601	$ 192,668	$ 211,018
Color Solutions	119,071	114,939	124,852
Other cost of sales	(916)	369	2,519
Total gross profit	293,756	307,976	338,389
Selling, general and administrative expenses	202,413	212,365	219,708
Restructuring and impairment charges	17,425	10,955	7,116
Other expense, net	29,017	41,865	41,622
Income before income taxes	$ 44,901	$ 42,791	$ 69,943

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

(Dollars in thousands)	2020	2019	2018
Functional Coatings	$ 12,266	$ 46,304	$ 49,964
Color Solutions	17,626	16,597	24,940
Total segment expenditures for long-lived assets	29,892	62,901	74,904
Unallocated corporate expenditures for long-lived assets	1,891	2,069	5,715
Total expenditures for long lived assets (1)	$ 31,783	$ 64,970	$ 80,619

(1) Includes capital expenditures for discontinued operation of $4.7 million, $10.0 million and $5.8 million in 2020, 2019 and 2018, respectively, integrated within Functional Coatings.

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 Germany represent greater than 10% of our net sales. Net sales by geography are as follows:

(Dollars in thousands)	2020	2019	2018
United States	$341,461	$ 359,267	$ 379,912
Germany	143,861	149,270	148,706
Other international	473,632	505,920	546,078
Total net sales	$958,954	$1,014,457	$1,074,696

None of our operations in countries other than the U.S., Mexico, Germany and Columbia owns greater than 10% of consolidated long-lived assets. Long-lived assets that consist of property, plant, and equipment by geography at December 31, 2020 and 2019 are as follows:

(Dollars in thousands)	2020	2019
United States	$ 69,088	$ 71,617
Mexico	58,503	51,224
Germany	39,733	34,996
Columbia	30,888	32,475
Other international	117,118	112,360
Total long-lived assets	$ 315,330	$ 302,672

22. Unconsolidated Affiliates Accounted For Under the Equity Method

Our investments have been accounted for under the equity method because we exert significant influence over these affiliates, but we do not control them. Investment income from these equity method investments, which is reported in Miscellaneous expense (income), net was approximately zero in 2020, approximately zero in 2019, and income of $0.1 million in 2018. The balance of our equity method investments, which is reported in Other non-current assets, was $7.4 million at December 31, 2020, and $8.0 million at December 31, 2019.

The income (loss) 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:

(Dollars in thousands)	2020	2019	2018
Net sales	$ 12,444	$ 16,563	$ 18,950
Gross profit	1,150	2,507	3,343
Income (loss) from continuing operations	(1,362)	(861)	746
Net income (loss)	(1,090)	(689)	596

(Dollars in thousands)	2020	2019
Current assets	$ 12,353	$ 13,623
Non-current assets	3,644	4,214
Current liabilities	(1,938)	(2,994)
Non-current liabilities	(27)	(161)

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

(Dollars in thousands)	2020	2019	2018
Sales	$ 11,013	$ 7,308	$ 4,898
Purchases	146	316	15
Dividends and interest received	144	154	415
Commission and royalties received	108	363	305
Commissions and royalties paid	12	11	—

23. Quarterly Data (Unaudited)

(Dollars in thousands, except per share data)	Net Sales	Gross Profit	Net Income (Loss)	Net Income (Loss) Attributable to Ferro Corporation	Earnings (Loss) Attributable to Ferro Corporation Common Shareholders Per Common Share	
					Basic	Diluted
2019						
Quarter 1	$ 263,382	$ 77,859	$ 13,878	$ 13,604	$ 0.16	$ 0.16
Quarter 2	260,958	79,130	11,109	10,871	0.13	0.13
Quarter 3	245,339	76,062	13,210	12,820	0.16	0.16
Quarter 4	244,778	74,925	(30,782)	(31,257)	(0.38)	(0.38)
Total	$ 1,014,457	$ 307,976	$ 7,415	$ 6,038	$ 0.07	$ 0.07
2020						
Quarter 1	$ 252,326	$ 80,738	$ 16,133	$ 16,123	$ 0.19	$ 0.19
Quarter 2	204,801	63,744	(5,164)	(5,540)	(0.07)	(0.07)
Quarter 3	241,877	70,166	14,914	14,474	0.18	0.17
Quarter 4	259,950	79,108	18,160	17,742	0.22	0.22
Total	$ 958,954	$ 293,756	$ 44,043	$ 42,799	$ 0.52	$ 0.52

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 2020 were $1.2 million in the first quarter, $8.6 million in the second quarter, $2.4 million in the third quarter, and $5.2 million in the fourth quarter. Restructuring and impairment charges in 2019 were $1.7 million in the first quarter, $4.1 million in the second quarter, $2.1 million in the third quarter, and $3.1 million in the fourth quarter. Additionally, Net income (loss) and Net income (loss) attributable to Ferro Corporation during the fourth quarter of 2019 include an impairment charge of $33.5 million associated with the Tile Coatings business. The impairment charge and related assets are recorded within discontinued operations and as assets held-for-sale, respectively, in our consolidated financial statements as of December 31, 2019. Mark-to-market net losses on our postretirement benefit plans was $14.0 million in the fourth quarter of 2020 and net loses of $13.3 million in the fourth quarter of 2019.

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, 2020. 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, 2020.

Changes in Internal Control over Financial Reporting and Other Remediation

During the fourth quarter of 2020, 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. We have not observed any material impact to our internal controls over financial reporting despite the fact that many of our employees are working remotely due to the COVID-19 pandemic. We are continually monitoring and assessing the COVID-19 situation on our internal controls to minimize the impact on their design and operating effectiveness.

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.

Management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2020. 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, 2020.

Deloitte & Touche LLP, the independent registered public accounting firm that audited the Company's consolidated financial statements, has issued an audit report on the Company's internal control over financial reporting as of December 31, 2020, 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, 2020, 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, 2020, 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, 2020, of the Company and our report dated March 1, 2021, expressed an unqualified opinion on those consolidated financial statements and financial statement schedule.

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
March 1, 2021

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 2021 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 2021 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 2021 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 website 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 website (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 "2020 Executive Compensation" of the Proxy Statement for Ferro Corporation's 2021 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 2021 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, 2020, were as follows:

Equity Compensation Plan	Number of Shares to Be Issued on Exercise of Outstanding Options, and Other Awards	Weighted-Average Exercise Price of Outstanding Options, and Other Awards	Number of Shares Remaining Available for Future Issuance Under Equity Compensation Plans(1)
Approved by Ferro Shareholders	3,261,311(2)	$8.17	4,531,794(3)
Not Approved by Ferro Shareholders	216,663	—	—
Total	3,477,974	$8.17(4)	4,531,794

(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 2018 Omnibus Incentive Compensation Plan and prior equity compensation plans.

(3) Shares are only available under the 2018 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:

- *Supplemental Defined Contribution Plan for Executive Employees.* 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 2021 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 2021 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, 2020, 2019 and 2018;
- Consolidated Statements of Comprehensive Income for the years ended December 31, 2020, 2019 and 2018;
- Consolidated Balance Sheets at December 31, 2020 and 2019;
- Consolidated Statements of Equity for the years ended December 31, 2020, 2019 and 2018;
- Consolidated Statements of Cash Flows for the years ended December 31, 2020, 2019 and 2018; and
- Notes to Consolidated Financial Statements.

(b) Schedule II — Valuation and Qualifying Accounts and Reserves for the years ended December 31, 2020, 2019 and 2018, contained on page 93 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 94 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: March 1, 2021

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 1st day of March, 2021.

/s/ Peter T. Thomas Peter T. Thomas	Chairman, President and Chief Executive Officer (Principal Executive Officer)
/s/ Benjamin J. Schlater Benjamin J. Schlater	Group Vice President and Chief Financial Officer (Principal Financial Officer)
/s/ Andrew T. Henke Andrew T. Henke	Chief Accounting Officer (Principal Accounting Officer)
/s/ David A. Lorber David A. Lorber	Director
/s/ Marran H. Ogilvie Marran H. Ogilvie	Director
/s/ Andrew M. Ross Andrew M. Ross	Director
/s/ Allen A. Spizzo Allen A. Spizzo	Director
/s/ Ronald P. Vargo Ronald P. Vargo	Director

FERRO CORPORATION AND SUBSIDIARIES

SCHEDULE II — VALUATION AND QUALIFYING ACCOUNTS AND RESERVES[1]
Years Ended December 31, 2020, 2019 and 2018

(Dollars in thousands)	Balance at Beginning of Period	Additions Charged (Reductions Credited) to Costs and Expenses	Deductions	Adjustment for Differences in Exchange Rates	Balance at End of Period
Allowance for Possible Losses on Collection of Accounts Receivable:					
Year ended December 31, 2020	$ 1,938	530	(205)	57	$ 2,320
Year ended December 31, 2019	$ 5,504	1,086	(4,487)	(165)	$ 1,938
Year ended December 31, 2018	$ 7,821	681	(2,642)	(356)	$ 5,504
Valuation Allowance on Net Deferred Tax Assets:					
Year ended December 31, 2020	$11,434	215	(84)[2]	115	$11,680
Year ended December 31, 2019	$25,596	—	(13,978)[2]	(184)	$11,434
Year ended December 31, 2018	$32,579	—	(5,617)[2]	(1,366)	$25,596

(1) Schedule II is presented on a total Ferro basis, inclusive of discontinued operations.

(2) Included within this deduction is $0.1 million, $5.4 million and $1.7 million for the years ended December 31, 2020, 2019, and 2018 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).
2.3	Asset and Stock Purchase Agreement, dated December 15, 2019, between Ferro Corporation and Pigments Spain, S.L. (incorporated by reference to Exhibit 2.1 to Ferro Corporation's Current Report on Form 8-K filed January 10, 2020).
2.4	Asset and Stock Purchase Agreement, dated December 15, 2019, between Ferro Corporation and Pigments Spain, S.L. (incorporated by reference to Exhibit 2.1 to Ferro Corporation's Current Report on Form 8-K filed on January 10, 2020).
2.5	First Amendment to the Asset and Stock Purchase Agreement, dated December 15, 2020, between Ferro Corporation and Pigments Spain, S.L. (incorporated by reference to Exhibit 2.2 to Ferro Corporation's Current Report on Form 8-K filed on March 1, 2021).
2.6	Second Amendment to the Asset and Stock Purchase Agreement, dated February 24, 2021, between Ferro Corporation and Pigments Spain, S.L. (incorporated by reference to Exhibit 2.3 to Ferro Corporation's Current Report on Form 8-K filed on March 1, 2021).
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:
4.1	Description of Securities
	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	Receivables Purchase and Servicing Agreement, dated December 5, 2018, among Ferro Spain S.A., Vetriceramici-Ferro S.p.A., Ferro Corporation and ING Belgique SA/NV (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K filed December 6, 2018).
10.2	Amendment and Restatement Agreement, dated December 20, 2019 and Receivables Purchase and Servicing Agreement, dated December 5, 2018, as amended on October 7, 2019 and as amended and restated on December 20, 2019 among Ferro Spain S.A., Vetriceramici-Ferro S.p.A., Ferro Corporation and ING Belgique SA/NV (filed herewith).

10.3 Amendment and Restatement Agreement, dated July 20, 2020 and Receivables Purchase and Servicing Agreement, dated December 5, 2018, as amended on October 7, 2019 and as amended and restated on December 20, 2019 and as amended and restated on July 20, 2020 among Ferro Spain S.A., Vetriceramici-Ferro S.p.A., Ferro Corporation and ING Belgique SA/NV (filed herewith).

10.4 Amendment and Restatement Agreement, dated December 18, 2020 and Receivables Purchase and Servicing Agreement, dated December 5, 2018, as amended on October 7, 2019 and as amended and restated on December 20, 2019 and as amended and restated on July 20, 2020 and as amended and restated on December 18, 2020 among Ferro Spain S.A., Vetriceramici-Ferro S.p.A., Ferro Corporation and ING Belgique SA/NV (filed herewith).

10.5 First Amendment, dated as of April 25, 2018, to Credit Agreement among Ferro Corporation, Ferro GmbH and Ferro Europe Holding LLC, certain other subsidiaries of Ferro Corporation, PNC Bank, National Association, as the Administrative Agent, Collateral Agent and an Issuer, Deutsche Bank AG New York Branch, as the Syndication Agent and 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 April 27, 2018).

10.6 Ferro Corporation 2018 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 7, 2018.

10.7 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).

10.8 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).

10.9 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).

10.10 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).

10.11 Third Amendment, dated May 4, 2020, to 2017 Credit Agreement by and among Ferro Corporation, PNC Bank, National Association as the administrative agent and collateral agent and various financial institutions as lenders (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 10-Q filed August 4, 2020).

10.12 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).*

10.13 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).*

10.14 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).*

10.15 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).*

10.16 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).*

10.17 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).*

10.18 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).*

10.19 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).*

10.20	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).*
10.21	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.*
10.22	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.*
10.23	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.*
10.24	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).*
10.25	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).*
10.26	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).*
10.27	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).*
10.28	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).*
10.29	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.*
10.30	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).*
10.31	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).*
10.32	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).*
10.33	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).*
10.34	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).*
10.35	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).*
10.36	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).*
10.37	Ferro Corporation 2018 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1 to Ferro Corporation's Current Report on Form 8-K, filed May 7, 2018).
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	Inline XBRL Documents:
101.INS	Inline XBRL Instance Document.**
101.SCH	Inline XBRL Schema Document.
101.CAL	Inline XBRL Calculation Linkbase Document.
101.LAB	Inline XBRL Labels Linkbase Document.

101.PRE	Inline XBRL Presentation Linkbase Document.
101.DEF	Inline XBRL Definition Linkbase Document.
104	The coverage page from the Company's Annual Report on Form 10-K for the year ended December 31, 2020, formatted in Inline XBRL and contained in Exhibit 101.

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* 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.

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Board of Directors and Leadership Team

BOARD OF DIRECTORS

Peter T. Thomas
Chairman, President, CEO
Ferro Corporation

David A. Lorber [2, 3 – Chair]
Mr. Lorber has been Chairman and Chief Executive Officer of PhenixFIN Corporation, a closed-end, externally managed business development company, since January 2021. He is also a co-founder of FrontFour Capital Group LLC, an investment adviser, and has served as Portfolio Manager since January 2007. He is also a co-founder and principal of FrontFour Capital Corp., an investment adviser.

Andrew M. Ross [1, 3]
Mr. Ross is the former President of the Pigments and Additives business of Rockwood Holdings, Inc., a performance additives and titanium dioxide business that was sold to Huntsman Pigments in October 2014.

Allen A. Spizzo [1, 2 – Chair]
Mr. Spizzo has been a business and management consultant focused on the chemicals, materials, biotechnology and pharmaceutical industries since November 2008, and he serves as an investment adviser and asset management trustee. He served as Vice President and Chief Financial Officer of Hercules Incorporated, a former S&P 500 specialty chemicals company, from March 2004 until the company was sold to Ashland Inc. in November 2008.

Marran Ogilvie [1, 3]
Ms. Ogilvie served as an advisor to the Creditors Committee for the Lehman Brothers (International) Europe Administration from 2008 to 2018. She serves on the boards of directors of Four Corners Property Trust, Inc., a real estate investment trust, and GCP Applied Technology, Inc., a global provider of construction product technologies.

Ronald P. Vargo [1 – Chair, 2]
Mr. Vargo served as Vice President and Chief Financial Officer of ICF International, a leading provider of consulting services and technology solutions to government and commercial clients, from April 2010 until May 2011, after serving as Executive Vice President and Chief Financial Officer of Electronic Data Systems, an information technology equipment and services company.

EXECUTIVE TEAM

Peter T. Thomas
Chairman, President
and Chief Executive Officer

Benjamin J. Schlater
Group Vice President
and Chief Financial Officer

Mark H. Duesenberg
Vice President,
General Counsel and Secretary

BUSINESS MANAGEMENT TEAM

Matthias Bell
Group Vice President,
Global Operations

Barry Misquitta
Chief Commercial Officer

1 Audit Committee
2 Compensation Committee
3 Governance & Nomination Committee

Exchange Listing
New York Stock Exchange Common Stock
Stock symbol: FOE

Executive Offices
Ferro Corporation, 6060 Parkland Boulevard,
Suite 250, Mayfield Heights, OH 44124, U.S.A.
216-875-5600

Investor Contact
Kevin Cornelius Grant
Director, Investor Relations and
Corporate Communications
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, 2020, is available to shareholders at no cost at the Company's website (ferro.com) or upon request.

Stock Purchase Plan
The Plan is administered by Computershare. Any questions or correspondence about the Plan should be addressed to:

Computershare
P.O. Box 505000, Louisville, KY 40233-5000
Shareholder Services Number(s): 800-622-6757
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 505000, Louisville, KY 40233-5000
Shareholder Services Number(s): 800-622-6757
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

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