

GRAFTECH INTERNATIONAL LTD

Form 10-K

February 22, 2019

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, 2018

OR

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

for the transition period from _____ to _____

Commission file number: 1-13888

GRAFTECH INTERNATIONAL LTD.

(Exact name of registrant as specified in its charter)

Delaware 27-2496053

(State or other jurisdiction of (I.R.S. Employer
incorporation or organization) Identification Number)

982 Keynote Circle 44131

Brooklyn Heights, Ohio (Zip Code)

Registrant's telephone number, including area code: (216) 676-2000

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

Title	Name of
of	each
each	exchange
class	on which
registered:	registered:
Common	
Stock,	
\$0.01	New York
par	Stock
value	Exchange
per	
share	

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

None

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

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 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

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such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

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

Large Accelerated Filer Accelerated Filer Non-Accelerated Filer

Smaller reporting company Emerging Growth Company

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

Indicate by check mark whether the registrant is a shell company (as defined in Exchange Act Rule 12b-2).

Yes No

The aggregate market value of the voting and non-voting common stock held by non-affiliates of the registrant as of June 29, 2018 was \$685.4 million, based on the closing price of the registrant's common stock as reported on the New York Stock Exchange as of the last business day of the registrant's most recently completed second quarter. On February 15, 2019, 290,537,612 shares of our common stock were outstanding, par value \$.01 per share.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the definitive proxy statement (the "Definitive Proxy Statement") to be filed with the Securities and Exchange Commission relative to the registrant's 2019 Annual Meeting of Stockholders are incorporated by reference into Part III of this Report.

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PART I

References herein to the "Company", "we", "our", or "us" refer collectively to GrafTech International Ltd. and its subsidiaries.

Presentation of Financial, Market and Legal Data

We present our financial information on a consolidated basis. Unless otherwise noted, when we refer to dollars, we mean U.S. dollars.

Certain market and industry data included in this Annual Report on Form 10-K for the year ended December 31, 2018 (the "Annual Report" or "report") has been obtained from third party sources that we believe to be reliable. Market estimates are calculated by using independent industry publications, government publications and third party forecasts in conjunction with our assumptions about our markets. We have not independently verified such third party information. We cannot guarantee the accuracy or completeness of this market and market share data and have not independently verified it. None of the sources has consented to the disclosure or use of data in this Annual Report. While we are not aware of any misstatements regarding any market, industry or similar data presented herein, such data involves risks and uncertainties and is subject to change based on various factors, including those discussed under the headings "Forward Looking Statements" and "Risk Factors" in this Annual Report.

Forward Looking Statements

Some of the statements under "Management's Discussion and Analysis of Financial Condition and Results of Operations," and elsewhere in this report may contain forward looking statements that reflect our current views with respect to, among other things, future events and financial performance. You can identify these forward looking statements by the use of forward looking words such as "will," "may," "plan," "estimate," "project," "believe," "anticipate," "intend," "should," "would," "could," "target," "goal," "continue to," "positioned to" or the negative version of those words or comparable words. Any forward looking statements contained in this report are based upon our historical performance and on our current plans, estimates and expectations in light of information currently available to us. The inclusion of this forward looking information should not be regarded as a representation by us that the future plans, estimates or expectations contemplated by us will be achieved. These forward looking statements are subject to various risks and uncertainties and assumptions relating to our operations, financial results, financial condition, business, prospects, growth strategy and liquidity. Accordingly, there are or will be important factors that could cause our actual results to differ materially from those indicated in these statements. We believe that these factors include, but are not limited to:

- the cyclical nature of our business and the selling prices of our products may lead to periods of reduced profitability and net losses in the future;
- the possibility that we may be unable to implement our business strategies, including our initiative to secure and maintain longer-term customer contracts, in an effective manner;
- the possibility that recent tax legislation could adversely affect us or our stockholders;
- pricing for graphite electrodes has historically been cyclical and current prices are relatively high, however, the price of graphite electrodes may decline in the future;
- the sensitivity of our business and operating results to economic conditions;
- our dependence on the global steel industry generally and the electric arc furnace (EAF) steel industry in particular;
- the possibility that global graphite electrode overcapacity may adversely affect graphite electrode prices;
- the competitiveness of the graphite electrode industry;
- our dependence on the supply of petroleum needle coke;
- our dependence on supplies of raw materials (in addition to petroleum needle coke) and energy;
- the possibility that our manufacturing operations are subject to hazards;
- changes in, or more stringent enforcement of, health, safety and environmental regulations applicable to our manufacturing operations and facilities;
- the legal, economic, social and political risks associated with our substantial operations in multiple countries;
- the possibility that fluctuation of foreign currency exchange rates could materially harm our financial results;

the possibility that our results of operations could deteriorate if our manufacturing operations were substantially; disrupted for an extended period, including as a result of equipment failure, climate change, natural disasters, public health crises, political crises or other catastrophic events; the possibility that plant capacity expansions may be delayed or may not achieve the expected benefits;

our dependence on third parties for certain construction, maintenance, engineering, transportation, warehousing and logistics services;

- the possibility that we are unable to recruit or retain key management and plant operating personnel or successfully negotiate with the representatives of our employees, including labor unions;

the possibility that we may divest or acquire businesses, which could require significant management attention or disrupt our business;

the sensitivity of goodwill on our balance sheet to changes in the market;

the possibility that we are subject to information technology systems failures, cybersecurity attacks, network disruptions and breaches of data security;

our dependence on protecting our intellectual property;

the possibility that third parties may claim that our products or processes infringe their intellectual property rights

the possibility that significant changes in our jurisdictional earnings mix or in the tax laws of those jurisdictions could adversely affect our business;

the possibility that our indebtedness could limit our financial and operating activities or that our cash flows may not be sufficient to service our indebtedness;

the possibility that restrictive covenants in our financing agreements could restrict or limit our operations;

the fact that borrowings under certain of our existing financing agreements subjects us to interest rate risk;

the possibility of a lowering or withdrawal of the ratings assigned to our debt;

the possibility that disruptions in the capital and credit markets could adversely affect our results of operations, cash flows and financial condition, or those of our customers and suppliers;

the possibility that highly concentrated ownership of our common stock may prevent minority stockholders from influencing significant corporate decisions;

the fact that certain of our stockholders have the right to engage or invest in the same or similar businesses as us;

- the fact that certain provisions of our Amended and Restated Certificate of Incorporation and our Amended and Restated By Laws could hinder, delay or prevent a change of control;

the fact that the Court of Chancery of the State of Delaware will be the exclusive forum for substantially all disputes between us and our stockholders; and

our status as a “controlled company” within the meaning of the NYSE corporate governance standards, which allows us to qualify for exemptions from certain corporate governance requirements; and other risks described in the “Risk Factors” section of this report.

These factors should not be construed as exhaustive and should be read in conjunction with the other cautionary statements that are included in this report. The forward looking statements made in this report relate only to events as of the date on which the statements are made. We do not undertake any obligation to publicly update or review any forward looking statement except as required by law, whether as a result of new information, future developments or otherwise.

If one or more of these or other risks or uncertainties materialize, or if our underlying assumptions prove to be incorrect, our actual results may vary materially from what we may have expressed or implied by these forward looking statements. We caution that you should not place undue reliance on any of our forward looking statements. You should specifically consider the factors identified in this report that could cause actual results to differ before making an investment decision to purchase our

common stock. Furthermore, new risks and uncertainties arise from time to time, and it is impossible for us to predict those events or how they may affect us.

For a more complete discussion of these and other factors, see "Risk Factors" in Part I of this report.

Item 1. Business

Business

Our company

GrafTech International Ltd. is a leading manufacturer of high quality graphite electrode products essential to the production of electric arc furnace (or EAF) steel and other ferrous and non ferrous metals. We believe that we have the most competitive portfolio of low cost graphite electrode manufacturing facilities in the industry, including three of the five highest capacity facilities in the world (excluding China). We are the only large scale graphite electrode producer that is substantially vertically integrated into petroleum needle coke, the primary raw material for graphite electrode manufacturing, which is currently in limited supply. This unique position provides us with competitive advantages in product quality and cost. Founded in 1886, we have over 130 years of experience in the research and development (or R&D) of graphite-and carbon based solutions, and our intellectual property portfolio is extensive. We currently have graphite electrode manufacturing facilities in Calais, France, Pamplona, Spain, Monterrey, Mexico and St. Marys, Pennsylvania. Our customers include major steel producers and other ferrous and non ferrous metal producers in Europe, the Middle East and Africa (or EMEA), the Americas and Asia Pacific (or APAC), which sell their products into the automotive, construction, appliance, machinery, equipment and transportation industries. Our vision is to provide highly engineered graphite electrode services, solutions and products to EAF operators. Based on the high quality of our graphite electrodes, reliability of our petroleum needle coke supply and our excellent customer service, we believe that we are viewed as a preferred supplier to the global EAF steel producer market.

Graphite electrodes are an industrial consumable product used primarily in EAF steel production, one of the two primary methods of steel production and the steelmaking technology used by all "mini mills." Electrodes act as conductors of electricity in the furnace, generating sufficient heat to melt scrap metal, iron ore or other raw materials used to produce steel or other metals. We estimate that, on average, the cost of graphite electrodes represents only approximately 1% to 5% of the total production cost of steel in a typical EAF, but they are essential to EAF steel production. Graphite electrodes are currently the only known commercially available products that have the high levels of electrical conductivity and the capability to sustain the high levels of heat generated in EAF steel production. As a result, EAF steel manufacturers have been willing to pay a premium for a reliable supply of high quality graphite electrodes, and, in some cases, to pass on this premium to their customers in the form of surcharges. Graphite electrodes are also used in steel refining in ladle furnaces and in other processes, such as the production of titanium dioxide, stainless steel, aluminum, silicon metals and other ferrous and non ferrous metals.

Petroleum needle coke, a crystalline form of carbon derived from decant oil, is the primary raw material used in the production of graphite electrodes. We achieved substantial vertical integration with this critical raw material source through our acquisition of Seadrift Coke LP (or Seadrift) in November 2010, significantly reducing our reliance on other suppliers. The petroleum needle coke industry is highly concentrated. We believe Seadrift is the second largest petroleum needle coke producer in the world. We also believe that the quality of Seadrift's petroleum needle coke is superior for graphite electrode production compared to most of the petroleum needle coke available to our peers on the open market, allowing us to produce higher quality electrodes in a cost efficient manner. Additionally, we believe that this vertical integration provides a significant cost advantage relative to our competitors in periods of tight petroleum needle coke supply, such as the current market environment. We believe this cost advantage will grow as demand for petroleum needle coke increases for use in lithium ion batteries in electric vehicles. The demand for petroleum needle coke in lithium ion batteries is growing rapidly, with usage going from approximately 1,000 MT in 2014 to 60,000 MT in 2017. This rapidly growing alternative source of demand is a significant development for the petroleum needle coke industry and is contributing to the global shortage in petroleum needle coke.

According to the World Steel Association (or WSA), EAFs accounted for 46%, or 394 million metric tons (or MT), of global crude steel production (excluding China) in 2017, which represented an increase of 8% over 2016. Between 1984 and 2011, EAF steelmaking was the fastest growing segment of the steel sector, with production increasing at an average rate of 3.5% per year, based on WSA data. Historically, EAF steel production has grown faster than the

overall steel market due to the greater resilience, more variable cost structure, lower capital intensity and more environmentally friendly nature of EAF steelmaking. This trend was partially reversed between 2011 and 2015 due to global steel production overcapacity driven largely by Chinese blast furnace (or BOF) steel production. Beginning in 2016, efforts by the Chinese government to restructure China's domestic steel industry have led to limits on Chinese BOF steel production and lower export levels. In addition, developed economies,

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which typically have much larger EAF steel industries, have instituted a number of trade policies in support of domestic steel producers. As a result, since 2016, the EAF steel market has rebounded strongly and resumed its long term growth trajectory. This revival in EAF steel production has resulted in increased demand for our graphite electrodes.

At the same time, two supply side structural changes have contributed to record high prices of graphite electrodes in 2018. First, ongoing consolidation and rationalization of graphite electrode production capacity have limited the ability of graphite electrode producers to meet demand. We estimate that approximately 20% of graphite electrode industry production capacity (excluding China) was closed or repurposed from 2014-2016, and we believe the majority of these closures represent permanent reductions. Second, demand for petroleum needle coke has outpaced supply due to increasing demand for petroleum needle coke for lithium ion batteries used in electric vehicles. As a result, graphite electrode prices have reached record high prices in 2018. Historically, between 2008 and 2017, our weighted average realized price of graphite electrodes was approximately \$4,500 per MT (on an inflation adjusted basis using constant 2018 dollars) and fell to a historic low of approximately \$2,500 per MT in 2016. With the renewed demand for, and constrained supply of, graphite electrodes, industry spot prices have reached record highs in 2018. In light of improved market conditions, the long lead time required to produce our products, our position as one of the market's largest producers and our ability, through our substantial vertical integration with Seadrift, to provide customers with a reliable long term supply of graphite electrodes despite the market shortage of petroleum needle coke, we have implemented a commercial strategy to sell graphite electrodes through three to five year take or pay contracts.

GrafTech historical weighted average realized prices and signed three to five year weighted average contract prices for graphite electrodes

(1) Weighted average realized price for a period reflects the total revenues from sales of graphite electrodes for the period divided by the graphite electrode sales volume for that period. The weighted average realized prices in this chart are shown in constant 2018 dollars for comparability. See "Management's Discussion and Analysis of Financial Condition and Results of Operations-Key Operating Metrics."

(2) Weighted average contract price for a period reflects the volume weighted average price for graphite electrodes to be delivered under the three to five year take or pay contracts we have entered into in 2018 and 2019. All of these contracts have fixed prices and either fixed volumes (85% of the portfolio) or a specified volume range (15% of the portfolio). For those contracts with a specified volume range, weighted average contract prices are computed using the volume midpoint. The aggregate difference between the volume midpoint and the minimum or maximum volumes across our cumulative portfolio of take or pay contracts with specified volume ranges is approximately 5,000 MT per year in 2019-2022. See "Business-Contracts and Customers."

As a leading producer of graphite electrodes, we believe we are well positioned to benefit from this industry transformation. In 2017, based on our three primary operating facilities, we had the capability, depending on product demand and mix, to manufacture approximately 167,000 MT of graphite electrodes per year. In 2018, we completed an operational improvement and debottlenecking initiative to increase production capacity at these facilities by approximately 20% to approximately 202,000 MT. Currently, our warm idled St. Marys facility is finishing some electrodes sourced from other facilities to provide flexibility to our overall manufacturing footprint. We could ramp up production at St. Marys if required to support our customers. If restarted, St. Marys would add approximately 28,000 MT of annual capacity. This overall total production capacity would be comparable to our largest

competitor, which we estimate currently has a total of approximately 230,000 MT of production capacity (excluding China). We believe the total worldwide graphite electrode production capacity was approximately 800,000 MT (excluding China) in 2018, with a capacity utilization of approximately 90% (excluding China). We believe worldwide graphite electrode production capacity, excluding China, has now increased to approximately 850,000 MT. Electrode production globally (excluding China) is focused on the manufacture of ultra high power (or UHP) electrodes for EAFs, while the majority of Chinese production is of ladle electrodes for BOFs. The production of UHP electrodes requires an extensive proprietary manufacturing process and material science knowledge, including the use of superior needle coke blends. As a result, graphite electrode producers inside and outside of China are generally not in direct competition with each other for major product lines.

On August 15, 2015, we became an indirect wholly owned subsidiary of Brookfield Asset Management Inc. (together with its affiliates "Brookfield") through a tender offer to shareholders and subsequent merger transaction. Brookfield is an experienced operator of industrial, natural resource and other tangible asset businesses. This transaction has provided us with a stable equity partner with experience in industrial sectors.

On April 23, 2018, we completed our initial public offering (or IPO) of 35,000,000 shares of our common stock held by Brookfield at a price of \$15.00 per share. On April 26, 2018, we closed the sale of an additional 3,097,525 shares of common stock held by Brookfield at a price to the public of \$15.00 per share, as a result of the partial exercise by the underwriters in our IPO of their over-allotment option. We did not receive any proceeds related to the IPO. Our common stock is listed on the NYSE under the symbol "EAF."

On August 13, 2018, we repurchased 11,688,311 shares directly from Brookfield. These shares were retired upon repurchase. The price per share paid by us was equal to the price at which the underwriters purchased the shares from Brookfield's August 2018 public secondary offering of 23,000,000 shares of our common stock, net of underwriting commissions and discounts. We funded the share repurchase from cash on hand. After giving effect to the offerings by Brookfield and our repurchase of shares, Brookfield owns approximately 79% of our common stock.

Our executive offices are located at 982 Keynote Circle, Brooklyn Heights, Ohio 44131 and our telephone number is (216) 676 2000. Our Internet website address is www.graftech.com. Information on, or accessible through, our website is not part of this Annual Report. We have included our website address only as an inactive textual reference and do not intend it to be an active link to our website.

Competitive strengths

We are one of the two largest producers of graphite electrodes outside of China, accounting for approximately 24% of global production capacity (excluding China), and we believe our strategically positioned global footprint provides us with competitive advantages

We believe our facilities are among the most strategically located and lowest cost large scale graphite electrode manufacturing plants in the world. Of the graphite electrode manufacturing facilities currently operating outside of China, we estimate that our three operating manufacturing facilities represent approximately 24% of estimated production capacity for graphite electrodes, making us a critical supplier to global EAF steel manufacturers. Our manufacturing facilities are located in the Americas and EMEA, providing us with access to low cost and reliable energy sources, logistical and freight advantages in sourcing raw materials and shipping our graphite electrodes to our customers compared to our competitors, and excellent visibility into the large North American and European EAF steelmaking markets. Our experience in producing graphite electrodes for a varied global customer base positions us to meet customer requirements across a range of product types and quality levels, including support and technical services, further distinguishing us from our competitors.

We are a pure play provider of an essential consumable for EAF steel producers, the fastest growing sector of the steel industry

According to WSA, EAF steelmaking grew at an annual pace of approximately 14% in 2017, compared with 4% for steelmaking overall. As a result of the increasing global availability of steel scrap and the more resilient, high variable cost and environmentally friendly EAF model, we expect EAF producers to continue to grow at a faster rate than BOF producers globally. Additionally, EAF producers are increasingly able to utilize higher quality scrap and iron units, their two primary raw materials, to produce higher quality steel grades and capture market share from BOF producers, while maintaining a favorable cost structure. According to the WSA, in EMEA and the Americas, which together made up 93% of our 2018 net sales, EAF producers have increased market share from approximately 37% in 2000 to

49% in 2017, reflecting growth from 190 million MT to 257 million MT. In APAC, which made up approximately 7% of our 2018 net sales, government initiatives in China are expected to result in a greater use of the EAF method in steelmaking despite the historical dominance of BOF producers. These initiatives are the result of efforts to eliminate excess steelmaking production capacity and to improve environmental conditions. The EAF method produces

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approximately 25% of the carbon dioxide (or CO₂) emissions of a BOF facility and does not require the smelting of virgin iron ore or the burning of coal. Additionally, as a result of significantly increased steel production in China since 2000, the supply of Chinese scrap is expected to increase substantially, which may result in lower scrap prices and provide the Chinese steel manufacturing industry with local scrap feedstock that was not historically available. We believe these trends will allow EAF steel producers to increase their market share and grow at a faster rate than BOF steel producers, resulting in increasing demand for graphite electrodes.

We have capital efficient growth opportunities available to us

The graphite electrode industry responded to oversupplied markets from 2011 to 2015 with production capacity rationalization and consolidation, and after the normalization of the market for EAF steel in 2017. We believe the lead time from initial permitting to full production of a greenfield graphite electrode manufacturing facility would be approximately three to five years and cost approximately \$10,000 per MT. Similarly, brownfield development is complicated by significant capital costs and space and process constraints. Only one new greenfield graphite electrode facility outside of China has been built since the 1980s and only one significant brownfield expansion has occurred, reflecting the historical difficulty of adding further graphite electrode production capacity. As a result of this long and uncertain time horizon to build new plants, we believe only a few companies have the necessary technology and expertise to meet the rising demand for graphite electrodes.

Our current facilities are modern, strategically located and well maintained, providing us with ample operational optimization capabilities. In 2018, we completed the expansion of our production capacity by approximately 20%, to 202,000 MT, through strategic capital investments and operational improvements. As a result of our prior operational improvement activities, we are able to achieve this large capacity increase with specific, highly targeted capital investments. These expansions will provide additional fixed cost absorption and drive further efficiencies of scale across our manufacturing base. We also have our currently warm idled St. Marys facility, which remains a viable long-term option. Currently, St. Marys is graphitizing and machining some semi finished electrodes sourced from Monterrey in order to leverage existing infrastructure.

We believe we have the industry's most efficient production platform of high production capacity assets with substantial vertical integration

Based on our experience, high capacity manufacturing facilities can have operating costs of more than \$1,000 per MT lower than low capacity manufacturing facilities. Our previous restructuring activities included the closures of our lower capacity manufacturing facilities in South Africa and Brazil and the idling of our St. Marys facility, which together accounted for approximately 35% of our previous production capacity. Our restructuring actions have eliminated a significant amount of annual fixed manufacturing costs and maintenance capital expenditure requirements since 2012. These actions allow us to run our Calais, Pamplona and Monterrey plants at a high level of capacity utilization. Since 2014, we have also improved our manufacturing processes and made strategic investments across our plant network, which have improved productivity while also reducing our energy and raw material consumption. Following our footprint optimization, we are producing a greater quantity of graphite electrodes from our three primary operating facilities than we did from our six operating facilities in 2012. In 2017, the Calais and Pamplona plants exceeded previous annual record production levels by 15% and 12%, respectively, and production at the Monterrey plant was 12% higher than the highest annual production level during the past 10 years. Our recently completed debottlenecking initiative added approximately 20% to our capacity at a very low cost per MT. We believe that the optimization of our plant network will continue to drive improved fixed cost absorption.

Moreover, our Seadrift, Calais, Pamplona, Monterrey and St. Marys facilities each provide unique advantages for us. Seadrift provides a substantial portion of our petroleum needle coke supply needs internally and at a competitive cost and allows us to maximize capacity utilization more efficiently than competitors, who may be more constrained by petroleum needle coke supply. Seadrift is one of only five petroleum needle coke facilities in the world outside of China, and we believe it is the second largest petroleum needle coke producer in the world. We also believe that Calais, Pamplona and Monterrey are three of the five highest capacity graphite electrode facilities in the world (excluding China), allowing for significant operating leverage. We believe our facilities have significant cost advantages given their scale and access to low cost, reliable energy sources. While much of the production capacity rationalized during the downturn was permanently shut down, we temporarily idled our St. Marys facility and retain the option to restart it.

We are the only petroleum needle coke producer in the world specifically focused on the production of graphite electrodes

Our production of petroleum needle coke specifically for graphite electrodes provides us the opportunity to produce super premium petroleum needle coke of the highest quality and allows us to tailor graphite electrodes for customer requirements. Seadrift has 140,000 MT of petroleum needle coke production capacity, which we believe makes it the second largest petroleum needle coke producer in the world. We produced approximately 110,000 MT of needle coke in 2018. We expect to produce approximately 125,000 MT in 2019 as we do not have a planned maintenance outage in 2019 and we expect a modest productivity

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enhancement related to our efficiency improvement project. We believe that no petroleum needle coke production capacity has been added outside of China for at least 10 years, given high capital costs and technological barriers. Additionally, the growing petroleum needle coke demand from manufacturers of lithium ion batteries for electric vehicles has led to a limited supply of petroleum needle coke available to graphite electrode manufacturers. Sourcing the majority of our petroleum needle coke internally allows us to offer our customers certainty of supply, further enhancing our competitive position and supporting our three to five year, take or pay contracts strategy. To align with our three to five year contract profile, we have hedged the decant oil required to produce all of the graphite electrodes sold under these contracts, providing us with substantial visibility into our future raw material costs. We believe our use of petroleum needle coke is a further competitive advantage, as the use of pitch needle coke, an alternative raw material, results in longer bake times during graphite electrode production, significantly affecting graphite electrode production rates and cost.

Our graphite electrodes and petroleum needle coke are among the highest quality in the industry

After the divestiture of our non-core legacy Engineered Solutions businesses in 2016 and 2017, we focused on our core competency of graphite electrode production and generated approximately \$60 million in cash proceeds and release of working capital from these divestitures. Our restructured and simplified business model has reduced our annual overhead expenses significantly since 2012, allowing us to redeploy the savings into our graphite electrode business. We have identified and implemented mechanical and chemical improvements to our electrodes, invested in the capability to produce super premium petroleum needle coke needed for high margin UHP graphite electrodes, and optimized our production of pins at our Monterrey plant, which are a critical component used to connect and fasten graphite electrodes together in a furnace. By producing pins at our Monterrey plant, we are able to realize meaningful fixed cost synergies with our graphite electrode production on site. As a result, we believe the quality and the consistency of our electrodes is unrivaled in North America and EMEA and on par with that of any producer globally. We have seen customer satisfaction rise to ten year highs at a time when the industry has been focused on production capacity rationalization rather than quality. We believe the durability and infrequent breakage of our graphite electrodes create operating efficiencies and value opportunities for our customers. We also believe we have a competitive advantage in offering customers our ArchiTech Furnace Productivity System (or ArchiTech), which we believe is the most advanced support and technical service platform in the graphite electrode industry. ArchiTech, which has been installed in customer furnaces around the world, enables our engineers to work with our customers seamlessly to maximize the performance of their furnaces and provide real time diagnostics and troubleshooting. We believe our customers value our high quality products and customer service, and have provided us with opportunities to expand our business with them as a result.

Our experienced executive leadership and general managers and flexible workforce have positioned us for future earnings growth

Our seasoned leadership is committed to earnings growth. We have undertaken strategic investments to increase our production capacity in a capital efficient manner while reducing our cost position. Our executive and manufacturing leadership have led manufacturing companies through many cycles and are focused on positioning us for profitable growth in any environment. Our operational improvement and debottlenecking initiative is completed and increased capacity by approximately 20%, or 35,000 MT. Currently, our warm idled St. Marys facility is finishing some electrodes sourced from other facilities to provide flexibility to our overall manufacturing footprint. We could ramp up production at St. Marys if required to support our customers. If restarted, St. Marys would add approximately 28,000 MT of annual capacity.

Additionally, since our acquisition by Brookfield, we have reorganized our manufacturing facilities as profit centers. We use LEAN manufacturing techniques, which focus on the constant elimination of waste from the manufacturing process. We also rely on Six Sigma methods, a set of management techniques intended to improve quality by significantly reducing the probability that an error or defect will occur. We believe the LEAN and Six Sigma initiatives have increased overall utilization by optimizing our plant production capacity and controlled costs while also improving quality. We also redesigned general manager incentive plans to reward efficiency gains. Similarly, our labor force is incentivized to drive efficiencies through country specific labor incentive plans.

Facilities

We currently manufacture our graphite electrodes in three manufacturing facilities strategically located in the Americas and EMEA, two of the largest EAF steelmaking markets. Our locations allow us to serve our customers in the Americas and EMEA efficiently and are located near low cost and reliable energy sources with essential logistical infrastructure in place. In addition to these three facilities, we have a fourth graphite electrode manufacturing site in St. Marys, Pennsylvania that is currently warm idled. We estimate that the 202,000 MT of graphite electrode production capacity at our three primary operating sites represents approximately 24% of estimated global graphite electrode production capacity (excluding China). Due to our productivity

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improvement efforts, and because of the increased demand for graphite electrodes, we achieved near 100% capacity utilization at our Calais, France, Pamplona, Spain and Monterrey, Mexico plants in 2017 and 2018. In 2017, the Calais and Pamplona plants exceeded previous annual record production levels by 15% and 12%, respectively, and production at the Monterrey plant was 12% higher than the highest annual production level during the past 10 years. In 2018, we added capacity to all three locations through our debottlenecking initiative. We believe our business has the lowest manufacturing cost structure of all of our major competitors, primarily due to the large scale of our manufacturing facilities.

Our manufacturing facilities significantly benefit from their size and scale, work force flexibility, access to attractively priced sources of power and other key raw materials, and our substantial vertical integration with Seadrift. By operating three of the five highest capacity graphite electrode production facilities in the world, we are able to achieve meaningful operating leverage relative to our competitors. Because of the attractive cost of labor available to our Monterrey facility, we believe we have a significant cost advantage in the production of pins, which are used to connect and fasten graphite electrodes together in a furnace and are more labor intensive to produce than other graphite electrodes. Our Calais, Pamplona and Monterrey facilities have access to low cost sources of electricity, a significant element of our manufacturing costs. Our Seadrift facility currently produces approximately 70% of our petroleum needle coke requirements for our graphite electrode production, allowing us to source our primary raw material internally and at cost, a significant advantage relative to our peers. Seadrift also produces sufficient needle coke to supply substantially all of the graphite electrode production that we have contracted under our take or pay contracts. The recent transformation in the industry was driven in part by substantial production capacity rationalization and consolidation. We estimate that, at the beginning of 2014, the graphite electrode industry globally (excluding China) had capacity to produce approximately 1.0 million MT of graphite electrodes across 30 graphite electrode manufacturing facilities. We estimate that the industry outside of China has closed or repurposed approximately 20% of production capacity from 2014-2016, reducing production capacity to approximately 800,000 MT of electrodes. Moreover, the third largest producer has acquired the second largest producer. As part of this overall industry rationalization, we permanently shut down two plants and temporarily idled our St. Marys plant, reducing our electrode manufacturing from six operating facilities in 2012 to three operating facilities in 2017. Despite this, we are producing a greater quantity of graphite electrodes in 2018 from our three primary operating facilities than we did in 2012 from our six facilities. We believe worldwide graphite electrode production capacity, excluding China, has now increased to approximately 850,000 MT.

Manufacturing

We manufacture graphite electrodes ranging in size up to 30 inches in diameter, over 11 feet in length, and weighing as much as 5,900 pounds (2.6 MT). The manufacturing process includes six main processes: screening of raw materials (needle coke) and blending with coal tar pitch followed by forming, or extrusion, of the electrode, baking the electrode, impregnating the electrode with a special pitch that improves strength, re baking the electrode, graphitizing the electrode using electric resistance furnaces, and machining. The first baking process converts the pitch into hard coke. During the baking process, the electrode pitch volatiles are removed, leaving porosities inside. To improve graphite electrode quality, the electrode is then impregnated with additional coal tar pitch to fill the porosities and baked a second time. After impregnation and re baking, the manufacturing process continues with graphitization as the electrodes are heated at 5000°F in a special longitudinal furnace to convert the carbon into graphite. The graphitization cycle removes additional impurities and improves the electrodes' key qualities: thermal and electrical conductivity, thermal shock resistance performance, lubricity, and abrasion resistance. Graphitization is energy intensive, and, according to CRU International Ltd (or CRU), requires around 3200 to 4800 kWh electricity per MT, representing 20% to 35% of the total electrode costs.

High quality graphite electrodes have low electrical resistivity and strong durability. Resistivity is enhanced by removing impurities during the production process, while durability is determined by the coefficient of thermal expansion (or CTE) of the raw material used to produce the graphite electrode. Lower CTE needle coke produces higher quality electrodes. UHP electrodes used in harsh EAF melter applications have low resistivity and low CTE to maximize efficient use of electricity in the EAF and minimize electrode consumption. The total manufacturing time of a graphite electrode and its associated connecting pin is on average approximately six months from needle coke production to customer delivery. We believe that the period of time required to produce a graphite electrode

meaningfully constrains the ability of graphite electrode producers to react to real time changes in steel market environments and acts as a barrier to entry.

Production of a graphite electrode begins with the production of either petroleum needle coke, our primary raw material, or pitch needle coke, a less favorable substitute for petroleum needle coke. Petroleum needle coke is produced through a manufacturing process very similar to a refinery. The production process converts decant oil, a byproduct of the gasoline refining process, into petroleum needle coke and generally takes two to three months to produce. Needle coke takes its name from the needle like shape of the coke particles. We produce calcined petroleum needle coke at Seadrift. Seadrift is not dependent on any single refinery for decant oil. While Seadrift has purchased a substantial majority of its raw material inventory from a limited number of suppliers in recent years, we believe that there is a large supply of suitable decant oil in the United States available

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from a variety of sources. In addition, we use derivatives to hedge the decant oil required to produce all of the graphite electrodes sold under our three to five year take or pay contracts, providing us with substantial visibility into our future raw material costs. Seadrift is one of the three largest petroleum needle coke facilities in the world.

We purchase the electric power used in our manufacturing processes from local suppliers under contracts with pricing based on rate schedules or price indices. Our electricity costs can vary significantly depending on these rates and usage. Natural gas used in the baking and re-baking processes is purchased from local suppliers primarily under annual volume contracts with pricing based on various natural gas price indices.

Sales and customer service

We differentiate and sell the value of our graphite electrodes primarily based on price, product quality and performance, delivery reliability and customer technical service.

We have a large customer technical service organization, with supporting application engineering and scientific groups and more than 30 engineers and specialists around the world serving in this area. We believe that we are one of the industry leaders in providing value added technical services to our customers.

Our direct sales force currently operates from 10 sales offices located around the world. We sell our graphite electrodes primarily through our direct sales force, independent sales representatives and distributors, all of whom are trained and experienced with our products.

We have customer technical service personnel based around the world to assist customers to maximize their production and minimize their costs. A portion of our engineers and technicians provide technical service and advice to key steel and other metals customers. These services relate to furnace applications and operation, as well as furnace upgrades to reduce energy consumption, improve raw material costs and increase output.

We believe we have a competitive advantage in offering customers ArchiTech, which we believe is the most advanced support and technical service platform in the graphite electrode industry. ArchiTech, which has been installed in customer furnaces worldwide, enables our engineers to work with our customers seamlessly to maximize the performance of their furnaces and provide real time diagnostics and troubleshooting.

Distribution

We deploy various demand management and inventory management techniques to seek to ensure that we can meet our customers' delivery requirements while still maximizing the capacity utilization of our production capacity. We can experience significant variation in our customers' delivery requirements as their specific needs vary and change through the year. We generally seek to maintain appropriate inventory levels, taking into account these factors as well as the significant differences in manufacturing cycle times for graphite electrode products and our customers' products. Finished products are usually stored at our manufacturing facilities. Limited quantities of some finished products are also stored at local warehouses around the world to meet customer needs.

Contracts and Customers

In 2017, we reoriented our commercial strategy around a three to five year take or pay contract framework and restructured our sales force incentives. As graphite electrodes are an essential consumable in the EAF steel production process and require a long lead time to manufacture, our strategic customers are highly focused on securing certainty of supply of reliable, high quality graphite electrodes. Prior to our three to five year take or pay contract initiative, our sales of graphite electrodes were generally negotiated annually through purchase orders on an uncontracted, nonbinding basis. The majority of our customers sought to secure orders for a supply of their anticipated volume requirements each upcoming year. The remaining, small balance of our graphite electrode customers purchased their electrodes as needed throughout the year at industry spot prices.

We believe we are uniquely capable among graphite electrode producers to pursue our three to five year take or pay contracting strategy due to our substantial vertical integration into petroleum needle coke production. All of our petroleum needle coke production is used internally and is not sold to external customers. Demand for petroleum needle coke increased due to the use of needle coke in lithium ion batteries for electric vehicles, as well as increased demand for graphite electrodes. Consequently, we expect this limited availability of petroleum needle coke will restrict new graphite electrode production. Seadrift, our wholly owned subsidiary acquired in 2010, provides approximately 70% of our petroleum needle coke requirements and produces sufficient needle coke to supply substantially all of the graphite electrode production that we have contracted under our take or pay contracts.

We have hedged the decant oil required to produce all of the graphite electrodes sold under these contracts, providing us substantial visibility into our future raw material costs.

Because the market price of graphite electrodes may be based, in part, on the current or forecasted costs of key raw materials, periods of raw material price volatility may have an impact on the market price. In particular, as petroleum needle coke represents a significant percentage of the raw material cost of graphite electrodes, the price of graphite electrodes has historically been influenced by the price of petroleum needle coke. See “Risk Factors-Risks Related to Our Business and Industry-pricing for graphite electrodes has historically been cyclical and current prices are relatively high, however, the price of graphite electrodes may decline in the future.” The fixed prices under our contracts prevent us from passing along changes related to our costs of raw materials to our customers. See “Risk Factors-Risks Related to Our Business and Industry-We are dependent on the supply of petroleum needle coke. Our results of operations could deteriorate if recent disruptions in the supply of petroleum needle coke continue or worsen for an extended period.” However, as described above, we believe our ability to source all of our petroleum needle coke requirements for these contracts from our Seadrift facility and our hedging of our purchases of decant oil mitigates the impact of periodic shortages and price fluctuations of raw materials.

We have executed three to five year take or pay contracts, representing approximately 674,000 MT, or approximately 60% to 65% of our cumulative expected production capacity from 2018 through 2022. Approximately 90% of the contracted volumes have terms extending to 2022. We have contracted to sell approximately 147,000, 144,000, 127,000 and 120,000 MT in 2019, 2020, 2021 and 2022, respectively. Approximately 83% of these volumes are under pre determined fixed annual volume contracts, while approximately 17% of the volumes are under contracts with a specified volume range. The aggregate difference between the midpoint and the minimum or maximum volumes across our cumulative portfolio of take or pay contracts with specified volume ranges is approximately 5,000 MT per year in 2019, 2020, 2021 and 2022.

All of our take or pay contracts have fixed prices. The weighted average contract price for the contracted volumes over the next four years is approximately \$9,700 per MT, with the weighted average contract prices for contracts with a specified volume range computed using the volume midpoint. Weighted average contract prices for our contracted volume will differ from the weighted average realized prices that we will actually realize for all MT of graphite electrodes we sell in these years because contracted volumes represent only a portion of our production capacity.

Three to Five Year Take or Pay Contract Volume and Price Profile

(1) Contract volume reflects volumes contracted under three to five year take or pay contracts. Contract volume in the above graph reflects the midpoint of the contracts with a specified volume range.

Weighted average contract price reflects the volume weighted average price for graphite electrodes at which we (2) have entered into three to five year take or pay contracts as of the date hereof. For those contracts with a specified volume range, weighted average contract prices are computed using the volume midpoint.

Within this contract framework, our customers agree to purchase a specified volume of product at the price under the contract. Contract customers are unable to renegotiate or adjust the price under the contract and order. These fixed prices under the contracts also prevent us from passing along any changes related to the costs of raw materials to contract customers. As a result of the take or pay obligation of the contracts, the customer must purchase the annual contracted volume (or annual volume within

the specified range). In the event the customer does not take delivery of the annual volume specified in the contract, our contracts provide for a capacity payment equal to the product of the number of MTs short of the annual volume specified in the contract multiplied by the price under the contract for that contract year.

In addition to defining annual volumes and prices, these three to five year take or pay contracts include significant termination payments (typically, 50% to 70% of remaining contracted revenue) and, in certain cases, parent guarantees and collateral arrangements to manage our customer credit risk. In most cases, the customer can only terminate the contract unilaterally: (i) upon certain bankruptcy events; (ii) if we materially breach certain anti corruption legislation; (iii) if we are affected by a force majeure event that precludes the delivery of the agreed to graphite electrodes for more than a six month period; or (iv) if we fail to ship certain minimum levels during a specified period of time. The customer will also be able to temporarily suspend obligations under the contract due to a force majeure event, as will we, with the contract term being extended by a period equal to the duration of such suspension.

Our contracts provide our customers with certain remedies in the event that we are unable to deliver the contracted volumes of graphite electrodes on a quarterly basis. Our substantially vertically integrated Seadrift plant is particularly important to our ability to provide our customers with a reliable supply of graphite electrodes. Therefore, the likelihood that we will fail to deliver the contracted volume is significantly reduced due to our substantial vertical integration. For a discussion of certain risks related to our take or pay contracting initiative, see “Risk Factors-Risks related to our business and industry-We may be unable to implement our business strategies, including our initiative to secure and maintain three to five year take or pay customer contracts, in an effective manner.”

We aim to be the leading producer of the highest performing graphite electrodes in order to enhance customer production efficiency. Our global manufacturing network, vertical integration with needle coke and R&D team provide us with competitive advantages in product quality, product costs, and operational flexibility. We continuously work to improve the consistent overall quality of our products and services, including the performance characteristics of each product, and the uniformity of the products manufactured at different facilities. We believe our efforts have succeeded, as in 2017 and 2018 we improved our quality and performance metrics to the highest levels in ten years and added new, leading steelmakers as customers.

Approximately 91% of our graphite electrodes were purchased by EAF steel producers in 2018. The remaining portion is primarily used in various other ferrous and non ferrous melting applications, BOF production, fused materials, chemical processing, and alloy metals. In 2018, one customer accounted for more than 10% of our net sales. We sell our products in every major geographic region globally. Sales of our products to buyers outside the United States accounted for approximately 83% of net sales in 2016, approximately 81% of net sales in 2017 and approximately 77% of net sales in 2018. Overall, in 2018, we generated more than 93% of our net sales from EMEA and the Americas.

2018 Revenue and production by region and end market

We believe our three to five year take or pay contracting strategy provides cash flow visibility and stability to our customers and, as a result, has secured a high quality customer base. We perform financial and credit reviews of all eligible potential customers prior to entering into these contracts. Less creditworthy customers are required to post a bank guarantee, letter of credit or significant cash prepayment. Based on total revenues over the life of the contracts, our ten largest customers represent 38% of total revenue, while the next ten customers and all other customers represent 17% and 45% of total revenue, respectively. During 2018, approximately 71% of our sales came from our three-to-five year take-or-pay contracts.

Research and development

We have over 130 years of experience in the R&D of graphite and carbon based solutions. By focusing our management's attention and R&D spending exclusively on the graphite electrode business, we have been able to meaningfully improve the quality of our graphite electrodes, repositioning ourselves as an industry quality leader and improving our relationships with strategic customers. Our focus on improving the quality of petroleum needle coke through R&D has led to our petroleum needle coke production at Seadrift now being best in class for use in the manufacturing of highly durable UHP electrodes. We believe that our technological and manufacturing strengths and capabilities provide us with a significant growth opportunity as well as a competitive advantage.

Intellectual property

We believe that our intellectual property, consisting primarily of patents and proprietary know how, provides us with competitive advantages and is important to our growth opportunities. Our intellectual property portfolio is extensive, with approximately 200 carbon and graphite U.S. and foreign patents and published patent applications, which we believe is more than any of our major competitors in the businesses in which we operate.

We own or have obtained licenses for various trade names and trademarks used in our businesses. For example, the trade name and trademark UCAR are owned by Union Carbide Corporation (which was acquired by Dow Chemical Company) and are licensed to us on a worldwide, exclusive and royalty free basis until 2025. This particular license automatically renews for successive ten year periods. It permits non renewal by Union Carbide at the end of any renewal period upon five years' notice of non renewal.

We rely on patent, trademark, copyright and trade secret laws, as well as appropriate agreements to protect our intellectual property. Among other things, we seek to protect our proprietary know how and information, by requiring employees, consultants, strategic partners and others who have access to such proprietary information and know how to enter into confidentiality or restricted use agreements.

Insurance

We maintain insurance against civil liabilities relating to personal injuries to third parties, for loss of or damage to property, for business interruptions and for certain environmental matters, that provides coverage, subject to the applicable coverage limits, deductibles and retentions, and exclusions, that we believe are appropriate upon terms and conditions and for premiums that we consider fair and reasonable in the circumstances. There can be no assurance that we will not incur losses beyond the limits of or outside the coverage of our insurance.

Environment

Our facilities and operations are subject to a wide variety of federal, state, local and foreign environmental laws and regulations. These laws and regulations relate to air emissions, water discharges and solid and hazardous waste generation, treatment, storage, handling, transportation and disposal; the presence of wastes and other substances; the reporting of, responses to and liability for, releases of hazardous substances into the environment; and the import, production, packaging, labeling and transportation of products that are defined as hazardous or toxic or otherwise believed to have potential to harm the environment or human health. These laws and regulations (and the enforcement thereof) are periodically updated and are becoming increasingly stringent. We have incurred substantial costs in the past, and will continue to incur additional costs in the future, to comply with these legal requirements.

We believe that we are currently in compliance in all material respects with the federal, state, local and foreign environmental laws and regulations to which we are subject. We have experienced some level of regulatory scrutiny at most of our current and former facilities and, in some cases, have been required to take or are continuing to take corrective or remedial actions and incur related costs, and may experience further regulatory scrutiny, and may be required to take further corrective or remedial actions and incur additional costs, in the future. Although it has not been the case in the past, these costs could have a material adverse effect on us in the future.

Further, laws and regulations in various jurisdictions impose or may impose, as the case may be, environmental monitoring, reporting and/or remediation requirements if operations cease or property is transferred or sold. We have sold or closed a number of facilities that had operated solid waste management units (landfills) on site. In most cases where we divested the properties, we have retained ownership of on site landfills. When our landfills were or are to be sold, we negotiate for contractual provisions providing for financial assurance to be maintained, which we believe will be adequate to protect us from any potential future liability associated with these landfills. When we have closed landfills, we believe that we have done so in material compliance with applicable laws and regulations. We continue

to monitor these landfills and observe any reporting obligations we may have

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with respect to them pursuant to applicable laws and regulations. To date, the costs associated with the retained landfills have not had, and we do not anticipate that future costs will have, a material adverse effect on us.

We have received and may in the future receive notices from the U.S. Environmental Protection Agency (or U.S. EPA) or state environmental protection agencies, as well as claims from other parties, alleging that we are a potentially responsible party (or PRP) under the Superfund Act and similar state laws for past and future remediation costs at waste disposal sites and other contaminated properties. Although Superfund Act liability is joint and several, in general, final allocation of responsibility at sites where there are multiple PRPs is made based on each PRP's relative contribution of hazardous substances to the site. Based on information currently available to us, we believe that any potential liability we may have as a PRP will not have a material adverse effect on us.

Certain of our U.S. facilities have been or will be required to comply with reporting requirements under the Federal Clean Air Act and standards for air emissions that have been or may be adopted by the U.S. EPA and state environmental protection agencies pursuant to new and revised regulations, including the possible promulgation of future maximum achievable control technology standards that apply specifically to our manufacturing sector(s), or more generally to our operation(s) or equipment. Achieving compliance with the regulations that have been promulgated to date has resulted in the need for additional administrative and engineered controls, changes to certain manufacturing processes, and increased monitoring and reporting obligations. Similar foreign laws and regulations have been or may also be adopted to establish new standards for air emissions, which may also require best available control technology on our manufacturing operations outside the United States. Based on information currently available to us, we believe that compliance with these regulations will not have a material adverse effect on us. International accords, foreign laws and regulations, and U.S. federal, state and local laws and regulations have been enacted to address concerns about the effects that CO₂ emissions and other identified greenhouse gases ("GHGs") may have on the environment and climate worldwide. These effects are widely referred to as Climate Change. The international community has taken actions to address Climate Change issues on a global basis. In particular, in December 2015, the 21st Conference of Parties for the UNFCCC concluded with more than 190 countries adopting the Paris Agreement, which then came into force and was legally binding on the parties in November 2016. The Paris Agreement sets a goal of limiting the increase in global average temperature and consists of two elements: a legally binding commitment by each participating country to set an emissions reduction target, referred to as "nationally determined contributions" (or NDCs), with a review of the NDCs that could lead to updates and enhancements every five years beginning in 2023, and a transparency commitment requiring participating countries to disclose in full their progress. Our activities in the EU are subject to the EU Emissions Trading Scheme (or ETS), and it is likely that requirements relating to GHG emissions will become more stringent and will continue to expand to other jurisdictions in the future as NDCs under the Paris Agreement are implemented. In the United States, although the current Administration has announced its intent to withdraw from the Paris Agreement, the EPA currently requires reporting of GHG emissions from certain sources and, in the future, the EPA or states may impose permitting obligations on new sources or existing sources that seek to modify their operations that would otherwise result in an increase in certain GHG emissions.

In the EU, the ETS, which was initially enacted under the provisions of the 1997 Kyoto Protocol, requires certain listed energy intensive industries to participate in an international "cap and trade" system of GHG emission allowances. A third phase of the EU ETS under Directive 2009/29/EC, covers the period 2013 to 2020 and instituted a number of program changes. EU Member States brought into force the necessary laws, regulations and administrative provisions to comply with this EU Directive. Carbon and graphite manufacturing is still not a covered industry sector in the revised Annex 1 of this Directive. However, one of our European manufacturing operations was required to comply with these provisions under a more general fuel combustion category, because its combustion units met the applicability levels. The operations subject to these provisions was eligible to receive free CO₂ emission allowances under the member state allocation program. On November 9, 2017, to implement the EU's NDC under the Paris Agreement and other GHG commitments, the European Parliament and Council announced a provisional agreement to revise and make more stringent the ETS during the Phase 4 period of 2021 to 2030. Among other changes, the Phase 4 provisions would further accelerate reduction in the current oversupply of allowances in the ETS market and establish further protections against the risks of carbon leakage. After extensive negotiations, the European Parliament and the Council formally supported the revision in February 2018. The revised EU ETS Directive (Directive (EU) 2018/410)

entered into force on April 8, 2018. The EU's current target for 2030 is to achieve a GHG reduction of at least 40% compared to 1990 levels. Implementation of Phase 4 could increase the cost of our current GHG allowances and require us to obtain additional allowances. Based on information currently available to us, we believe that compliance with international accords, U.S. and foreign laws and regulations concerning Climate Change which have been promulgated, or that could be promulgated in the future, including Phase 4 of the ETS, will not have a material adverse effect on us.

Some of our products (including our raw materials) are subject to extensive environmental and industrial hygiene regulations governing the registration and safety analysis of their component substances. For example, in connecting with the EU's Registration, Evaluation, Authorization and Restriction of Chemicals Regulation ("REACH") or the EU's Classification, Labelling

and Packaging Regulation, any key raw material, chemical or substance, including our products, could be classified as having a toxicological or health related impact on the environment, users of our products, or our employees. Coal tar pitch, which is classified as a substance of very high concern under REACH, is used in certain of our processes, but in a manner that we believe does not require us to obtain a specific authorization under the REACH guidelines.

Estimates of future costs for compliance with U.S. and foreign environmental protection laws and regulations, and for environmental liabilities, are necessarily imprecise due to numerous uncertainties, including the impact of potential new laws and regulations, the availability and application of new and diverse technologies, the extent of insurance coverage, the potential discovery of contaminated properties, or the identification of new hazardous substance disposal sites at which we may be a PRP and, in the case of sites subject to the Superfund Act and similar state and foreign laws, the final determination of remedial requirements and the ultimate allocation of costs among the PRPs. Subject to the inherent imprecision in estimating such future costs, but taking into consideration our experience to date regarding environmental matters of a similar nature and facts currently known, we estimate that our costs and capital expenditures (in each case, before adjustment for inflation) for environmental protection regulatory compliance programs and for remedial response actions will not be material over the next several years. Furthermore, we establish accruals for environmental liabilities when it is probable that a liability has been or will be incurred, and the amount of the liability can be reasonably estimated. We adjust the accrual as new remedial actions or other commitments are made, as well as when new information becomes available that changes the prior estimates previously made and we believe our existing accruals are reasonable.

Employee relations

As of December 31, 2018, we had 1,387 employees (excluding contractors). A total of 451 employees were in Europe (including Russia), 710 were in Mexico and Brazil, 3 were in South Africa, 216 were in the United States and 7 were in the Asia Pacific region. As of December 31, 2018, 945 of our employees were hourly employees.

As of December 31, 2018, approximately 846 employees, or 61%, of our worldwide employees, are covered by collective bargaining or similar agreements. As of December 31, 2018, approximately 691 employees, or 50%, of our worldwide employees, were covered by agreements that expire, or are subject to renegotiation, at various times through December 31, 2019. We believe that, in general, our relationships with our unions are satisfactory and that we will be able to renew or extend our collective bargaining or similar agreements on reasonable terms as they expire. We cannot assure, however, that renewed or extended agreements will be reached without a work stoppage or strike or will be reached on terms satisfactory to us. As of December 31, 2018, none of the employees in our Seadrift plant or St. Marys facility were covered by collective bargaining or similar agreements.

We have not had any material work stoppages or strikes during the past decade.

Industry

Graphite electrode industry

Graphite electrodes are an industrial consumable product used primarily in EAF steel production. EAFs and BOFs are the two primary technologies for steel production. In the EAF method, steel scrap is melted and recycled to produce liquid steel, while in the BOF method, virgin iron ore is smelted with metallurgical coke, a carbon product derived from metallurgical coal. According to the WSA, in 2017, EAF steel producers accounted for 46%, or 472 million MT, of global crude steel production (excluding China, which almost exclusively uses the BOF method), an increase of 44% since 2000. EAFs have historically been the fastest growing segment of the global steel industry due to their greater resilience, more variable cost structure, lower capital intensity and more environmentally friendly nature. EAF steel producers are the primary consumers of graphite electrodes, and use them to conduct electricity in a furnace, generating an electric arc of sufficient heat to melt scrap metal, iron ore or other raw materials used to produce steel or other metals. EAFs operate using either alternating electric current or direct electric current. The vast majority of EAFs use alternating electric current and typically use nine electrodes (in three columns of three electrodes each) at one time. Direct electric current EAFs typically use one column of three electrodes. Graphite electrodes are the only known commercially available products that have both the capacity to handle high levels of electrical current and the capability to sustain the high levels of heat generated in EAF steel production, making graphite electrodes essential to the EAF process.

The size of the electrodes varies depending on the size of the furnace, the size of the furnace's electric transformer and the planned productivity of the furnace. In a typical furnace using alternating electric current and operating at a typical

number of production cycles per day, three electrodes are fully consumed (requiring the addition of new electrodes), on average, every 8 to 10 operating hours. Graphite electrodes are consumed at a rate of approximately 1.7 kilograms per MT of steel production.

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The actual rate of consumption and addition of electrodes for a particular furnace depends primarily on the efficiency and productivity of the furnace. Therefore, demand for graphite electrodes is directly related to the amount and efficiency of EAF steel production. EAF steel production requires significant heat (as high as 5,000° F) to melt the raw materials, primarily scrap metal, in the furnace. Heat is generated as electricity (as much as 150,000 amps) passes through the electrodes and creates an electric arc between the electrodes and the raw materials.

Market size and major producers

Electrode production globally (excluding China) is focused on the manufacture of UHP electrodes for EAFs, while the majority of Chinese production is of ladle electrodes for BOFs. UHP electrodes must be able to endure more harsh operating environments than ladle electrodes, as EAFs melt solid scrap steel to a liquid state whereas BOF ladle electrodes are used to maintain the temperature of steel already in a liquid state. UHP electrodes are more difficult to make and are sold at a premium relative to ladle electrodes because their production requires an extensive proprietary manufacturing process and material science knowledge, including the use of superior needle coke blends. As a result, graphite electrode producers outside of China and electrode producers in China are generally not in direct competition for major product lines.

We believe the worldwide graphite electrode production capacity (excluding China) was approximately 800,000 MT in 2018. We believe worldwide graphite electrode production capacity, excluding China, has now increased to approximately 850,000 MT. The industry is fairly consolidated with the top five players holding approximately 82% of the total capacity according to management estimates. The five largest producers in the industry are Showa Denko K.K., GrafTech, Graphite India Limited, Tokai Carbon Co., Ltd. and HEG Ltd.

Customers of UHP graphite electrode producers primarily include EAF steel producers across the Americas and EMEA. As the capacity utilization and production levels for EAF steel producers have increased beginning in 2017, demand for graphite electrodes exceeded production capacity. Customers have historically procured graphite electrodes through annual agreements negotiated in the third and fourth quarters of each calendar year for graphite electrodes to be delivered the following year. In light of recent market trends described below, certainty of supply of graphite electrodes has become a critical concern for EAF steelmakers.

We believe that greenfield graphite electrode manufacturing projects have been difficult to develop due to significant capital costs, long lead times, technical know how, and cumbersome permitting and regulatory regimes. We believe the lead time from initial permitting to full production of a greenfield graphite electrode manufacturing facility would be approximately three to five years and potentially cost as much as approximately \$10,000 per MT. Similarly, brownfield graphite electrode manufacturing development is complicated by significant capital costs. Only one greenfield project and one brownfield expansion have been completed since the 1980s outside of China. Therefore, we believe that the industry does not currently have the ability to increase production capacity easily to meet rising demand. Additionally, graphite electrodes require petroleum needle coke, which is an essential raw material for production. Needle coke is in short supply due to demand constraints explained below.

Restructuring of industry production capacity

Supply trends

According to the WSA, between 1984 and 2011, EAF steel production has grown at 3.5% per year, encouraging the growth of the graphite electrode industry. The rapid growth of Chinese steel production, primarily by the BOF method, created an oversupply in steel which led graphite electrode producers to rationalize production capacity and consolidate between 2014 and 2016, a phase which we believe has concluded with renewed EAF steel demand. In 2013, the graphite electrode industry (excluding China) had capacity to produce approximately 1.0 million MT of graphite electrodes across 30 graphite electrode plants. We estimate that from 2014-2016, the industry has closed or repurposed approximately 20% of global production capacity outside of China, consisting of smaller, higher cost facilities. Based on our experience, high capacity manufacturing facilities can have operating costs of more than \$1,000 per MT lower than low capacity manufacturing facilities, encouraging producers to consolidate facilities in order to reduce costs.

We believe the majority of the production capacity reduction was permanent due to the demolition, long term environmental remediation and repurposing of most of these lower capacity facilities. Additionally, in October 2017, Showa Denko, the industry's third largest producer, acquired SGL Carbon, the second largest producer. The consolidation and production capacity reductions in the graphite electrode industry, along with the EAF industry's

recovery since 2016, lead us to believe that the graphite electrode industry has recovered from the downturn and will resume its long term growth trajectory. We estimate that in 2018, global production capacity (outside of China) was approximately 800,000 MT with a capacity utilization of

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approximately 90%, excluding China. We believe worldwide graphite electrode production capacity, excluding China, has now increased to approximately 850,000 MT.

Demand trends

Our graphite electrodes are primarily used in the EAF steelmaking process, and global growth in that market has driven increasing demand for graphite electrodes. EAF steelmaking has historically been the fastest growing segment of the global steel market. According to the WSA, EAF steelmaking grew at an average annual rate of 3.5% from 1984, the first year for which data is available for all relevant countries, until 2011, while overall steel production (using all methods) grew at an average annual rate of 2.9%. After average annual declines in EAF steel production of 2.7% from 2011 through 2015, EAF steel production grew by 2.8% in 2016 and 13.7% in 2017.

This growth has resulted from the development by EAF steelmakers of diversified raw material sources, including non scrap materials rich in iron content, such as direct reduced iron and hot briquetted iron. These high quality sources of iron, in addition to technological advances in the EAF process, have enabled EAF steel producers to produce higher quality grades of steel traditionally produced by BOF steelmakers and to enter new markets as a result. EAF steelmakers have therefore been able to increase both market share and overall production. According to the WSA, as of 2017, EAF steel production has grown to 68% of total U.S. steel production from 47% in 2000, 46% of total EMEA steel production from 33% in 2000, and 41% of total APAC (excluding China) steel production from 36% in 2000.

Over the same period, global EAF production increased from 287 million MT in 2000 to 472 million MT in 2017, while non EAF steel production (excluding China) was relatively flat at 453 million MT in 2000 to 464 in 2017. This ongoing shift toward EAF steelmaking has resulted in increasing demand globally for graphite electrodes.

We believe there is a particular opportunity for EAF steelmaking to take further market share in China as well. China's 12th Five Year Plan, released in 2011, called for EAFs to constitute 20% of overall steel production by 2020.

According to the WSA, in 2017, Chinese EAF production increased to 77 million MT, or 9% of China's total steel production, up from 2016 levels of 51 million MT or 6% of China's total steel production. If Chinese EAF steelmaking production capacity were to reach 20%, based on 2017 production levels, that would add 89 million MT of additional EAF production for a total of 166 million MT, compared to 2017 EAF production in the next largest regions of 68 million MT in the EU, 55 million MT in India and 56 million MT in the United States.

While China's 13th Five Year Plan, released in March 2016, did not explicitly address the EAF target, it did emphasize the importance of environmental efforts, such that 10 of 25 targets in the plan were related to the environment. The Chinese government's increasing focus on the environment may eventually incentivize steelmakers to convert from BOFs to EAFs in order to continue operating. Significant BOF capacity in the country has been shuttered since 2016 given increasing government mandated environmental efforts. China's rapid increase in BOF steel production between 2000 and 2016 has also created a significant new source of scrap. As a result of these factors, we believe total UHP graphite electrode demand in China will increase in 2019 and going forward.

Pricing trends

Pricing for graphite electrodes is determined through contract negotiations and spot transactions between producers and consumers. Pricing has historically been cyclical, reflecting the demand trends of the global EAF steelmaking industry and supply of graphite electrodes. Moreover, as petroleum needle coke represents a significant percentage of the raw material cost of graphite electrodes, graphite electrodes have typically been priced at a spread to petroleum needle coke. Over the period from 2008 to 2017, the average graphite electrode spread over petroleum needle coke was approximately \$3,000 per MT, on an inflation adjusted basis using constant 2018 dollars. In tight demand markets, this spread has increased, resulting in higher graphite electrode prices. We believe that the new source of demand for petroleum needle coke presented by lithium ion battery producers for electric vehicles will place upward pressure on petroleum needle coke pricing compared to historical levels. While there is no widely accepted graphite electrode reference price, we believe that our weighted average realized prices are indicative of prices in the overall industry. Historically, between 2008 and 2017, our weighted average realized price of graphite electrodes was approximately \$4,500 per MT (on an inflation adjusted basis using constant 2018 dollars).

During the most recent demand trough, our weighted average realized price of graphite electrodes fell to approximately \$2,500 per MT in 2016. Following the significant rationalization of graphite electrode production globally, the resumption of growth in EAF steel production, falling scrap prices, reductions in Chinese steel, and constrained supply of needle coke, graphite electrode spot prices increased in late 2017 and 2018. As of February

2019, current spot prices were approximately \$12,000 per MT.

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Needle coke industry

Introduction

Needle coke is the primary raw material for the production of graphite electrodes used by EAF steelmakers and producers of aluminum, stainless steel, silicon metals and other ferrous and non ferrous metals, and is also a key raw material in the production of lithium ion batteries used to power electric vehicles. Needle coke is derived from two carbon sources. Petroleum needle coke is produced through a manufacturing process very similar to a refinery. The production process converts decant oil, a byproduct of the gasoline refining process, into petroleum needle coke and generally takes two months to produce. Pitch needle coke, used principally by Asian graphite electrode manufacturers, is made from coal tar pitch, a byproduct of coking metallurgical coal used in BOF steelmaking.

Graphite electrode producers combine petroleum and pitch needle coke with binders and other ingredients to form graphite electrodes. Petroleum and pitch needle coke, relative to other varieties of coke, are distinguished by their needle like structure and their quality, which is measured by the presence of impurities, principally sulfur, nitrogen and ash. Petroleum and pitch needle coke are typically low in these impurities. Additionally, the needle like structure of petroleum and pitch needle coke creates expansion along the length of the electrode, rather than the width, which reduces the likelihood of fractures. In order to minimize fractures caused by disproportionate expansion over the width of an electrode, and minimize the effect of impurities, large diameter graphite electrodes (18 inches to 32 inches) employed in high intensity EAF applications are comprised almost exclusively of petroleum and pitch needle coke. The process map below shows the raw materials required to make graphite electrodes, the various consumers of these raw materials, as well as the consumers of graphite electrodes.

(1) Graphite electrode sales represent sales outside of China

Source: Management Estimates

Previously, producers of petroleum needle coke typically agreed to supply petroleum needle coke in twelve month contracts; however, in 2017, producers of petroleum needle coke only agreed to six month contracts. This practice has continued in 2018 and 2019. As a result, our competitors must continually renegotiate supply agreements in response to changing market

conditions. We are substantially vertically integrated through our ownership of our Seadrift facility, which provides approximately 70% of our needle coke requirements and insulates us from rapid changes in the needle coke market.

Market size and major producers

The needle coke industry is highly concentrated with approximately ten major producers of needle coke and only four major producers of petroleum needle coke, excluding China. These firms include Phillips 66 (U.S.), Seadrift (GrafTech), Petrocokes Japan Limited (Japan), JX Nippon Oil & Energy Co., Ltd. (Japan) and Petrochina International Jinzhou Co., Ltd. (China), which produce petroleum needle coke, and Mitsubishi Chemical Company, Baosteel Group (China), C Chem Co., Ltd. (Japan), Indian Oil Company Limited (India), JX Holdings Inc. (Japan), Petrochina International Jinzhou Co., Ltd. (China) and Anshan Kaitan Thermo Energy New Materials Co. Ltd (China), which produce pitch needle coke. We believe that Phillips 66 and Seadrift are the largest and second largest needle coke producers in the world, respectively. We estimate that Seadrift has approximately 19% of the petroleum needle coke production capacity outside China.

Graphite electrode manufacturers prefer petroleum needle coke because of the meaningfully longer bake and graphitizing time required for pitch needle coke and the subsequent impact on graphite electrode production throughput. Electric vehicle manufacturers prefer petroleum needle coke in lithium ion batteries because of its greater energy density, providing batteries with longer driving ranges and longevity.

Estimated Petroleum needle coke industry production capacity (excluding China) by company (MT)

Source: Management estimates

Industry trends

Petroleum needle coke production capacity, excluding China, has remained unchanged for at least the last 10 years due to the capital intensity, technical know how and long lead times required to build greenfield needle coke production facilities and the stringent regulatory process associated with building new needle coke production capacity. Furthermore, we believe that brownfield expansion opportunities are generally not available as petroleum needle coke manufacturing is a continuous process with significant costs associated with shutting down and restarting facilities for maintenance or capital investment.

While supply has become constrained, demand for petroleum needle coke is increasing due to the use of needle coke in lithium ion batteries used in electric vehicles. The International Energy Agency (or IEA) estimates that the global electric car stock exceeded three million vehicles in 2017, tripling from 2015 levels. The IEA further projects that the global electric car stock may range between 9 million and 20 million by 2020, and between 40 million and 70 million by 2025. Most electric vehicles rely on lithium ion batteries as their key performance component. In the last two years, manufacturers of lithium ion batteries for electric vehicles have begun using needle coke instead of other forms of graphite as a raw material for carbon anodes in their batteries due to technological advances and the consistent quality that needle coke provides. We expect that lithium ion battery manufacturers will continue to prefer petroleum needle coke instead of pitch needle coke for the majority of their supply, due to petroleum needle coke's better energy density and superior energy storage. These qualities provide lithium ion batteries made with petroleum needle coke with longer potential driving ranges and battery lives. According to the ICC, electric vehicles comprised approximately

220,000 MT of total demand for needle coke in 2018, up 84% from 2017. Based on IEA's estimates of growth in electric vehicle stock to 2025, requirements for petroleum needle coke to fulfill demand would grow exponentially.

EAF steel industry

Emergence and initial period of growth

According to the WSA, global EAF production grew at a 3.5% compound annual growth rate from 1984 to 2011, while taking share from other methods of steelmaking in most regions of the world, outside of China. EAFs benefit from their flexibility in sourcing iron units, being able to make steel from either scrap or alternative sources of iron like direct reduced iron and hot briquetted iron, both made directly from iron ore. Most of the growth in EAF steelmaking has taken place in Western Europe and North America, two regions with substantial amounts of scrap available for use in EAFs.

Source: World Steel Association

Industry disruption 2011 to 2015

According to the WSA, EAF steel production declined approximately 10% from 2011 to 2015, reversing a trend of annual growth from 1984 to 2011, largely due to substantial increases in Chinese steel production. In 1984, China produced 21 million MT of BOF steel, which by 2017 had grown to 754 million MT, representing approximately 91% of its total steel production. Growth in production capacity surpassed growth in demand, resulting in significant excess capacity within China and increased exports into global markets. China net steel exports peaked at 112 million MT in 2015. These exports negatively affected steel prices and led EAF producers to reduce production. In 2011, EAF production globally was 454 million MT representing 30% of global steel production, but by 2015, EAF production had declined to 407 million MT, representing 25% of global steel production respectively. Declining EAF production significantly impacted demand for our graphite electrode products.

EAFs recovering and positioned for long term growth

The EAF steel industry has recovered since the downturn from 2011 to 2015. EAF production started to recover in 2016 with growth of 2.8%, according to the WSA. EAF production is now rebounding very strongly. WSA reported an 14% growth in EAF production in 2017. This recovery has taken place since China began in 2015 to restructure its steel industry by encouraging consolidation and shutting down excess capacity. China has also begun to implement increased environmental regulations to improve air quality, which has been impacted by CO₂ emissions associated with the burning of coal in BOF steelmaking. Additionally, developed economies such as North America and Western Europe have implemented trade decisions against BOF steel producing countries to protect their domestic steel industries against imports. These actions have resulted in a significant decrease in Chinese steel exports. According to China Customs and Baiinfo, Chinese steel exports have declined from 112 million MT in 2015 to 70 million MT in 2018. This reduction in exports has resulted in increased steel production outside of China, especially EAF steel production.

Chinese Monthly Steel Exports

Sources: China Customs, Baiinfo

Outlook

We expect EAF steel production to continue to grow globally. In 2000, according to the WSA, EAF steel production represented 47% of total U.S. steel production, increasing to 68% of total U.S. steel production by 2017. In absolute terms, total EAF production in the United States increased from 48 million MT in 2000 to 56 million MT in 2017. In 2000, EAF steel production reflected 33% of total EMEA steel production, increasing to 46% of total EMEA steel production by 2017. This represented an increase in total EAF production in EMEA from 111 million MT in 2000 to 166 million MT in 2017. In 2000, 36% of total APAC (excluding China) steel production was by the EAF method, representing 77 million MT of EAF production. This share of production increased to 41% of total APAC (excluding China) steel production by 2017; this represents 137 million MT of EAF production, or an incremental increase of 60 million MT. As a result, we believe there is substantial opportunity for trends in the U.S. and EMEA steel markets to replicate elsewhere.

China also represents a significant opportunity for EAF growth and market share expansion. Chinese steel production today is substantially through the BOF method, but increasing focus on environmental protection within China may encourage conversion from BOFs to EAFs. In its 12th Five Year Plan, the Chinese government set a goal of achieving 20% EAF market share by 2020. While China's 13th Five Year Plan, released in March 2016, did not explicitly address the EAF target, it did emphasize the importance of environmental efforts, such that 10 of 25 targets in the plan were related to the environment. The government's increasing focus on the environment may eventually incentivize steelmakers to convert from BOFs to EAFs in order to continue operating. Additionally, the rapid historical increase in Chinese steel production has resulted in increasing supplies of scrap, making EAFs more cost attractive relative to BOFs. According to McKinsey, so much scrap is expected to become available that EAF production capacity in China would need to triple by 2020 to keep pace. Steel producers may conclude that lower capital intensity mini mills are more attractive investment opportunities than rebuilding blast furnaces as they age, further supporting demand for graphite electrodes. China's crude steel output from electric arc furnace producers is estimated to reach 90-100 million metric tons in 2018. This would mark a 20%-30% increase over 2017, S&P Global Platts calculates.

Available Information

We make available, free of charge, on or through our web site, our annual reports on Form 10-K, our quarterly reports on Form 10-Q, our current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after we electronically file them with, or furnish them to, the U.S. Securities and Exchange Commission ("SEC"). We maintain our website at <http://www.graftech.com>. The information contained on our web site is not part of this Report. The SEC maintains a website that contains reports, proxy and information statements, and other information regarding issuers that file electronically. Please see <http://www.sec.gov> for more information.

Item 1A. Risk Factors

Our business, financial condition, results of operations and cash flow can be affected by a number of factors, whether currently known or unknown, including but not limited to those described below. You should carefully read all of the information included in this report and carefully consider, among other matters, the following risk factors, as well as any discussed under Part II, Item 7, "Management's Discussion and Analysis of Financial Conditions and Results of Operations." The occurrence of any of the following risks could materially and adversely affect our business, financial condition, results of operations and cash flow, in which case, the market price of our securities could decline.

Risks related to our business and industry

Our business is cyclical and the selling prices of our products may lead to periods of reduced profitability and net losses in the future.

We have a history of significant net losses, including a net loss of \$235.8 million for the year ended December 31, 2016. Our ability to maintain profitability depends on a number of factors, including the growth rate of the graphite electrode industry, the price of our products, the cost to produce our products, the competitiveness of our products and the production capacity at our existing plants. We may incur significant losses in the future for a number of reasons, including due to the other risks described in this Annual Report, and we may encounter unforeseen expenses, difficulties, complications and delays and other unknown events. In addition, as a public company, we now incur significant legal, accounting and other expenses that we did not incur as a private company. As a result, our operations may not maintain profitability in the future and, even if we do maintain profitability, we may not be able to increase it. We may be unable to implement our business strategies, including our initiative to secure and maintain three to five year take or pay customer contracts, in an effective manner.

Our future financial performance and success largely depend on our ability to implement our business strategies for growth successfully. We have undertaken, and will continue to undertake, various business strategies to sell a significant portion of our production capacity through three to five year, take or pay contracts, and improve operating efficiencies and generate cost savings. We cannot assure you that we will successfully implement our business strategies or that implementing these strategies will sustain or improve and not harm our results of operations. In particular, our ability to implement our strategy to enter into three to five year take or pay contracts successfully is subject to certain risks, including customers seeking to renegotiate key terms of their contracts, such as pricing and specified volume commitments, in the event market conditions change during the contract term; our inability to extend contracts when they expire; and a disruption in our access to Seadrift produced petroleum needle coke, which we will rely on, in part, to deliver the contracted volumes under the contracts. As a result, we cannot assure you that we will successfully implement this strategy or realize the anticipated benefits of these contracts. In addition, the costs involved in implementing our strategies may be significantly greater than we currently anticipate. For example, our ability to make other operational improvements as planned may be delayed or interrupted by the need to obtain environmental and other regulatory approvals, the availability of labor and materials, unforeseen hazards, such as weather conditions, and other risks customarily associated with construction projects.

Our business strategies are based on our assumptions about future demand for our products and on our continuing ability to produce our products profitably. Each of these factors depends, among other things, on our ability to finance our operations, maintain high quality and efficient manufacturing operations, respond to competitive and regulatory changes, access quality raw materials in a cost effective and timely manner, and retain and attract highly skilled technical, managerial, marketing and finance personnel. Any failure to develop, revise or implement our business strategies in a timely and effective manner may adversely affect our business, financial condition, results of operations or cash flows.

Pricing for graphite electrodes has historically been cyclical and current prices are relatively high, however, the price of graphite electrodes may decline in the future.

Pricing for graphite electrodes has historically been cyclical, reflecting the demand trends of the global EAF steelmaking industry and the supply of graphite electrodes. In addition, as petroleum needle coke reflects a significant percentage of the raw material cost of graphite electrodes, graphite electrodes have historically been priced at a spread to petroleum needle coke, which in the past has increased in tight demand markets. Historically, between 2008 and 2017, our weighted average realized price of graphite electrodes was approximately \$4,500 per MT (on an

inflation adjusted basis using constant 2018 dollars).

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During the most recent demand trough, our weighted average realized price of graphite electrodes fell to approximately \$2,500 per MT in 2016, on an inflation adjusted basis using constant 2018 dollars. Following the significant rationalization of graphite electrode production globally, the resumption of growth in EAF steel production, falling scrap prices, reductions in Chinese steel production and constrained supply of needle coke, graphite electrode prices reached record highs in 2018. We have executed three to five year take or pay contracts, representing approximately 60% to 65% of our production capacity from 2018 through 2022. The weighted average contract price for the contracted volumes over the next four years is approximately \$9,700 per MT. If spot prices remain above our contract prices, our profitability may be negatively impacted compared to what it would have been if we had sold the contracted volume in the spot market. Pricing for graphite electrodes has historically been cyclical and current prices are relatively high, however, the price of graphite electrodes may decline in the future. Our business, financial condition and operating results could be materially and adversely affected to the extent prices for graphite electrodes decline in the future to or below our historical weighted average realized price levels.

Our business and operating results have been and will continue to be sensitive to economic conditions and a downturn in economic conditions may materially adversely affect our business.

Our operations and performance are materially affected by global and regional economic conditions. As described further below, we are dependent on the steel industry, which historically has been highly cyclical and is affected by general economic conditions. An economic downturn may reduce customer demand, reduce prices for our products or inhibit our ability to produce our products, which would negatively affect our operating results. Our business and operating results have also been and will continue to be sensitive to declining consumer and business confidence; fluctuating commodity prices; volatile exchange rates and other challenges that can affect the economy. Our customers may experience deterioration of their businesses, cash flow shortages and difficulty obtaining financing, leading them to delay or cancel plans to purchase our products or seek to renegotiate terms of their supply contracts, and they may not be able to fulfill their obligations to us in a timely fashion. Further, suppliers and other business partners may experience similar conditions, which could impact their ability to fulfill their obligations to us. Also, it could be difficult to find replacements for business partners without incurring significant delays or cost increases. These events would negatively impact our revenues and results of operations.

We are dependent on the global steel industry generally and the EAF steel industry in particular, and a downturn in these industries may materially adversely affect our business.

We sell our products primarily to the EAF steel production industry. The steel industry historically has been highly cyclical and is affected significantly by general economic conditions. Significant customers for the steel industry include companies in the automotive, construction, appliance, machinery, equipment and transportation industries, which are industries that were negatively affected by the general economic downturn and the deterioration in financial markets, including severely restricted liquidity and credit availability, in the recent past. In particular, EAF steel production declined approximately 17% from 2008 to 2009 as a result of that general economic downturn and deterioration in financial markets.

In addition, EAF steel production declined approximately 10% from 2011 to 2015 due to global steel production overcapacity driven largely by Chinese BOF steel production. Since 2016, however, the EAF steel market has rebounded strongly and resumed its long term growth trajectory. Our customers, including major steel producers, have in the past experienced and may again experience downturns or financial distress that could adversely impact our ability to collect our accounts receivable on a timely basis or at all.

Global graphite electrode overcapacity has adversely affected graphite electrode prices in the past, and may adversely affect them again in the future, which could negatively impact our sales, margins and profitability.

Overcapacity in the graphite electrode industry has adversely affected pricing and may do so again. The rapid growth of Chinese steel production after 2010, which was primarily produced from BOF steelmaking, created a significant global oversupply of steel. Chinese steel exports gained market share from EAF producers, creating graphite electrode industry oversupply and inventory de-stocking in this period. Historically, between 2008 and 2017, our weighted average realized price of graphite electrodes was approximately \$4,500 per MT (on an inflation adjusted basis using constant 2018 dollars). During the most recent demand trough, our weighted average realized price fell to approximately \$2,500 per MT in 2016. Although Chinese steel production has decreased since 2016 as a result of the enactment of certain Chinese governmental initiatives, any significant future growth in Chinese BOF steel production

could once again lead to an oversupply of steel, which would adversely affect the price of graphite electrodes. An increase in global graphite electrode production capacity that outpaces an increase in demand for graphite electrodes could adversely affect the price of graphite electrodes. Excess production capacity may result in manufacturers producing and exporting electrodes at prices that are lower than prevailing domestic prices, and sometimes at or below their cost of production.

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Excessive imports into the Americas and EMEA, which collectively make up over 90% of our market, can also exert downward pressure on graphite electrode prices, which negatively affects our sales, margins and profitability.

The graphite industry is highly competitive. Our market share, net sales or net income could decline due to vigorous price and other competition.

Competition in the graphite industry (other than, generally, with respect to new products) is based primarily on price, product differentiation and quality, delivery reliability and customer service. Graphite electrodes, in particular, are subject to rigorous price competition. Competition with respect to new products is, and is expected to continue to be, based primarily on price, performance and cost effectiveness, customer service as well as product innovation.

Competition could prevent implementation of price increases, require price reductions or require increased spending on research and development, marketing and sales that could adversely affect us. In such a competitive market, changes in market conditions, including customer demand and technological development, could adversely affect our competitiveness, sales and/or profitability.

We are dependent on the supply of petroleum needle coke. Our results of operations could deteriorate if recent disruptions in the supply of petroleum needle coke continue or worsen for an extended period.

Petroleum needle coke is the primary raw material used in the production of graphite electrodes. The supply of petroleum needle coke has been limited starting in the second half of 2017 as the demand for petroleum needle coke has outpaced supply due to increasing demand for petroleum needle coke for use in the production of lithium ion batteries used in electric vehicles. Seadrift currently provides approximately 70% of our current petroleum needle coke requirements, and we purchase the remaining 30% from a variety of external sources. We plan to rely on Seadrift produced petroleum needle coke to support the production substantially all of the contracted volumes of graphite electrodes under our three to five year take or pay contracts. As a result, a disruption in Seadrift's production of petroleum needle coke could adversely affect our ability to achieve the anticipated benefits of these contracts if we are forced to purchase petroleum needle coke from external sources at a higher cost to support the production of these contracted volumes. Moreover, although estimates vary as to the duration of this period of tight petroleum needle coke supply, if the current market shortage of petroleum needle coke continues or worsens, we may be unable to acquire sufficient amounts of petroleum needle coke from external sources to support the 30% of our needle coke requirements currently used in the production of graphite electrodes for sale in the spot market. As a result, a continued or worsening disruption in the supply of petroleum needle coke could have a material adverse effect on our business, financial condition, results of operations and cash flows.

We are dependent on supplies of raw materials (in addition to petroleum needle coke) and energy. Our results of operations could deteriorate if those supplies increase in cost or are substantially disrupted for an extended period.

We purchase raw materials and energy from a variety of sources. In many cases, we purchase them under short term contracts or on the spot market, in each case at fluctuating prices. The availability and price of raw materials and energy may be subject to curtailment or change due to:

- limitations, which may be imposed under new legislation or regulation;
- suppliers' allocations to meet demand from other purchasers during periods of shortage (or, in the case of energy suppliers, extended hot or cold weather);
- interruptions or cessations in production by suppliers; and
- market and other events and conditions.

Petroleum and coal products, including decant oil and coal tar pitch, which are our principal raw materials other than petroleum needle coke, and energy, particularly natural gas, have been subject to significant price fluctuations. For example, Seadrift may not always be able to obtain an adequate quantity of suitable low sulfur decant oil for the manufacture of petroleum needle coke, and capital may not be available to install equipment to allow use of higher sulfur decant oil (which is more readily available in the United States) if supplies of low sulfur decant oil become more limited in the future.

We have in the past entered into, and may continue in the future to enter into, derivative contracts and short duration fixed rate purchase contracts to effectively fix a portion of our exposure to certain products. These strategies may not be available or successful in eliminating our exposure. A substantial increase in raw material or energy prices that cannot be mitigated or passed on to customers or a continued interruption in supply, particularly in the supply of decant oil or energy, would have a material adverse effect on our business, financial condition, results of operations or

cash flows.

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Our operations are subject to hazards which could result in significant liability to us.

Our operations are subject to hazards associated with manufacturing and the related use, storage, transportation and disposal of raw materials, products and wastes. These hazards include explosions, fires, severe weather (including but not limited to hurricanes or other adverse weather that may be increasing as a result of climate change) and natural disasters, industrial accidents, mechanical failures, discharges or releases of toxic or hazardous substances or gases, transportation interruptions, human error and terrorist activities. These hazards can cause personal injury and loss of life, severe damage to or destruction of property and equipment as well as environmental damage, and may result in suspension of operations and the imposition of civil and criminal liabilities, including penalties and damage awards. While we believe our insurance policies are in accordance with customary industry practices, such insurance may not cover all risks associated with the hazards of our business and is subject to limitations, including deductibles and maximum liabilities covered. We may incur losses beyond the limits, or outside the coverage, of our insurance policies. In the future, we may not be able to obtain coverage at current levels, and our premiums may increase significantly on coverage that we maintain. Costs associated with unanticipated events in excess of our insurance coverage could have a material adverse effect on our business, competitive or financial position or our ongoing results of operations.

Stringent health, safety and environmental regulations applicable to our manufacturing operations and facilities could result in substantial costs related to compliance, sanctions or material liabilities and may affect the availability of raw materials.

We are subject to stringent environmental, health and safety laws and regulations relating to our current and former properties (including former onsite landfills over which we have retained ownership), other properties that neighbor ours or to which we sent wastes for treatment or disposal, as well as our current raw materials, products, and operations. Some of our products (including our raw materials) are subject to extensive environmental and industrial hygiene regulations governing the registration and safety analysis of their component substances. Coal tar pitch, which is classified as a substance of very high concern under REACH, is used in certain of our processes but in a manner that we believe does not currently require us to obtain a specific authorization under the REACH guidelines. Violations of these laws and regulations, or of the terms and conditions of permits required for our operations, can result in damage claims, in the imposition of substantial fines and criminal sanctions and sometimes require the installation of costly pollution control or safety equipment or costly changes in operations to limit pollution or decrease the likelihood of injuries. In addition, we are currently conducting remediation and/or monitoring at certain current and former properties and may become subject to material liabilities in the future for the investigation and cleanup of contaminated properties, including properties on which we have ceased operations. We have been in the past, and could be in the future, subject to claims alleging personal injury, death or property damage resulting from exposure to hazardous substances, accidents or otherwise for conditions creating an unsafe workplace. Further, alleged noncompliance with or stricter enforcement of, or changes in interpretations of, existing laws and regulations, adoption of more stringent new laws and regulations, discovery of previously unknown contamination or imposition of new or increased requirements could require us to incur costs or become the basis of new or increased liabilities that have a material adverse impact on our operations, costs or results of operations. It is also possible that the impact of safety and environmental regulations on our suppliers could affect the availability and cost of our raw materials. For example, legislators, regulators and others, as well as many companies, are considering ways to reduce emissions of greenhouse gases (or GHGs) due to scientific, political and public concern that GHG emissions are altering the atmosphere in ways that are affecting, and are expected to continue to affect, the global climate. The EU has established GHG regulations and is revising its emission trading system for the period after 2020 in a manner that may require us to incur additional costs. The United States required reporting of greenhouse gas emissions from certain large sources beginning in 2011. Further measures, in the EU and many other countries, may be enacted in the future. In particular, in December 2015, more than 190 countries participating in the United National Framework Convention on Climate Change reached an international agreement related to curbing GHG emissions (or Paris Agreement). Further GHG regulations under the Paris Agreement or otherwise may take the form of a national or international cap and trade emissions permit system, a carbon tax, emissions controls, reporting requirements, or other regulatory initiatives. For more information, see the section entitled "Business-Environment."

It is possible that some form of regulation of GHG emissions will also be introduced in the future in other countries in which we operate or market our products. Regulation of GHG emissions could impose additional costs, both direct and indirect, on our business, and on the businesses of our customers and suppliers, such as increased energy and insurance rates, higher taxes, new environmental compliance program expenses, including capital improvements, environmental monitoring and the purchase of emission credits, and other administrative costs necessary to comply with current and potential future requirements or limitations that may be imposed, as well as other unforeseen or unknown costs. To the extent that similar requirements and limitations are not imposed globally, this regulation may impact our ability to compete with companies located in countries that do not have these requirements or limitations. We may also experience a change in competitive position relative to industry peers, changes in prices received for products sold and changes to profit or loss arising from increased or decreased demand for our products. The impact of any future GHG regulatory requirements on our global business will be dependent upon the design of the regulatory schemes that are ultimately adopted and, as a result, we are unable to predict their significance to our operations at this time.

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We are subject to a variety of legal, economic, social and political risks associated with our substantial operations in multiple countries, which could have a material adverse effect on our financial and business operations.

A substantial majority of our net sales are derived from sales outside the United States, and a majority of our operations and our property, plant and equipment and other long lived assets are located outside the United States. As a result, we are subject to risks associated with operating in multiple countries, including:

- currency fluctuations and devaluations in currency exchange rates, including impacts of transactions in various currencies, translation of various currencies into dollars for U.S. reporting and financial covenant compliance purposes, and impacts on results of operations due to the fact that the costs of our non U.S. operations are primarily incurred in local currencies while their products are primarily sold in dollars and euros;
- imposition of or increase in customs duties and other tariffs;
- imposition of or increases in currency exchange controls, including imposition of or increases in limitations on conversion of various currencies into dollars, euros, or other currencies, making of intercompany loans by subsidiaries or remittance of dividends, interest or principal payments or other payments by subsidiaries;
- imposition of or increases in revenue, income or earnings taxes and withholding and other taxes on remittances and other payments by subsidiaries;
- inflation, deflation and stagflation in any country in which we have a manufacturing facility;
- imposition of or increases in investment or trade restrictions by the United States or other jurisdictions or trade sanctions adopted by the United States;
- inability to determine or satisfy legal requirements, effectively enforce contract or legal rights, including our rights under our three to five year take or pay contracts, and obtain complete financial or other information under local legal, judicial, regulatory, disclosure and other systems; and
- nationalization or expropriation of assets, and other risks that could result from a change in government or government policy, or from other political, social or economic instability.

Any of these risks could have a material adverse effect on our business, financial condition, results of operations or cash flows, and we may not be able to mitigate these effects.

The fluctuation of foreign currency exchange rates could materially harm our financial results.

Changes in foreign currency exchange rates have in the past resulted, and may in the future result, in significant gains or losses. When the currencies of non U.S. countries in which we have a manufacturing facility decline (or increase) in value relative to the U.S. dollar, this has the effect of reducing (or increasing) the U.S. dollar equivalent cost of sales and other expenses with respect to those facilities. In certain countries in which we have manufacturing facilities, and in certain instances where we price our products for sale in export markets, we sell in currencies other than the dollar. Accordingly, increases (or declines) in value in these currencies relative to the U.S. dollar have the effect of increasing (or reducing) our net sales. The result of these effects is to increase (or decrease) operating profit and net income. Additionally, as part of our cash management, we have non U.S. dollar denominated intercompany loans between our subsidiaries. These loans are deemed to be temporary and, as a result, remeasurement gains and losses on these loans are recorded as currency gains and losses in other income (expense), net, on the Consolidated Statements of Income. We have in the past entered into, and may in the future enter into, foreign currency derivatives to attempt to manage exposure to changes in currency exchange rates. These hedges may be insufficient or ineffective in protecting against the impact of these fluctuations. We also may purchase or sell these financial instruments, and open and close hedges or other positions, at any time. Fluctuations in foreign currency exchange rates could materially harm our financial results.

Our results of operations could deteriorate if our manufacturing operations were substantially disrupted for an extended period for any reason, including equipment failure, climate change, natural disasters, public health crises, political crises or other catastrophic events.

Our manufacturing operations are subject to disruption due to equipment failure, extreme weather conditions, floods, hurricanes and tropical storms and similar events, major industrial accidents, including fires or explosions, cybersecurity attacks, strikes and lockouts, adoption of new laws or regulations, changes in interpretations of existing laws or regulations or changes in

governmental enforcement policies, civil disruption, riots, terrorist attacks, war, public health crises and other events. These events may also impact the operations of one or more of our suppliers. For example, the potential physical impacts of climate change on our operations are uncertain and will likely be particular to the geographic circumstances. These physical impacts may include changes in rainfall and storm patterns, shortages of water or other natural resources, changing sea levels, and changing global average temperatures. For instance, our Seadrift facility in Texas and our Calais facility in France are located in geographic areas less than 50 feet above sea level. As a result, any future rising sea levels could have an adverse impact on their operations and on their suppliers. In addition, our three operating manufacturing facilities are currently operating at a high level of production capacity utilization. As a result, in the event manufacturing operations are substantially disrupted at one of our operating facilities, we will not have the ability to increase production at our remaining operating facilities in order to compensate. To the extent any of these events occur, our business, financial condition and operating results could be materially and adversely affected.

Plant production capacity expansions may be delayed or may not achieve the expected benefits.

Our ability to complete future production capacity expansions, including the potential full restart of our St. Marys plant, may be delayed, interrupted or otherwise limited by the need to obtain environmental and other regulatory approvals, unexpected cost increases, availability of labor and materials, unforeseen hazards such as weather conditions, and other risks customarily associated with construction projects. For example, the potential full restart of our St. Marys plant will be substantially dependent on the availability of external sources of petroleum needle coke and market conditions. Moreover, the costs of these activities could have a negative impact on our results of operations, particularly until capacity utilization at the facility is sufficient to absorb the incremental costs of expansion. In addition, completed capacity expansions from our debottlenecking initiative may not achieve the expected benefits as a result of changes in market conditions, raw material shortages or other unforeseen contingencies.

We depend on third parties for certain construction, maintenance, engineering, transportation, warehousing and logistics services.

We contract with third parties for certain services relating to the design, construction and maintenance of various components of our production facilities and other systems. If these third parties fail to comply with their obligations, the facilities may not operate as intended, which may result in delays in the production of our products and materially adversely affect our ability to meet our production targets and satisfy customer requirements or we may be required to recognize impairment charges. In addition, production delays could cause us to miss deliveries and breach our contracts, which could damage our relationships with our customers and subject us to claims for damages under our contracts. Any of these events could have a material adverse effect on our business, financial condition, results of operations or cash flows.

We also rely primarily on third parties for the transportation of the products we manufacture. In particular, a significant portion of the goods we manufacture are transported to different countries, which requires sophisticated warehousing, logistics and other resources. If any of the third parties that we use to transport products are unable to deliver the goods we manufacture in a timely manner, we may be unable to sell these products at full value or at all, which could cause us to miss deliveries and breach our contracts, which could damage our relationships with our customers and subject us to claims for damages under our contracts. Any of these events could have a material adverse effect on our business, financial condition, results of operations or cash flows.

We may not be able to recruit or retain key management and plant operating personnel.

Our success is dependent on the management and leadership skills of our key management and plant operating personnel. Following the completion of our acquisition by Brookfield, our management team has been reorganized, including the establishment of new positions reporting directly to the chief executive officer, and significant competencies have been added to the management team to further strengthen our business. The loss of any member of our reorganized key management team and personnel or an inability to attract, retain, develop and maintain additional personnel could prevent us from implementing our business strategy. In addition, our future growth and success also depend on our ability to attract, train, retain and motivate skilled managerial, sales, administration, operating and technical personnel. The loss of one or more members of our key management or plant operating personnel, or the failure to attract, retain and develop additional key personnel, could have a material adverse effect on our business,

financial condition, results of operations or cash flows.

If we are unable to successfully negotiate with the representatives of our employees, including labor unions, we may experience strikes and work stoppages.

We are party to collective bargaining agreements and similar agreements with our employees. As of December 31, 2018, approximately 846 employees, or 61%, of our worldwide employees, are covered by collective bargaining or similar agreements. As of December 31, 2018, approximately 691 employees, or 50%, of our worldwide employees, were covered by agreements that expire, or are subject to renegotiation, at various times through December 31, 2019. Although we believe that, in general, our relationships with our employees are good, we cannot predict the outcome of current and future negotiations and consultations with employee representatives, which could have a material adverse effect on our business. We may not succeed in renewing or

extending these agreements on terms satisfactory to us. Although we have not had any material work stoppages or strikes during the past decade, they may occur in the future during renewal or extension negotiations or otherwise. A material work stoppage, strike or other union dispute could adversely affect our business, financial condition, results of operations and cash flows.

We may divest or acquire businesses, which could require significant management attention or disrupt our business. We may divest or acquire businesses to rationalize or expand our businesses and enhance our cash flows. For example, on February 26, 2016, we announced a strategic review of our Engineered Solutions businesses to better direct its resources and simplify its operations. The disposition of those businesses was substantially complete by the end of the third quarter of 2017.

Any acquisitions that we are able to identify and complete may involve a number of risks, including:

- our inability to successfully or profitably integrate, operate, maintain and manage our newly acquired operations or employees;
- the diversion of our management's attention from our existing business;
- possible material adverse effects on our results of operations during the integration process;
- becoming subject to contingent or other liabilities, including liabilities arising from events or conduct predating the acquisition that were not known to us at the time of the acquisition; and
- our possible inability to achieve the intended objectives of the transaction, including the inability to achieve cost savings and synergies.

Any divestitures may also involve a number of risks, including the diversion of management's attention, significant costs and expenses, the loss of customer relationships and cash flow, and the disruption of the affected business or business operations. Failure to timely complete or to consummate an acquisition or a divestiture may negatively affect the valuation of the affected business or business operations or result in restructuring charges.

We have significant goodwill on our balance sheet that is sensitive to changes in the market, which could result in impairment charges.

We have \$171.1 million of goodwill on our balance sheet as of December 31, 2018. Our annual impairment test of goodwill was performed in the fourth quarter of 2018. The estimated fair values of our reporting units were based on discounted cash flow models derived from internal earnings forecasts and assumptions. The assumptions and estimates used in these valuations incorporated the current and expected economic environment. In that annual impairment test, our graphite electrode reporting unit's fair value exceeded its carrying value. A deterioration in the global economic environment or in any of the input assumptions in our calculation could adversely affect the fair value of our reporting units and result in further impairment of some or all of the goodwill on the balance sheet.

We may be subject to information technology systems failures, cybersecurity attacks, network disruptions and breaches of data security, which could compromise our information and expose us to liability.

Our information technology systems are an important element for effectively operating our business. Information technology systems failures, including risks associated with any failure to maintain or upgrade our systems, network disruptions and breaches of data security could disrupt our operations by impeding our processing of transactions, our ability to protect customer or company information or our financial reporting, leading to increased costs. It is possible that future technological developments could adversely affect the functionality of our computer systems and require further action and substantial funds to prevent or repair computer malfunctions. Our computer systems, including our back up systems, could be damaged or interrupted by power outages, computer and telecommunications failures, computer viruses, cybercrimes, internal or external security breaches, events such as fires, earthquakes, floods, tornadoes and hurricanes, or errors by our employees. Although we have taken steps to address these concerns by implementing network security, back up systems and internal control measures, these steps may be insufficient or ineffective and a system failure or data security breach could have a material adverse effect on our business, financial condition, results of operations or cash flows.

Further, we collect data, including personally identifiable information of our employees, in the course of our business activities and transfer such data between our affiliated entities, to and from our business partners and to third party service providers, which may be subject to global data privacy laws and cross border transfer restrictions. While we take steps to comply with these

legal requirements, any changes to such laws may impact our ability to effectively transfer data across borders in support of our business operations and any breach of such laws may lead to administrative, civil or criminal liability, as well as reputational harm to the Company and its employees. For example, the European Union's General Data Protection Regulation (GDPR), which became enforceable on May 25, 2018, introduced a number of new obligations for subject companies, including obligations relating to data transfers and the security of personal data they process. We take steps to protect the security and integrity of the information we collect, but there is no guarantee that the steps we have taken will prevent inadvertent or unauthorized use or disclosure of such information, or prevent third parties from gaining unauthorized access to this information despite our efforts. Any such incident could result in legal claims or proceedings, liability under laws that protect the privacy of personally identifiable information (including the GDPR) and damage to our reputation.

The cost of ongoing compliance with global data protection and privacy laws and the potential fines and penalties levied in the event of a breach of such laws may have an adverse effect on our business and operations. For example, the GDPR currently provides that supervisory authorities in the European Union may impose administrative fines for non-compliance of up to €20,000,000 or 4% of the subject company's annual, group-wide turnover (whichever is higher) and individuals who have suffered damage as a result of a subject company's non-compliance with the GDPR also have the right to seek compensation from such company. We will need to continue dedicating financial resources and management time to compliance efforts with respect to global data protection and privacy laws, including the GDPR. Our ability to grow and compete effectively depends on protecting our intellectual property. Failure to protect our intellectual property could adversely affect our business.

We believe that our intellectual property, consisting primarily of patents and proprietary know-how and information, is important to our growth. Failure to protect our intellectual property may result in the loss of the exclusive right to use our technologies. We rely on patent, trademark, copyright and trade secret laws and confidentiality and restricted use agreements to protect our intellectual property. However, some of our intellectual property is not covered by any patent or patent application or any such agreement. Intellectual property protection does not protect against technological obsolescence due to developments by others or changes in customer needs.

Patents are subject to complex factual and legal considerations. Accordingly, the validity, scope and enforceability of any particular patent can be uncertain. Therefore, we cannot assure you that:

- any of the U.S. or non-U.S. patents now or hereafter owned by us, or that third parties have licensed to us or may in the future license to us, will not be circumvented, challenged or invalidated;

- any of the U.S. or non-U.S. patents that third parties have non-exclusively licensed to us, or may non-exclusively license to us in the future, will not be licensed to others; or

- any of the patents for which we have applied or may in the future apply will be issued at all or with the breadth of claim coverage we seek.

Moreover, patents, even if valid, only provide protection for a specified limited duration. In addition, effective patent, trademark and trade secret protection may be limited or unavailable or we may not apply for it in the United States or in any of the other countries in which we operate.

The protection of our intellectual property rights may be achieved, in part, by prosecuting claims against others who we believe have misappropriated our technology or have infringed upon our intellectual property rights, as well as by defending against misappropriation or infringement claims brought by others against us. Our involvement in litigation to protect or defend our rights in these areas could result in a significant expense to us, adversely affect the development of sales of the related products, and divert the efforts of our technical and management personnel, regardless of the outcome of such litigation.

We cannot assure you that agreements designed to protect our proprietary know-how and information will not be breached, that we will have adequate remedies for any such breach, or that our strategic alliance suppliers and customers, consultants, employees or others will not assert rights against us with respect to intellectual property arising out of our relationships with them.

Third parties may claim that our products or processes infringe their intellectual property rights, which may cause us to pay unexpected litigation costs or damages or prevent us from selling our products or services.

From time to time, we may become subject to legal proceedings, including allegations and claims of alleged infringement or misappropriation by us of the patents and other intellectual property rights of third parties. We cannot

assure you that the use

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of our patented technology or proprietary know how or information does not infringe the intellectual property rights of others. In addition, attempts to enforce our own intellectual property claims may subject us to counterclaims that our intellectual property rights are invalid, unenforceable or are licensed to the party against whom we are asserting the claim or that we are infringing that party's alleged intellectual property rights. We may also be obligated to indemnify affiliates or other partners who are accused of violating third parties' intellectual property rights by virtue of those affiliates or partners' agreements with us, and this could increase our costs in defending such claims and our damages. Legal proceedings involving intellectual property rights, regardless of merit, are highly uncertain and can involve complex legal and scientific analyses, can be time consuming, expensive to litigate or settle and can significantly divert resources, even if resolved in our favor. Our failure to prevail in such matters could result in loss of intellectual property rights or judgments awarding substantial damages and injunctive or other equitable relief against us. If we were to be held liable or discover or be notified that our products or processes potentially infringe or otherwise violate the intellectual property rights of others, we may face a loss of reputation and may not be able to exploit some or all of our intellectual property rights or technology. If necessary, we may seek licenses to intellectual property of others. However, we may not be able to obtain the necessary licenses on terms acceptable to us or at all. Our failure to obtain a license from a third party for that intellectual property necessary for the production or sale of any of our products could cause us to incur substantial liabilities and/or suspend the production or shipment of products or the use of processes requiring the use of that intellectual property. We may be required to substantially re engineer our products or processes to avoid infringement.

Any of the foregoing may require considerable effort and expense, result in substantial increases in operating costs, delay or inhibit sales or preclude us from effectively competing in the marketplace, which in turn could have a material adverse effect on our business and financial results.

Significant changes in our jurisdictional earnings mix or in the tax laws of those jurisdictions could adversely affect our business, financial condition, results or operations and cash flows.

Our future tax rates may be adversely affected by a number of factors, including the enactment of new tax legislation, other changes in tax laws or the interpretation of tax laws, changes in the estimated realization of our net deferred tax assets (arising, among other things, from tax loss carry forwards and our acquisition by Brookfield), changes to the jurisdictions in which profits are determined to be earned and taxed, adjustments to estimated taxes upon finalization of various tax returns, increases in expenses that are not deductible for tax purposes, including write offs of acquired in process R&D and impairment of goodwill in connection with acquisitions, changes in available tax credits and additional tax or interest payments resulting from tax audits with various tax authorities. Losses for which no tax benefits can be recorded could materially impact our tax rate and its volatility from period to period. Any significant change in our jurisdictional earnings mix or in the tax laws in those jurisdictions could increase our tax rates and adversely impact our financial results in those periods.

Recent tax legislation could adversely affect us or our stockholders.

Recent tax legislation, the Tax Cuts and Jobs Act (or the Tax Act), was enacted on December 22, 2017. The Tax Act significantly revises the U.S. corporate income tax regime by, among other things:

- lowering corporate income tax rates;
- temporarily allowing for immediate expensing of expenditures for certain tangible property;
- repealing the corporate alternative minimum tax;
- implementing a 100% dividends received deduction on certain dividends from 10% or greater owned foreign subsidiaries;
- imposing an income tax on deemed repatriated earnings of foreign subsidiaries generally as of December 31, 2017 (payable at reduced rates and potentially over an eight year period);
- imposing tax at a reduced rate on certain income derived by foreign corporate subsidiaries in excess of a deemed return on tangible assets (i.e., tax on "global intangible low taxed income" or GILTI);
- imposing limitations on the ability to deduct interest expense and utilize net operating losses (or NOLs), and
- instituting certain proposals to limit base erosion (including the "base erosion anti abuse tax" or BEAT, and limitations on the deductibility of certain related party payments).

Although we currently anticipate that the Tax Act and the accompanying changes in the corporate tax rate and calculation of taxable income will have a favorable effect on our financial condition, profitability and cash flows, the overall implications of the Tax Act at this time are uncertain, and it is not possible to predict the full effect of the Tax Act on our business and operations. Thus, the Tax Act and future implementing regulations, administrative guidance or interpretations of the legislation may have unanticipated adverse effects on us or our stockholders. We are required to make payments under a tax receivable agreement for certain tax benefits we may claim in the future, and the amounts we may pay could be significant.

In connection with the completion of our IPO, we entered into a tax receivable agreement (or the TRA) that provides the right to receive future payments from us to certain of our pre IPO stockholders (or the Existing Stockholders) of 85% of the amount of cash savings, if any, in U.S. federal income tax and Swiss tax that we and our subsidiaries realize as a result of the utilization of certain tax assets attributable to periods prior to our IPO, including certain federal net operating losses (or NOLs), previously taxed income under Section 959 of the Internal Revenue Code of 1986, as amended from time to time (or the Code), foreign tax credits, and certain NOLs in GrafTech Switzerland S.A. (or, collectively, the Pre IPO Tax Assets). In addition, we will pay interest on the payments we will make to the Existing Stockholders with respect to the amount of this cash savings from the due date (without extensions) of our tax return where we realize this savings to the payment date at a rate equal to LIBOR plus 1.00% per annum. The term of the TRA commenced on April 23, 2018 and will continue until there is no potential for any future tax benefit payments.

We expect that, based on current tax laws, future payments under the TRA relating to the Pre IPO Tax Assets will be approximately \$86.5 million, which was recognized as an expense in 2018, with a maximum amount of approximately \$100 million. This figure does not account for our Pre IPO Tax Assets attributable to previously taxed income under Section 959 of the Code, the value of which is highly speculative, and certain NOLs in GrafTech Switzerland S.A., which we expected to have nominal value at the time of the IPO. Any payments made by us to our counterparties under the TRA will generally reduce the amount of overall cash flow that might have otherwise been available to us. For more information about the TRA, see “Certain relationships and related party transactions-Tax Receivable Agreement.”

Risks related to our indebtedness

Our indebtedness could limit our financial and operating activities and adversely affect our ability to incur additional debt to fund future needs and our ability to fulfill our obligations under our existing and future indebtedness.

On February 12, 2018, we entered a credit agreement (or, as amended from time to time, the 2018 Credit Agreement) among us, various of our subsidiaries, the lenders and issuing banks party thereto and JPMorgan Chase Bank, N.A. as administrative agent and as collateral agent, which provides for (i) a \$1,500 million senior secured term loan facility (or the 2018 Term Loan Facility) and (ii) a \$250 million senior secured revolving credit facility (or the 2018 Revolving Credit Facility) and, together with the 2018 Term Loan Facility, as amended by the First Amendment, the Senior Secured Credit Facilities). The 2018 Revolving Credit Facility may be used from time to time for revolving credit borrowings denominated in dollars or Euro, the issuance of one or more letters of credit denominated in dollars, Euro, Pounds Sterling or Swiss Francs and one or more swing line loans denominated in dollars. On February 12, 2018, our wholly owned subsidiary, GrafTech Finance Inc., a Delaware corporation (or GrafTech Finance), borrowed \$1,500 million aggregate principal under the 2018 Term Loan Facility (or the 2018 Term Loans). The 2018 Term Loans mature on February 12, 2025. The maturity date for the 2018 Revolving Credit Facility is February 12, 2023. On June 15, 2018, we entered into a first amendment (or the First Amendment) to the 2018 Credit Agreement among us, GrafTech Finance, various of our other subsidiaries and JPMorgan Chase Bank, N.A. as administrative agent and incremental term lender. The First Amendment amended the 2018 Credit Agreement to provide for an additional \$750 million in aggregate principal amount of incremental term loans (or the Incremental Term Loans) to GrafTech Finance, increasing the aggregate principal amount of term loans incurred by GrafTech Finance under the 2018 Credit Agreement from \$1,500 million to \$2,250 million. The Incremental Term Loans have the same terms as those applicable to the 2018 Term Loans, including interest rate, payment and prepayment terms, representations and warranties and covenants. The Incremental Term Loans mature on February 12, 2025, the same date as the 2018 Term Loans.

As of December 31, 2018, we had approximately \$2,156.6 million of indebtedness outstanding, with \$245.5 million available for borrowing under the 2018 Revolving Credit Facility (taking into account approximately \$4.5 million of outstanding letters of credit issued thereunder).

Interest expense for the years ended December 31, 2018 and December 31, 2017 was \$135.1 million and \$30.8 million, respectively.

This substantial amount of indebtedness could:

- require us to dedicate a substantial portion of our cash flow to the payment of principal and interest, thereby reducing the funds available for operations and future business opportunities;

- make it more difficult for us to satisfy our obligations;

- limit our ability to borrow additional money if needed for other purposes, including working capital, capital expenditures, debt service requirements, acquisitions and general corporate or other purposes, on satisfactory terms or at all;

- limit our ability to adjust to changing economic, business and competitive conditions;

- place us at a competitive disadvantage with competitors who may have less indebtedness or greater access to financing;

- make us more vulnerable to an increase in interest rates, a downturn in our operating performance or a decline in general economic conditions; and

- make us more susceptible to changes in credit ratings, which could impact our ability to obtain financing in the future and increase the cost of such financing.

Compliance with our debt obligations under the Senior Secured Credit Facilities could materially limit our financial or operating activities, or hinder our ability to adapt to changing industry conditions, which could result in our losing market share, a decline in our revenue or a negative impact on our operating results.

The 2018 Credit Agreement includes covenants that could restrict or limit our financial and business operations.

The 2018 Credit Agreement contains a number of restrictive covenants that, subject to certain exceptions and qualifications, restrict or limit our ability and the ability of our subsidiaries to, among other things:

- incur, repay or refinance indebtedness;

- create liens on or sell our assets;

- engage in certain fundamental corporate changes or changes to our business activities;

- make investments or engage in mergers or acquisitions;

- pay dividends or repurchase stock;

- engage in certain affiliate transactions;

- enter into agreements or otherwise restrict our subsidiaries from making distributions or paying dividends to the borrowers under the Senior Secured Credit Facilities or to us or certain of our subsidiaries, as applicable; and

- repay intercompany indebtedness or make intercompany distributions or pay intercompany dividends.

The 2018 Credit Agreement also contains certain affirmative covenants and contains a financial covenant that requires us to maintain a senior secured first lien net leverage ratio not greater than 4.00:1.00 when the aggregate principal amount of borrowings under the 2018 Revolving Credit Facility and outstanding letters of credit issued under the 2018 Revolving Credit Facility (except for undrawn letters of credit in an aggregate amount equal to or less than \$35 million), taken together, exceed 35% of the total amount of commitments under the 2018 Revolving Credit Facility.

These covenants and restrictions could affect our ability to operate our business, and may limit our ability to react to market conditions or take advantage of potential business opportunities as they arise. Additionally, our ability to comply with these covenants may be affected by events beyond our control, including general economic and credit conditions and industry downturns.

If we fail to comply with the covenants in the 2018 Credit Agreement and are unable to obtain a waiver or amendment, an event of default would result, and the lenders and noteholders could, among other things, declare outstanding amounts due and payable or refuse to lend additional amounts to us, or require deposit of cash collateral in respect of outstanding letters of credit. If we were unable to repay or pay the amounts due, the lenders under the 2018 Credit Agreement could, among other things, proceed against the collateral granted to them to secure the indebtedness, which includes substantially all of our and our U.S. subsidiaries' assets and certain assets of certain of our non U.S. subsidiaries.

Our cash flows may not be sufficient to service our indebtedness, and if we are unable to satisfy our obligations under our indebtedness, we may be required to seek other financing alternatives, which may not be successful.

Our ability to make timely payments of principal and interest on our debt obligations, including our obligations under the Senior Secured Credit Facilities, depends on our ability to generate positive cash flows from operations, which is subject to general economic conditions, competitive pressures and certain financial, business and other factors beyond our control. If our cash flows and capital resources are insufficient to make these payments, we may be required to seek additional financing sources, reduce or delay capital expenditures, sell assets or operations or refinance our indebtedness. These actions could have a material adverse effect on our business, financial conditions and results of operations. In addition, we may not be able to take any of these actions, and, even if successful, these actions may not permit us to meet our scheduled debt service obligations. Our ability to restructure or refinance the debt under the Senior Secured Credit Facilities will depend on, among other things, the condition of the capital markets and our financial condition at the time. We may not be able to restructure or refinance any of our indebtedness on commercially reasonable terms or at all. If we cannot make scheduled payments on our debt, we will be in default and the outstanding principal and interest on our debt could be declared to be due and payable, in which case we could be forced into bankruptcy or liquidation or required to substantially restructure or alter our business operations or debt obligations.

Borrowings under the Senior Secured Credit Facilities bear interest at a variable rate, which subjects us to interest rate risk, which could cause our debt service obligations to increase significantly.

All of our borrowings under the Senior Secured Credit Facilities are at variable rates of interest and expose us to interest rate risk. If interest rates increase, our debt service obligations on this variable rate indebtedness would increase even if the amount borrowed remains the same.

Additionally, we have in the past entered into, and may in the future enter into, interest rate swaps and caps to attempt to manage interest rate expense. We may purchase or sell these financial instruments, and open and close hedges or other positions, at any time. Changes in interest rates have in the past resulted, and may in the future result, in significant gains or losses. These instruments are marked to market monthly and related gains and losses are recorded in Other Comprehensive Income on the Consolidated Balance Sheets.

A lowering or withdrawal of the ratings assigned to our debt by rating agencies may increase our future borrowing costs and reduce our access to capital.

Any rating assigned to our debt could be lowered or withdrawn entirely by a rating agency if, in that rating agency's judgment, future circumstances relating to the basis of the rating, such as adverse changes, so warrant. Any future lowering of our ratings likely would make it more difficult or more expensive for us to obtain additional debt financing. Additionally, we enter into various forms of hedging arrangements against currency, interest rate or decant oil price fluctuations. Financial strength and credit ratings are also important to the availability and pricing of these hedging activities, and a downgrade of our credit ratings may make it more costly for us to engage in these activities. Disruptions in the capital and credit markets, which may occur at any time, could adversely affect our results of operations, cash flows and financial condition, or those of our customers and suppliers.

Disruptions in the capital and credit markets as a result of uncertainty, changing or increased regulation, reduced alternatives or failures of significant financial institutions could adversely affect our access to liquidity needed to conduct or expand our businesses or conduct acquisitions or make other discretionary investments, as well as our ability to effectively hedge our currency or interest rate risks and exposures, which could adversely impact our business, results of operations, financial condition and cash flows. These disruptions may also adversely impact the financial position of our customers and suppliers, which, in turn, could adversely affect our results of operations, financial condition and cash flows.

Risks related to our common stock

If the ownership of our common stock continues to be highly concentrated, it may prevent minority stockholders from influencing significant corporate decisions and may result in conflicts of interest.

Brookfield owns approximately 79% of our outstanding common stock. As a result, Brookfield will own shares sufficient for the majority vote over all matters requiring a stockholder vote, including the election of directors; mergers, consolidations and acquisitions; the sale of all or substantially all of our assets and other decisions affecting our capital structure; the amendment of our Amended and Restated Certificate of Incorporation (or Amended Certificate of Incorporation) and our Amended and Restated By Laws (or Amended By Laws); and our winding up and dissolution. This concentration of ownership may delay, deter or prevent acts that would be favored by our other stockholders. The interests of Brookfield may not always coincide with our interests or the interests of our other stockholders. This concentration of ownership may also have the effect of delaying, preventing or deterring a change in control. Also, Brookfield may seek to cause us to take courses of action that, in its judgment, could enhance its investment in us, but that might involve risks to our other stockholders or adversely affect us or our other stockholders. As a result, the market price of our common stock could decline or stockholders might not receive a premium over the then current market price of our common stock upon a change in control. In addition, this concentration of share ownership may adversely affect the trading price of our common stock because investors may perceive disadvantages in owning shares in a company with significant stockholders.

Certain of our stockholders have the right to engage or invest in the same or similar businesses as us.

Brookfield has other investments and business activities in addition to their ownership of us. Brookfield has the right, and has no duty to abstain from exercising such right, to engage or invest in the same or similar businesses as us, do business with any of our clients, customers or vendors or employ or otherwise engage any of our officers, directors or employees. If Brookfield or any of its officers, directors or employees acquire knowledge of a potential transaction that could be a corporate opportunity, they have no duty, to the fullest extent permitted by law, to offer such corporate opportunity to us, our stockholders or our affiliates.

In the event that any of our directors and officers who is also a director, officer or employee of Brookfield acquires knowledge of a corporate opportunity or is offered a corporate opportunity, provided that this knowledge was not acquired solely in such person's capacity as our director or officer and such person acts in good faith, then to the fullest extent permitted by law such person is deemed to have fully satisfied such person's fiduciary duties owed to us and is not liable to us, if Brookfield pursues or acquires the corporate opportunity or if Brookfield does not present the corporate opportunity to us.

We may not pay cash dividends on our common stock.

We currently pay cash dividends on our common stock in accordance with our dividend policy. We cannot assure you, however, that we will pay dividends in the future in these amounts or at all. Our board of directors may change the timing and amount of any future dividend payments or eliminate the payment of future dividends in its sole discretion, without any prior notice to our stockholders. Our ability to pay dividends will depend upon many factors, including our financial position and liquidity, results of operations, legal requirements, restrictions that may be imposed by the terms of our current and future credit facilities and other debt obligations and other factors deemed relevant by our board of directors. For example, we may or may not be able to, or may decide not to, pay dividends if we are unable, for any reason, to continue our three to five year take or pay contracts strategy in the future or we experience a significant disruption in our manufacturing operations or our production of petroleum needle coke at Seadrift that, in either case, inhibits our ability to deliver the contracted volumes under our three to five year take or pay contracts. In addition, adverse market conditions may lead us to prioritize repaying the principal on our outstanding indebtedness. Our ability to pay dividends on our common stock is also limited as a practical matter by the terms of the 2018 Credit Agreement. In the future, we may also enter into other credit agreements or other borrowing arrangements or issue debt securities that, in each case, restrict or limit our ability to pay cash dividends on our common stock. In addition, since we are a holding company with no operations of our own, our ability to pay dividends is dependent on the ability of our subsidiaries to make distributions to us. Their ability to make such distributions will be subject to their operating results, cash requirements and financial condition. Any change in the level of our dividends or the suspension of the payment thereof could adversely affect the market price of our common stock. See "Dividend Policy."

Certain provisions, including in our Amended Certificate of Incorporation and our Amended By Laws could hinder, delay or prevent a change in control, which could adversely affect the price of our common stock. Our Amended Certificate of Incorporation and Amended By Laws contain provisions that could make it more difficult for a third party to acquire us without the consent of our board of directors or Brookfield, including: provisions in our Amended Certificate of Incorporation and Amended By Laws that prevent stockholders from calling special meetings of our stockholders, except where the Delaware General Corporation Law (or the DGCL) confers the right to fix the date of such meetings upon stockholders;

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advance notice requirements by stockholders with respect to director nominations and actions to be taken at annual meetings;

certain rights of Brookfield with respect to the designation of directors for nomination and election to our board of directors;

- no provision in our Amended Certificate of Incorporation or Amended By Laws provides for cumulative voting in the election of directors, which means that the holders of a majority of the outstanding shares of our common stock can elect all the directors standing for election;

under our Amended Certificate of Incorporation, our board of directors have authority to cause the issuance of preferred stock from time to time in one or more series and to establish the terms, preferences and rights of any such series of preferred stock, all without approval of our stockholders; and

nothing in our Amended Certificate of Incorporation precludes future issuances without stockholder approval of the authorized but unissued shares of our common stock.

These provisions may make it difficult and expensive for a third party to pursue a tender offer, change in control or takeover attempt that is opposed by Brookfield, our management or our board of directors. Public stockholders who might desire to participate in these types of transactions may not have an opportunity to do so, even if the transaction is favorable to stockholders. These anti takeover provisions could substantially impede the ability of public stockholders to benefit from a change in control or to change our management and board of directors and, as a result, may adversely affect the market price of our common stock and your ability to realize any potential change of control premium.

In addition, in the event of certain changes in control, including if Brookfield's ownership of our outstanding common stock were to fall below 30%, payments to certain of our senior management may be triggered under certain of our compensation arrangements, which could have an adverse impact on us.

Our Amended Certificate of Incorporation provides that the Court of Chancery of the State of Delaware will be the exclusive forum for substantially all disputes between us and our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers, or employees.

Our Amended Certificate of Incorporation provides that the Court of Chancery of the State of Delaware is the exclusive forum for:

- any derivative action or proceeding brought on our behalf;
- any action asserting a breach of fiduciary duty;
- any action asserting a claim against us arising under the DGCL, our Amended Certificate of Incorporation, or our Amended By Laws; and
- any action asserting a claim against us that is governed by the internal affairs doctrine.

This exclusive forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers, or other employees, which may discourage lawsuits against us and our directors, officers, and other employees. If a court were to find the exclusive forum provision in our Amended Certificate of Incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving the dispute in other jurisdictions, which could harm our business.

We are a "controlled company" within the meaning of the NYSE corporate governance standards and qualify for exemptions from certain corporate governance requirements.

Because Brookfield owns a majority of our outstanding common stock, we are a "controlled company" as that term is set forth in the NYSE corporate governance standards. Under these rules, a company of which more than 50% of the voting power is held by another person or group of persons acting together is a "controlled company" and may elect not to comply with certain corporate governance requirements, including:

- the requirement that a majority of our board of directors consist of independent directors;

the requirement that our governance committee be composed entirely of independent directors with a written charter addressing the committee's purpose and responsibilities; and

the requirement that our compensation committee be composed entirely of independent directors with a written charter addressing the committee's purpose and responsibilities.

These requirements will not apply to us as long as we remain a "controlled company." We may utilize some or all of these exemptions. Accordingly, you may not have the same protections afforded to stockholders of companies that are subject to all of the NYSE corporate governance requirements. Brookfield's significant ownership interest could adversely affect investors' perceptions of our corporate governance.

The market price and trading volume of our common stock may be volatile, which could result in rapid and substantial losses for our stockholders.

The market price of our common stock may be highly volatile and could be subject to wide fluctuations. In addition, the trading volume in our common stock may fluctuate and cause significant price variations to occur. If the market price of our common stock declines significantly, you may be unable to resell your shares at or above your purchase price, if at all. The market price of our common stock may fluctuate or decline significantly in the future. Some of the factors that could negatively affect our share price or result in fluctuations in the price or trading volume of our common stock include:

variations in our quarterly or annual operating results;

changes in our earnings estimates (if provided) or differences between our actual financial and operating results and those expected by investors and analysts;

the contents of published research reports about us or our industry or the failure of securities analysts to cover our common stock;

additions or departures of key management personnel;

any increased indebtedness we may incur in the future;

announcements by us or others and developments affecting us;

actions by institutional stockholders;

litigation and governmental investigations;

changes in market valuations of similar companies;

speculation or reports by the press or investment community with respect to us or our industry in general;

increases in market interest rates that may lead purchasers of our shares to demand a higher yield;

announcements by us or our competitors of significant contracts, acquisitions, dispositions, strategic relationships, joint ventures or capital commitments; and

general market, political and economic conditions, including any such conditions and local conditions in the markets in which our customers are located.

These broad market and industry factors may decrease the market price of our common stock, regardless of our actual operating performance. The stock market in general has from time to time experienced extreme price and volume fluctuations, including in recent months. In addition, in the past, following periods of volatility in the overall market and the market price of a company's securities, securities class action litigation has often been instituted against these companies. This litigation, if instituted against us, could result in substantial costs and a diversion of our management's attention and resources.

Future offerings of debt or equity securities by us may adversely affect the market price of our common stock. In the future, we may attempt to obtain financing or to further increase our capital resources by issuing additional shares of our common stock or offering debt or other equity securities, including commercial paper, medium term notes, senior or subordinated notes, debt securities convertible into equity or shares of preferred stock. Future acquisitions could require substantial additional capital in excess of cash from operations. We would expect to finance any future acquisitions through a combination of additional issuances of equity, corporate indebtedness, asset backed acquisition financing and/or cash from operations.

Issuing additional shares of our common stock or other equity securities or securities convertible into equity may dilute the economic and voting rights of our existing stockholders or reduce the market price of our common stock or both. Upon liquidation, holders of such debt securities and preferred shares, if issued, and lenders with respect to other borrowings would receive a distribution of our available assets prior to the holders of our common stock. Debt securities convertible into equity could be subject to adjustments in the conversion ratio pursuant to which certain events may increase the number of equity securities issuable upon conversion. Preferred shares, if issued, could have a preference with respect to liquidating distributions or a preference with respect to dividend payments that could limit our ability to pay dividends to the holders of our common stock. Our decision to issue securities in any future offering will depend on market conditions and other factors beyond our control, which may adversely affect the amount, timing or nature of our future offerings. Thus, holders of our common stock bear the risk that our future offerings may reduce the market price of our common stock and dilute their stockholdings in us.

The market price of our common stock could be negatively affected by sales of substantial amounts of our common stock in the public markets.

Sales of substantial amounts of our common stock in the public markets, or the perception that these sales could occur, could cause the market price of our common stock to decline. In particular, the sale in the public markets of our common stock by Brookfield, which owns approximately 79% of our outstanding common stock, or by our officers and directors, or the perception that these sales may occur, could cause the market price of our common stock to decline. Brookfield and our officers and directors may sell shares into the public markets in accordance with the requirements of Rule 144, and Brookfield is entitled to request that we facilitate SEC registration of their sales of shares pursuant to the terms of a registration rights agreement. A decline in the price of our common stock might impede our ability to raise capital through the issuance of additional common stock or other equity securities.

The future issuance of additional common stock in connection with our incentive plans, acquisitions or otherwise will dilute all other stockholdings.

We have an aggregate of 2,694,462,388 shares of common stock authorized but unissued and not reserved for issuance under our incentive plans. We may issue all of these shares of common stock without any action or approval by our stockholders, subject to certain exceptions. We also intend to continue to evaluate acquisition opportunities and may issue common stock in connection with these acquisitions. Any common stock issued in connection with our incentive plans, acquisitions, the exercise of outstanding stock options or otherwise would dilute the percentage ownership held by public investors.

As a public company, we incur additional costs and face increased demands on our management.

Since our acquisition by Brookfield in 2015, we have continued to comply with certain provisions of the Sarbanes Oxley Act and regulations of the SEC. However, as a public company with shares listed on a U.S. exchange, we must comply with additional rules and regulations that, until our initial public offering, had not applied to us since 2015. We expect these rules and regulations to increase our legal and financial compliance costs and to make some activities more time consuming and costly. For example, as a result of becoming a public company, we added independent directors and created additional board committees. In addition, we are incurring additional costs associated with our public company reporting requirements and maintaining directors' and officers' liability insurance. Any changes with respect to these rules may impose additional costs on us and materially affect our business, financial condition and results of operations.

If securities or industry analysts do not publish research or publish inaccurate or unfavorable research about our business, our stock price and trading volume could decline.

The trading market for our common stock depends in part on the research and reports that securities or industry analysts publish about us or our business. If one or more of the analysts who covers us downgrades our common stock

or publishes inaccurate or unfavorable research about our business, our stock price would likely decline. If one or more of these analysts ceases coverage of us or fails to publish reports on us regularly, demand for our common stock could decrease, which could cause our stock price and trading volume to decline.

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Item 1B. Unresolved Staff Comments

Not applicable.

Item 2. Properties

We currently operate the following facilities, which are owned or leased as indicated.

Location of Facility	Primary Use	Owned or Leased
Americas		
Brooklyn Heights, Ohio	Corporate Headquarters, Innovation and Technology Center and Sales Office	Leased
Monterrey, Mexico	Graphite Electrode Manufacturing Facility and Sales Office	Owned
St. Marys, Pennsylvania	Graphite Electrode Manufacturing Facility ⁽¹⁾	Owned
Port Lavaca, Texas	Petroleum Needle Coke Manufacturing Facility (Seadrift)	Owned
Salvador, Bahia, Brazil	Graphite Electrode Machine Shop and Sales Office	Owned
Europe		
Calais, France	Graphite Electrode Manufacturing Facility and Sales Office	Owned
Moscow, Russia	Sales Office	Leased
Pamplona, Spain	Graphite Electrode Manufacturing Facility and Sales Office	Owned
Bussigny, Switzerland	Global Sales and Production Planning Office	Leased
Other International		
Beijing, China	Sales Office	Leased
Hong Kong, China	Sales Office	Leased
Meyerton, South Africa	Sales Office	Leased

⁽¹⁾ Currently, our warm-idled St Mary's facility is semi-finishing products sourced from other plants to provide flexibility to our overall manufacturing footprint

Item 3. Legal Proceedings

We are involved in various investigations, lawsuits, claims, demands, labor disputes and other legal proceedings, including with respect to environmental and human exposure or other personal injury matters, arising out of or incidental to the conduct of our business. While it is not possible to determine the ultimate disposition of each of these matters and proceedings, we do not believe that their ultimate disposition will have a material adverse effect on our financial position, results of operations or cash flows.

Litigation has been pending in Brazil brought by employees seeking to recover additional amounts and interest thereon under certain wage increase provisions applicable in 1989 and 1990 under collective bargaining agreements to which employers in the Bahia region of Brazil were a party (including our subsidiary in Brazil). Companies in Brazil have settled claims arising out of these provisions and, in May 2015, the litigation was remanded in favor of the

employees, by the Brazilian Supreme Court to the lower courts for further proceedings which included procedural aspects of the case, such as admissibility of instruments filed by the parties. On October 1, 2015, an action was filed by current and former employees against our subsidiary in Brazil to recover amounts under such provisions, plus interest thereon, which amounts together with interest could be material to us. In the first quarter of 2017, the state court ruled in favor of the employees. We have appealed this ruling and intend to vigorously defend it. As of December 31, 2018, we are unable to assess the potential loss associated with these proceedings as the claims do not currently specify the number of employees seeking damages or the amount of damages being sought.

Item 4. Mine Safety Disclosures

Not applicable.

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Executive Officers of the Registrant

The following table sets forth information with respect to our current executive officers, including their ages, as of February 15, 2019. There are no family relationships between any of our executive officers.

Name	Age	Position
David J. Rintoul	62	President and Chief Executive Officer
Quinn J. Coburn	55	Vice President, Chief Financial Officer and Treasurer

David J. Rintoul became President and CEO and was elected to the board of directors in March 2018. Prior to joining the Company, Mr. Rintoul served as President of U.S. Steel Tubular Products and as a Senior Vice President of United States Steel Corporation (or U.S. Steel). Before that, Mr. Rintoul has served in various roles at U.S. Steel since 2007, including oversight of U.S. Steel’s Slovak and Serbian operations. Mr. Rintoul’s career in the steel industry spans 38 years with positions at both integrated and mini mill producers in the United States, Europe and Canada, including extensive mini mill operational experience at North Star Bluescope Steel in Delta, Ohio from 2001 to 2005 and from construction through full operations at Acme Steel Company in Riverdale, Illinois from 1995 to 2001. Mr. Rintoul holds an Associate’s degree in Mechanical Engineering Technology from Sault College of Applied Arts and Technology, a Bachelor’s degree in Business Administration from Lake Superior State University and a Master’s degree in Business Administration from the University of Notre Dame.

Quinn J. Coburn became CFO in September 2015. Mr. Coburn served as interim CFO beginning in May 2015 after previously serving as Vice President of Finance and Treasurer. He joined the Company in August 2010 after working at NCR Corporation from December 1992 until August 2010, including service as that company’s Vice President and Treasurer. Mr. Coburn graduated with a B.S. in Accounting from Utah State University in 1988. He received an MBA from University of Pennsylvania’s The Wharton School in 1992.

PART II

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

Market Information

Our common stock IPO was completed on April 23, 2018 and our stock is listed on the NYSE under the trading symbol “EAF”.

Holders

As of December 31, 2018, there were 2 holders of record of our common stock.

Dividend Policies and Restrictions

In 2017, we reoriented our commercial strategy around a three to five year take or pay contract framework. We expect a high degree of stability in our future operating results due to these contracts. We have executed three to five year take or pay contracts representing approximately 674,000 MT over the 2018-2022 period at a weighted average contract price of approximately \$9,700 per MT. In addition, we believe our ability to source substantially all of our petroleum needle coke requirements for these contracts from our Seadrift facility and our hedging of our purchases of decant oil mitigates the impact of periodic shortages and price fluctuations of raw materials on our sales and provides us with substantial visibility into our future raw material costs. See “Business-Contracts and customers.” As a result of this recent contract initiative, we currently pay a quarterly cash dividend of \$0.085 per share, or an aggregate of \$0.34 per share on an annualized basis. We expect to continue to pay this dividend out of cash generated from operations; we do not intend to incur indebtedness to fund regular, quarterly dividend payments.

We cannot assure you, however, that we will pay dividends in the future in these amounts or at all. Our board of directors may change the timing and amount of any future dividend payments or eliminate the payment of future dividends in its sole discretion, without any prior notice to our stockholders. Our ability to pay dividends will depend upon many factors, including our financial position and liquidity, results of operations, legal requirements, restrictions that may be imposed by the terms of our current and future credit facilities and other debt obligations and other factors

deemed relevant by our board of directors.

For example, we may or may not be able to, or may decide not to, pay dividends if we are unable, for any reason, to continue our contract strategy in the future or we experience a significant disruption in our manufacturing operations or our

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investing activities
Net cash (used in) provided by (731,044) (32,995) (8,317) (23,072) 20,824 (35,077)
financing activities

(a) Successor period data gives effect to the 3,022,259.23-for-1 stock split on our common stock effected on April 12, 2018.

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Calculated by total dividends paid of \$2,294,265 divided by weighted average shares outstanding. \$2,022,000 of (b) these dividends were declared and paid to Brookfield prior to our IPO. All other dividends were declared and paid to all common stockholders.

(c) Represents pension and post-retirement benefits and related costs and miscellaneous other long-term obligations.

(d) A closing balance sheet as of August 14, 2015 was not required as part of previous filings.

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

The following discussion and analysis of our financial condition and results of operations should be read together with our Consolidated Financial Statements and the accompanying notes and other financial information appearing elsewhere in this Annual Report on Form 10-K. Information in this section is intended to assist the reader in obtaining an understanding of our Consolidated Financial Statements, the changes in certain key items in those financial statements from year to year, the primary factors that accounted for those changes, any known trends or uncertainties that we are aware of that may have a material effect on our future performance, as well as how certain accounting principles affect our Consolidated Financial Statements. This discussion and analysis contains forward looking statements that involve risks, uncertainties and assumptions. See "Special Note Regarding Forward-Looking Statements." Our actual results could differ materially from those forward looking statements as a result of many factors, including those discussed in "Risk Factors" and elsewhere in this Form 10-K.

Overview

We are a leading manufacturer of high quality graphite electrode products essential to the production of electric arc furnace ("EAF") steel and other ferrous and non ferrous metals. We believe that we have the most competitive portfolio of low cost graphite electrode manufacturing facilities in the industry, including three of the five highest capacity facilities in the world (excluding China). We are the only large scale graphite electrode producer that is substantially vertically integrated into petroleum needle coke, the primary raw material for graphite electrode manufacturing, which is currently in limited supply. Between 1984 and 2011, EAF steelmaking was the fastest growing segment of the steel sector, with production increasing at an average rate of 3.5% per year, based on World Steel Association ("WSA") data. Historically, EAF steel production has grown faster than the overall steel market due to the greater resilience, more variable cost structure, lower capital intensity and more environmentally friendly nature of EAF steelmaking. This trend was partially reversed between 2011 and 2015 due to global steel production overcapacity driven largely by Chinese blast furnace ("BOF") steel production. Beginning in 2016, efforts by the Chinese government to restructure China's domestic steel industry have led to limits on BOF steel production and lower export levels, and developed economies, which typically have much larger EAF steel industries, have instituted a number of trade policies in support of domestic steel producers. As a result, since 2016, the EAF steel market has rebounded strongly and resumed its long term growth trajectory. This revival in EAF steel production has resulted in increased demand for our graphite electrodes.

At the same time, two supply side structural changes have contributed to record high prices of graphite electrodes in 2018. First, ongoing consolidation and rationalization of graphite electrode production capacity have limited the ability of graphite electrode producers to meet demand. Second, demand for petroleum needle coke has outpaced supply due to increasing demand for petroleum needle coke for lithium ion batteries used in electric vehicles. As a result, graphite electrode prices have reached record high prices in 2018. We have implemented a commercial strategy to sell 65% to 70% of our production capacity through three to five year take or pay contracts. These contracts define volumes and prices, along with price escalation mechanisms for inflation, and include significant termination payments (typically, 50% to 70% of remaining contracted revenue) and, in certain cases, parent guarantees and collateral arrangements to manage our customer credit risk. We expect a high degree of stability in our future operating results due to these contracts. We have entered into three to five year take or pay contracts to sell approximately 147,000, 144,000, 127,000 and 120,000 metric tons ("MT") in 2019, 2020, 2021 and 2022, respectively. We may enter into additional take-or-pay contracts in the future.

GrafTech's transformation

Since 2012, we have executed a three part transformation plan to improve our competitive position and allow us to better serve our customers. Since 2012, we have achieved significant annual fixed manufacturing cost improvements and annual overhead expense reductions, all while also improving the productivity of our plant network. We have strategically shifted production from our lowest to our highest production capacity facilities to increase fixed cost absorption. This, coupled with a recovery in customer demand, resulted in a steady increase in our capacity utilization, reaching 100% in the fourth quarter of 2018 (excluding our temporarily idled St. Marys, Pennsylvania facility). We have also significantly reduced our annual overhead expenses since 2012 by simplifying our corporate structure from a conglomerate model to a centralized business focused exclusively on the production of graphite electrodes and petroleum needle coke, and we have streamlined and combined our workforce and various administrative functions for

efficiency, and eliminated research and development ("R&D") functions unrelated to graphite electrodes. In addition to our fixed cost reductions, we have been able to achieve significant productivity improvements and variable cost reductions across our plants since 2014. We recently completed our plant debottlenecking initiative, which increased our current operating production capacity by 20% , allowing us to achieve further improvements in our cost structure. As a result of our operational improvement activities, we were able to achieve this large capacity increase with specific, highly targeted capital investments.

In light of improved market conditions, the long lead time required to produce our products, our position as one of the market's largest producers and our ability, through our substantial vertical integration with Seadrift Coke L.P. ("Seadrift"), to

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provide customers with a reliable long term supply of graphite electrodes despite the limited supply of petroleum needle coke, we have implemented a commercial strategy to sell graphite electrodes through three-to-five-year take-or-pay contracts. Additionally, the divestiture of our non-core legacy Engineered Solutions businesses in 2016 and 2017 has allowed our management team to focus on our core competency of graphite electrode production and generated approximately \$60 million in cash proceeds and release of working capital. By focusing our management's attention and R&D spending exclusively on the graphite electrode business, we have been able to meaningfully improve the quality of our graphite electrodes, repositioning ourselves as an industry quality leader and improving our relationships with strategic customers.

Global economic conditions and outlook

The graphite electrode industry has historically followed the growth of the EAF steel industry and, to a lesser extent, the steel industry as a whole, which has been highly cyclical and affected significantly by general economic conditions. Historically, EAF steel production has grown faster than the overall steel market due to the greater resilience, more variable cost structure, lower capital intensity and more environmentally friendly nature of EAF steelmaking.

This growth trend has resumed after a decline in EAF steelmaking between 2011 and 2015, as Chinese steel production, which is predominantly BOF based, grew significantly, taking market share from EAF steel producers. Throughout 2015 and 2016, our business faced significant headwinds in the major industries that we served, including slow economic growth and stagnation in steel production year over year. These factors exerted continued downward pressure on prices for our products, which negatively impacted our financial results from 2013 to 2017. Additionally, in 2015, steel producers utilized BOFs over EAFs at rates higher than we had historically seen, pressuring the prices of and demand for graphite electrodes, as steel consumers in the United States and Europe, our largest markets, increased imports of low cost steel products, primarily from China. Additionally, prices for iron ore, the key raw material for BOFs, declined faster than scrap steel, the key raw material in EAF production. While a decline in the price of oil benefited our cost structure overall, it contributed to lower prices for petroleum needle coke and, indirectly, graphite electrodes.

Graphite electrodes saw further pricing pressure in the first half of 2016, but EAF production started to recover during the second half of 2016, which indicated a potential bottoming out in prices. Costs of the key raw materials used to run BOFs increased, and the price of scrap steel decreased, re balancing the economics of EAF mills relative to BOFs. These developments resulted in an increase in our sales volume over the prior year; however, the decline in prices more than offset the volume increase. Because customers historically negotiated annual agreements in the third and fourth quarters of each calendar year for graphite electrodes to be delivered the following year, increases in price often lagged behind increases in volume. Nonetheless, a decline in the price of oil and our rationalization initiatives significantly improved our cost structure and positioned us to benefit from a potential recovery.

The outlook for general economic and industry specific growth brightened in 2017 and 2018. In its January 2019 report, the International Monetary Fund ("IMF") reported a global growth rate for 2017 of 3.8%. They estimated 2018 global growth rate at 3.7% and 2019 is estimated to be 3.5%. The estimates for 2018 and 2019 were down slightly from their October 2018 report as a result of a slowing second half of 2018. The WSA's October 2018 Short Range Outlook estimated global steel production outside of China would increase by 2.1% in 2018 and 2.7% in 2019. Other macroeconomic and industry trends have created significant increases in demand for graphite electrodes. Beginning in 2016, efforts by the Chinese government to eliminate excess steelmaking production capacity and improve environmental and health conditions have led to limits on Chinese BOF steel production, including the closure of over 200 million MT of its steel production capacity, based on data from S&P Global Platts and the Ministry of Commerce of the People's Republic of China. In 2017, Chinese steel exports fell by more than 30% from 2016. Chinese steel exports continued to decline an additional 8% in 2018 according to the National Bureau of Statistics of China, reflecting the reduction in steel production capacity. As a result, the historical growth trend of EAF steelmaking relative to the overall steel market resumed and has led to increased demand for our graphite electrodes. At the same time, consolidation and rationalization of graphite electrode production capacity limited the ability of graphite electrode producers to meet this demand. Prior to this improvement in demand, the electrode industry experienced an extended, five year downturn, resulting in a reduction of production capacity outside of China of approximately 200,000 MT, from approximately 1,000,000 MT to approximately 800,000 MT. Currently, we estimate

production capacity outside of China is approximately 850,000 MT.

Petroleum needle coke, which is the primary raw material for graphite electrode manufacturing, and coal tar pitch, which is a raw material used in our manufacturing processes, are currently in limited supply. Demand for petroleum needle coke has outpaced supply due to increasing demand for petroleum needle coke in the production of lithium ion batteries used in electric vehicles. Increased demand has led to pricing increases for petroleum needle coke in the current market. While we believe that our substantial vertical integration into petroleum needle coke through our ownership of Seadrift provides a significant cost

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advantage relative to our competitors in periods of tight petroleum needle coke supply, such as the current market environment, we currently purchase approximately 30% of our petroleum needle coke requirements from external sources. Going forward, we expect to purchase approximately one third of our needle coke requirements from external sources, given the increase in our graphite electrode capacity from our debottlenecking initiative. As a result, we continue to experience higher third party petroleum needle coke costs which will affect our cost of sales in 2019. Additionally, during the fourth quarter, our planned maintenance outage at our Seadrift needle coke facility decreased production levels at that facility. We produced approximately 110,000 MT of needle coke in 2018. We expect to produce approximately 125,000 MT of needle coke in 2019, as we do not have a planned maintenance outage in 2019 and we expect a modest productivity enhancement related to our efficiency improvement project.

Components of results of operations

Net sales

Net sales reflect sales of our products, including graphite electrodes and associated by products. Several factors affect net sales in any period, including general economic conditions, competitive conditions, scheduled plant shutdowns by customers, national vacation practices, changes in customer production schedules in response to seasonal changes in energy costs, weather conditions, strikes and work stoppages at customer plants and changes in customer order patterns including those in response to the announcement of price increases or price adjustments.

Revenue is recognized when a customer obtains control of promised goods. The amount of revenue recognized reflects the consideration to which the Company expects to be entitled to receive in exchange for these goods. See Note 2 "Revenue from Contracts with Customers" to the Consolidated Financial Statements for more information. Our fourth quarter has historically represented our strongest sales quarter and the first quarter is historically the weakest.

Cost of sales

Cost of sales includes the costs associated with products invoiced during the period as well as non inventoried manufacturing overhead costs and outbound transportation costs. Cost of sales includes all costs incurred at our production facilities to make products saleable, such as raw materials, energy costs, direct labor and indirect labor and facilities costs, including purchasing and receiving costs, plant management, inspection costs, product engineering and internal transfer costs. In addition, all depreciation associated with assets used to produce products and make them saleable is included in cost of sales. Direct labor costs consist of salaries, benefits and other personnel related costs for employees engaged in the manufacturing of our products.

Inventory valuation

Inventories are stated at the lower of cost or market. Cost is principally determined using the "first in, first out" (or FIFO) and average cost, which approximates FIFO, methods. Elements of cost in inventory include raw materials, energy costs, direct labor, manufacturing overhead and depreciation of the manufacturing fixed assets. We allocate fixed production overheads to the costs of conversion based on normal capacity of the production facilities. We recognize abnormal amounts of idle facility expense, freight, handling costs, and wasted materials (spoilage) as current period charges. Market, or net realizable value, is the estimated selling price in the ordinary course of business, less reasonably predictable costs of completion, disposal and transportation.

Research and development

We conduct our research and development both independently and in conjunction with our strategic suppliers, customers and others. Expenditures relating to the development of new products and processes, including significant improvements to existing products, are expensed as incurred.

Selling and administrative expenses

Selling and administrative expenses include salaries, benefits and other personnel related costs for employees engaged in sales and marketing, customer technical services, engineering, finance, information technology, human resources and executive management. Other costs include outside legal and accounting fees, risk management (insurance), global operational excellence, global supply chain, in house legal, share based compensation and certain other administrative and global resources costs. Our "mark to market adjustment" refers to our accounting policy regarding pension and OPEB plans, where we immediately recognize the change in the fair value of plan assets and net actuarial gains and losses annually in the fourth quarter of each year.

Other expense (income)

Other expense (income) consists primarily of foreign currency impacts on non operating assets and liabilities and miscellaneous income and expense.

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Interest expense

Interest expense consists primarily of interest expense on our 2018 Term Loans, 2018 Revolving Facility and the Senior Notes, accretion of the fair value adjustment on the Senior Notes and amortization of debt issuance costs.

Income (loss) from discontinued operations

As of June 30, 2016, the Engineered Solutions segment qualified for reporting as discontinued operations, and the disposition of the segment was substantially complete by the end of the third quarter of 2017. All results are reported as gain or loss from discontinued operations, net of tax.

Effects of changes in currency exchange rates

When the currencies of non U.S. countries in which we have a manufacturing facility decline (or increase) in value relative to the U.S. dollar, this has the effect of reducing (or increasing) the U.S. dollar equivalent cost of sales and other expenses with respect to those facilities. In certain countries in which we have manufacturing facilities, and in certain export markets, we sell in currencies other than the U.S. dollar. Accordingly, when these currencies increase (or decline) in value relative to the U.S. dollar, this has the effect of increasing (or reducing) net sales. The result of these effects is to increase (or decrease) operating profit and net income.

Some of the non U.S. countries in which we have a manufacturing facility have been subject to significant economic and political changes, which have significantly impacted currency exchange rates. We cannot predict changes in currency exchange rates in the future or whether those changes will have net positive or negative impacts on our net sales, cost of sales or net income.

The impact of these changes in the average exchange rates of other currencies against the U.S. dollar on our net sales was an increase of \$10.5 million, \$4.5 million and \$0.4 million for the years ended December 31, 2018, 2017 and 2016, respectively.

The impact of these changes in the average exchange rates of other currencies against the U.S. dollar on our cost of sales was an increase of \$3.6 million and \$4.2 million in 2018 and 2017, respectively, and a decrease of \$10.1 million for the year ended December 31, 2016.

As part of our cash management, we also have intercompany loans between our subsidiaries. These loans are deemed to be temporary and, as a result, remeasurement gains and losses on these loans are recorded as currency gains or losses in other income (expense), net, on the Consolidated Statements of Operations.

We have in the past and may in the future use various financial instruments to manage certain exposures to risks caused by currency exchange rate changes, as described under "Quantitative and Qualitative Disclosures about Market Risks."

Key metrics used by management to measure performance

In addition to measures of financial performance presented in our Consolidated Financial Statements in accordance with GAAP, we use certain other financial measures and operating metrics to analyze the performance of our company. The "non GAAP" financial measures consist of EBITDA from continuing operations and adjusted EBITDA from continuing operations, which help us evaluate growth trends, establish budgets, assess operational efficiencies and evaluate our overall financial performance. The key operating metrics consist of sales volume, weighted average realized price, production volume, production capacity and capacity utilization.

Key financial measures

(in thousands)	For the year ended December 31,		
	2018	2017	2016
Net sales	\$1,895,910	\$550,771	\$437,963
Net income (loss)	\$854,219	\$7,983	\$(235,843)
EBITDA from continuing operations ⁽¹⁾	\$1,102,625	\$97,884	\$(12,251)
Adjusted EBITDA from continuing operations ⁽¹⁾	\$1,205,021	\$95,806	\$(2,898)

Key operating metrics

(in thousands, except price data)	For the year ended		
	December 31,		
	2018	2017	2016
Sales volume (MT) ⁽²⁾	185	172	163
Weighted average realized price ⁽³⁾	9,937	2,945	2,459
Production volume (MT) ⁽⁴⁾	179	166	151
Production capacity excluding St. Marys during idle period (MT) ⁽⁵⁾⁽⁶⁾	180	167	176
Capacity utilization excluding St. Marys during idle period ⁽⁵⁾⁽⁷⁾	99 %	99 %	85 %
Total production capacity ⁽⁶⁾⁽⁸⁾	208	195	195
Total capacity utilization ⁽⁷⁾⁽⁸⁾	86 %	85 %	77 %

(1) See below for more information and a reconciliation of EBITDA and adjusted EBITDA to net income (loss), the most directly comparable financial measure calculated and presented in accordance with GAAP.

(2) Sales volume reflects the total volume of graphite electrodes sold for which revenue has been recognized during the period. See below for more information on our key operating metrics.

(3) Weighted average realized price reflects the total revenues from sales of graphite electrodes for the period divided by the graphite electrode sales volume for that period. See below for more information on our key operating metrics.

(4) Production volume reflects graphite electrodes produced during the period. See below for more information on our key operating metrics.

(5) The St. Marys, Pennsylvania facility was temporarily idled effective the second quarter of 2016 except for the machining of semi finished products sourced from other plants. In the first quarter of 2018, our St. Marys facility began graphitizing a limited amount of electrodes sourced from our Monterrey, Mexico facility.

(6) Production capacity reflects expected maximum production volume during the period under normal operating conditions, standard product mix and expected maintenance downtime. Actual production may vary. See below for more information on our key operating metrics.

(7) Capacity utilization reflects production volume as a percentage of production capacity. See below for more information on our key operating metrics.

(8) Includes graphite electrode facilities in Calais, France; Monterrey, Mexico; Pamplona, Spain and St. Marys, Pennsylvania.

Non GAAP financial measures

In addition to providing results that are determined in accordance with GAAP, we have provided certain financial measures that are not in accordance with GAAP. EBITDA from continuing operations and adjusted EBITDA from continuing operations are non GAAP financial measures. We define EBITDA from continuing operations, a non GAAP financial measure, as net income or loss plus interest expense, minus interest income, plus income taxes, discontinued operations and depreciation and amortization from continuing operations. We define adjusted EBITDA from continuing operations as EBITDA from continuing operations plus any pension and other post-employment benefit ("OPEB") plan expenses, impairments, rationalization related charges, initial public offering ("IPO") expenses, acquisition and proxy contest costs, non cash gains or losses from foreign currency remeasurement of non operating liabilities in our foreign subsidiaries where the functional currency is the U.S. dollar, related party Tax Receivable Agreement expense, stock-based compensation and non cash fixed asset write offs. Adjusted EBITDA from continuing operations is the primary metric used by our management and our board of directors to establish budgets and operational goals for managing our business and evaluating our performance.

We monitor adjusted EBITDA from continuing operations as a supplement to our GAAP measures, and believe it is useful to present to investors, because we believe that it facilitates evaluation of our period to period operating performance by eliminating items that are not operational in nature, allowing comparison of our recurring core business operating results over multiple periods unaffected by differences in capital structure, capital investment cycles and fixed asset base. In addition, we believe adjusted EBITDA from continuing operations and similar measures are widely used by investors, securities analysts, ratings agencies, and other parties in evaluating companies in our industry as a measure of financial performance and debt service capabilities.

Our use of adjusted EBITDA from continuing operations has limitations as an analytical tool, and you should not consider it in isolation or as a substitute for analysis of our results as reported under GAAP. Some of these limitations are:

- adjusted EBITDA from continuing operations does not reflect changes in, or cash requirements for, our working capital needs;

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adjusted EBITDA from continuing operations does not reflect our cash expenditures for capital equipment or other contractual commitments, including any capital expenditure requirements to augment or replace our capital assets;

adjusted EBITDA from continuing operations does not reflect the interest expense or the cash requirements necessary to service interest or principal payments on our indebtedness;

adjusted EBITDA from continuing operations does not reflect tax payments that may represent a reduction in cash available to us;

adjusted EBITDA from continuing operations does not reflect expenses relating to our pension and OPEB plans;

adjusted EBITDA from continuing operations does not reflect impairment of long lived assets and goodwill;

adjusted EBITDA from continuing operations does not reflect the non cash gains or losses from foreign currency remeasurement of non operating liabilities in our foreign subsidiaries where the functional currency is the U.S. dollar;

adjusted EBITDA from continuing operations does not reflect IPO expenses;

adjusted EBITDA from continuing operations does not reflect acquisition and proxy costs;

adjusted EBITDA from continuing operations does not reflect related party Tax Receivable Agreement expense;

adjusted EBITDA from continuing operations does not reflect rationalization related charges, stock-based compensation or the non cash write off of fixed assets; and

other companies, including companies in our industry, may calculate EBITDA from continuing operations and adjusted EBITDA from continuing operations differently, which reduces its usefulness as a comparative measure. In evaluating EBITDA from continuing operations and adjusted EBITDA from continuing operations, you should be aware that in the future, we will incur expenses similar to the adjustments in this presentation. Our presentations of EBITDA from continuing operations and adjusted EBITDA from continuing operations should not be construed as suggesting that our future results will be unaffected by these expenses or any unusual or non recurring items. When evaluating our performance, you should consider EBITDA from continuing operations and adjusted EBITDA from continuing operations alongside other financial performance measures, including our net income (loss) and other GAAP measures.

The following table reconciles our non GAAP key financial measures to the most directly comparable GAAP measures:

(in thousands)	For the year ended		
	December 31,		
	2018	2017	2016
Net income (loss)	854,219	7,983	(235,843)
Add:			
Discontinued operations	(331)	6,229	126,974
Depreciation and amortization	66,413	64,025	77,614
Interest expense	135,061	30,823	26,914
Interest income	(1,657)	(395)	(358)
Income taxes	48,920	(10,781)	(7,552)
EBITDA from continuing operations	1,102,625	97,884	(12,251)
Adjustments:			
Pension and OPEB plan (gain) expenses ⁽¹⁾	3,893	(1,611)	(626)
Rationalization related (gains)/charges ⁽²⁾	—	(3,970)	5,209
Initial public offering ("IPO") expenses ⁽³⁾	5,173	—	—
Acquisition and proxy contests costs ⁽⁴⁾	—	886	8,036
Non cash loss (gain) on foreign currency remeasurement ⁽⁵⁾	818	1,731	(5,465)
Stock-based compensation ⁽⁶⁾	1,152	—	—
Non cash fixed asset write off	4,882	886	2,199
Related party Tax Receivable Agreement expense ⁽⁸⁾	86,478	—	—
Adjusted EBITDA from continuing operations	1,205,021	95,806	(2,898)

(1) Service and interest cost of our OPEB plans. Also includes a mark to market loss (gain) for plan assets as of December of each year. See “Management’s Discussion and Analysis of Financial Condition and Results of Operations-Components of Results of Operations-Selling and Administrative Expenses” for more information.

(2) Costs associated with rationalizations in our graphite electrode manufacturing operations and in the corporate structure. They include severance charges, contract termination charges, write off of equipment and (gain)/loss on sale of manufacturing sites.

(3) Legal, accounting, printing and registration fees associated with the initial public offering

(4) Costs associated with the merger transaction with Brookfield, resulting in change in control compensation expenses.

(5) Non cash (gain) loss from foreign currency remeasurement of non operating liabilities of our non U.S. subsidiaries where the functional currency is the U.S. dollar.

(6) Non-cash expense for stock-based compensation grants

(7) Non cash fixed asset write off recorded for obsolete manufacturing equipment.

(8) Non-cash expense for future payment to our sole pre-IPO stockholder for tax assets that are expected to be utilized.

Key Operating Metrics

Key operating metrics consist of sales volume, weighted average realized price, production volume, production capacity and capacity utilization.

Sales volume reflects the total volume of graphite electrodes sold for which revenue has been recognized during the period. For a discussion of our revenue recognition policy, see “Management’s Discussion and Analysis of Financial Condition and Results of Operations-Critical Accounting Policies-Revenue Recognition.” Weighted average realized price reflects the total revenues from sales of graphite electrodes for the period divided by the graphite electrode sales volume for that period. Sales volume and weighted average realized price help investors understand the factors that drive our net sales.

Production volume reflects graphite electrodes produced during the period. Production capacity reflects expected maximum production volume during the period under normal operating conditions, standard product mix and expected maintenance downtime. Capacity utilization reflects production volume as a percentage of production capacity. Production volume, production capacity and capacity utilization help us understand the efficiency of our production, evaluate cost of sales and consider how to approach our contract initiative.

Customer base

We are a global company and sell our products in every major geographic market. Sales of these products to buyers outside the United States accounted for approximately 78%, 81% and 83% of our net sales in 2018, 2017 and 2016, respectively.

In 2018, six of our ten largest customers were based in Europe, two in the United States, and one each in Brazil, and Libya. However, nine of our top ten customers are multi national operations.

The following table summarizes information as to our operations in different geographical areas:

(in thousands)	For the year ended		
	December 31,		
	2018	2017	2016
Net sales:			
United States	429,599	103,890	74,526
Americas (excluding the United States)	367,561	129,103	116,944
Asia Pacific	131,578	46,329	41,302
Europe, Middle East, Africa	967,172	271,449	205,191
Total	1,895,910	550,771	437,963

In 2018, one customer accounted for more than 10% of our net sales. Due to the increased demand for our products, we believe this customer does not pose a significant concentration of risk, as sales to this customer could be replaced by demand from other customers.

Results of operations

Results of operations for 2018 as compared to 2017

The tables presented in our period-over-period comparisons summarize our Condensed Consolidated Statements of Operations and illustrate key financial indicators used to assess the consolidated financial results. Throughout our Management Discussion and Analysis ("MD&A"), insignificant changes may be deemed not meaningful and are generally excluded from the discussion.

(in thousands)	For the Year Ended		Increase/ Decrease	% Change	
	December 31, 2018	2017			
Net sales	\$1,895,910	\$550,771	\$1,345,139	244	%
Cost of sales	705,698	461,545	244,153	53	%
Additions to lower of cost or market inventory reserve	—	1,509	(1,509)	(100)	%
Gross profit	1,190,212	87,717	1,102,495	1,257	%
Research and development	2,129	3,456	(1,327)	(38)	%
Selling and administrative expenses	62,032	52,506	9,526	18	%
Operating income	1,126,051	31,755	1,094,296	3,446	%
Other expense (income), net	3,361	(2,104)	5,465	(260)	%
Related party Tax Receivable Agreement expense	86,478	—	86,478	N/A	
Interest expense	135,061	30,823	104,238	338	%
Interest income	(1,657)	(395)	(1,262)	319	%
Income from continuing operations before provision for income taxes	902,808	3,431	899,377	26,213	%
Provision (benefit) for income taxes	48,920	(10,781)	59,701	(554)	%
Net income from continuing operations	\$853,888	\$14,212	\$839,676	5,908	%
Income (loss) from discontinued operations, net of tax	331	(6,229)	6,560	(105)	%
Net income	\$854,219	\$7,983	\$846,236	10,600	%

Net sales. Net sales increased by \$1,345.1 million, or 244%, from \$550.8 million in 2017 to \$1,895.9 million in 2018. This increase was primarily driven by a 235% increase in weighted average realized price for graphite electrodes in 2018 compared to 2017. The weighted average sales price for graphite electrodes increased from \$2,945 per MT in 2017 to \$9,937 per MT in 2018. This increase in weighted average realized price was driven by increased demand for graphite electrodes due to growth in EAF steel manufacturing, combined with a constrained graphite electrode supply due to reductions in graphite electrode manufacturing capacity over the past several years and a limited supply of our key raw material, petroleum needle coke. These factors coupled with increased capacity from our debottlenecking initiative contributed to an increase in sales volume of 7% from 2017 to 2018.

Cost of sales. Cost of sales increased by \$244.2 million, or 53%, from \$461.5 million in 2017 to \$705.7 million in 2018. This increase was primarily the result of sales of inventory that was manufactured using higher priced needle coke and pitch. Increased sales volume also contributed a 5% increase in cost of sales.

Lower of cost or market inventory adjustment. We incurred an inventory adjustment of \$1.5 million in the first half of 2017 to reduce inventory to the lower of cost or market for certain product lines within our graphite electrode business. Improved pricing and lower costs later in 2017 and into 2018 eliminated the need for these charges.

Research and development. Research and development expenses decreased by \$1.3 million, or 38% from \$3.5 million in 2017 to \$2.1 million in 2018, primarily due to the non-recurrence of the write-off of certain research and development fixed assets in 2017.

Selling and administrative expenses. Selling and administrative expenses increased by \$9.5 million, or 18%, from \$52.5 million in 2017 to \$62.0 million in 2018. This increase was driven primarily by \$5.2 million of costs related to our initial public offering as well as stock-based compensation of \$1.2 million.

Other (income) expense. Other expense increased by \$5.5 million, from income of \$2.1 million in 2017 to expense of \$3.4 million in 2018. This increase was primarily due to pension and OPEB charges of \$1.9 million in 2018 versus a gain of \$3.7 million in 2017. These pension and OPEB gains and losses were primarily the result of our annual mark-to-market adjustment. Partially offsetting this increase were advantageous non cash foreign currency impacts on non operating assets and liabilities.

Interest expense. Interest expense increased by \$104.2 million, or 338%, from \$30.8 million in 2017 to \$135.1 million in 2018, primarily due to increased borrowings and refinancing charges of \$23.8 million.

Income from discontinued operations. Income from our discontinued operations increased from a loss of \$6.2 million in 2017 to income of \$0.3 million in 2018 as the disposition of our Engineered Solutions businesses was completed.

Provision for (benefit from) income taxes. The following table summarizes the benefit for income taxes in 2018 and 2017:

	For the Year Ended December 31, 2018	For the Year Ended December 31, 2017
Tax expense (benefit)	\$48,920	\$(10,781)
Income from continuing operations before provision for income taxes	902,808	\$3,431
Effective tax rates	5.4	% (314.2)%

The effective tax rate for fiscal 2018 was 5.4% and primarily reflects a \$93.1 million benefit related to the partial release of the valuation allowance recorded against U.S. federal and state deferred tax assets. Our accounting for the impacts of the Tax Act as they relate to the amounts provided in 2017, has been finalized according to the guidance provided in SEC Staff Accounting Bulletin No. 118, which was issued on December 22, 2017.

During 2018 the effective tax rate differs from the U.S. statutory rate of 21% due to the partial release of a valuation allowance recorded against the deferred tax asset related to U.S. federal and state tax attributes as well as worldwide earnings from various countries taxed at different rates.

The tax expense changed from a benefit of \$(10.8) million, for an effective tax rate of (314.2)% for the year ended December 31, 2017 to a tax charge of \$48.9 million for a 5.4% effective rate for the year ended December 31, 2018. This change in the effective tax rate is primarily due to the increase in earnings, the shift in the jurisdictional mix of earnings and losses from year to year, and offset by a partial release of a valuation allowance recorded against the deferred tax asset related to U.S. tax attributes. Certain jurisdictions shifted from pre-tax losses in 2017 to pretax earnings in 2018. The effective tax rate for 2017 reflects the release of \$16 million of valuation allowance reserve established against our GrafTech Switzerland net deferred tax assets. A \$54.1 million charge related to the impact of the Tax Act was recorded in the fourth quarter of 2017 but was offset by a release of a valuation allowance reserve on the deferred tax assets. See Note 14 "Income Taxes" to the Consolidated Financial Statements for more information.

Production Capacity

Our graphite electrode plant production capacity in 2018 was 180,000 MT excluding our St. Marys facility, which has been idled since the second quarter of 2016, except for machining of semi-finished products sourced from other plants. Beginning in the first quarter of 2018, our St. Marys facility began graphitizing a limited amount of electrodes sourced from our Monterrey, Mexico facility. Our capacity increased in the fourth quarter of 2018 as a result of the completion of our debottlenecking initiative. Excluding our St. Marys facility, our 2019 capacity will be 202,000 MT, an increase of approximately 20% over 2018.

Results of operations for 2017 as compared to 2016

(in thousands)	For the Year Ended		Increase/ Decrease	% Change
	December 31, 2017	2016		
Net sales	\$550,771	\$437,963	\$112,808	26 %
Cost of sales	461,545	449,228	12,317	3 %
Additions to lower of cost or market inventory reserve	1,509	18,974	(17,465)	(92)%
Gross profit (loss)	87,717	(30,239)	117,956	(390)%
Research and development	3,456	2,534	922	36 %
Selling and administrative expenses	52,506	58,515	(6,009)	(10)%
Impairment of long-lived assets and goodwill	—	2,843	(2,843)	N/A
Operating income (loss)	31,755	(94,131)	125,886	(134)%
Other expense (income), net	(2,104)	(4,266)	2,162	(51)%
Interest expense	30,823	26,914	3,909	15 %
Interest income	(395)	(358)	(37)	10 %
Income (loss) from continuing operations before provision for income taxes	3,431	(116,421)	119,852	(103)%
Benefit from income taxes	(10,781)	(7,552)	(3,229)	43 %
Net income (loss) from continuing operations	14,212	\$(108,869)	123,081	(113)%
Loss from discontinued operations, net of tax	(6,229)	(126,974)	120,745	(95)%

Net income (loss) \$7,983 \$(235,843) \$243,826 (103)%

Net sales. Net sales increased by \$112.8 million, or 26%, from \$438.0 million in 2016 to \$550.8 million in 2017. This increase was driven by a 19% increase in weighted average realized price for graphite electrodes and a 6.5% increase in sales volume in 2017 compared to 2016. The increases in weighted average sales price and sales volume were driven by increased demand for graphite electrodes due to recent general economic and industry conditions. In particular, prices decreased throughout 2016 and into the first quarter of 2017, but began to increase in the third quarter of 2017. The weighted average sales price increased an additional 42% from the third quarter to the fourth quarter of 2017.

Cost of sales. Cost of sales increased by \$12.3 million, or 3%, from \$449.2 million in 2016 to \$461.5 million in 2017. Increased sales volume of graphite electrodes was the primary driver of this increase resulting in additional cost of sales of \$15.1 million.

Lower of cost or market inventory adjustment. We incurred an inventory adjustment to reduce inventory to the lower of cost or market of \$19.0 million in 2016 for certain product lines within our graphite electrode business. Improved pricing and lower costs in 2017 lessened the need for these charges.

Research and development. Research and development expenses increased by \$0.9 million, or 36% from \$2.4 million in 2016 to \$3.5 million in 2017, primarily due to the write-off of certain research and development fixed assets in connection with our decision to stop research on a project.

Selling and administrative expenses. Selling and administrative expenses decreased by \$6.0 million, or 10%, from \$57.8 million in 2016 to \$52.5 million in 2017. This decrease was driven primarily by continued cost reduction efforts, which were achieved by simplifying our corporate structure.

Other (income) expense. Other expense was unchanged from 2016 to 2017. Increases from non-cash foreign currency impacts on non-operating assets and liabilities were offset by an increase in pension and OPEB mark-to-market gains of \$1.7 million and interest income received as part of the resolution of a value added tax (or VAT) dispute in a foreign jurisdiction.

Interest expense. Interest expense increased by \$3.9 million, or 15%, from \$26.9 million in 2016 to \$30.8 million in 2017, primarily due to the increased effective interest rate on our Old Revolving Credit Facility.

Loss from discontinued operations. Loss from our discontinued operations decreased by \$120.7 million, or 95%, from \$127.0 million in 2016 to \$6.2 million in 2017. The decrease in loss was primarily due to a \$119.9 million impairment charge to align the carrying value of assets held for sale to their estimated fair value in 2016.

Benefit from income taxes. The following table summarizes the benefit for income taxes in 2017 and 2016:

	For the Year Ended December 31, 2017 (Dollars in thousands)	For the Year Ended December 31, 2016 (Dollars in thousands)
Tax benefit	\$(10,781)	\$(7,552)
Income (loss) from continuing operations before provision for income taxes	\$3,431	\$(116,421)
Effective tax rates	(314.2)%	6.5%

The effective tax rate for 2017 was (314.2)% and primarily reflects the release of \$16 million of valuation allowance reserve established against our GrafTech Switzerland net deferred tax assets. This effective tax rate also reflects a \$54.1 million charge related to the impact of the Tax Act that was recorded in the fourth quarter of 2017 but was offset by a release of a valuation allowance reserve on the deferred tax assets. The \$54.1 million charge includes a \$52.2 million charge related to the revaluation of our deferred tax assets and liabilities due to the reduction of the U.S. corporate tax rate and \$39.6 million of transition tax, partially offset by \$37.7 million of additional foreign tax credit related to the transition tax on unrepatriated earnings.

During 2016, the effective tax rate differed from the U.S. statutory rate of 35% primarily due to the losses incurred in the United States (and in Switzerland in 2016), where we receive no tax benefit due to a full valuation allowance, and taxes on worldwide earnings from various other countries. The recognition of the valuation allowance does not result in or limit our ability to utilize these tax assets in the future.

The tax expense changed from a benefit of \$7.6 million, for an effective tax rate of 6.5% for the year ended December 31, 2016 to a tax benefit of \$10.8 million for a (314)% effective rate for the year ended December 31, 2017. This change in the effective tax rate is primarily related to a shift in the jurisdictional mix of earnings and losses from year to year. Certain foreign jurisdictions shifted from pre-tax losses in 2016 to pre-tax earnings in 2017 (including Switzerland, where a tax benefit was reflected in the 2017 effective tax rate) while the contribution of U.S. pre-tax losses, for which we receive no tax benefit, decreased from 2016 to 2017. See Note 14 "Income Taxes" to the Consolidated Financial Statements for more information.

Production capacity

Our graphite electrode plant production capacity in 2017 was 195,000 MT including our St. Marys facility, which has been temporarily idled since the second quarter of 2016. Due to the idling of St. Marys, our production capacity declined to 176,000 MT in 2016 and 167,000 MT in 2017. This production capacity reduction concentrated our manufacturing capabilities at our lowest cost, highest efficiency facilities. This, coupled with a recovery in customer demand, resulted in an increase to our capacity utilization, excluding the St. Marys facility, from 85% in 2016 to 99% in 2017.

Effects of inflation

We incur costs in the United States and each of the non U.S. countries in which we have a manufacturing facility. In general, our results of operations, cash flows and financial condition are affected by the effects of inflation on our costs incurred in each of these countries.

Currency translation and transactions

We translate the assets and liabilities of our non U.S. subsidiaries into U.S. dollars for consolidation and reporting purposes in accordance with the Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC) 830, Foreign Currency Matters. Foreign currency translation adjustments are generally recorded as part of stockholders' equity and identified as part of accumulated other comprehensive loss on the Consolidated Balance Sheets until such time as their operations are sold or substantially or completely liquidated.

We account for our Russian, Swiss, Luxembourg and Mexican subsidiaries using the dollar as the functional currency, as sales and purchases are predominantly dollar denominated. Our remaining subsidiaries use their local currency as

their functional currency.

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We also record foreign currency transaction gains and losses from non permanent intercompany balances as part of cost of sales and other (income) expense, net.

Significant changes in currency exchange rates impacting us are described under “Effects of Changes in Currency Exchange Rates” and “Results of Operations.”

Liquidity and capital resources

Our sources of funds have consisted principally of cash flow from operations and debt, including our credit facilities (subject to continued compliance with the financial covenants and representations). Our uses of those funds (other than for operations) have consisted principally of dividends, capital expenditures, scheduled debt repayments, optional debt prepayments, share repurchases and other obligations. Disruptions in the U.S. and international financial markets could adversely affect our liquidity and the cost and availability of financing to us in the future.

We believe that we have adequate liquidity to meet our needs. As of December 31, 2018, we had liquidity of \$295.4 million consisting of \$245.5 million of availability on our 2018 Revolving Facility (subject to continued compliance with the financial covenants and representations) and cash and cash equivalents of \$49.9 million. We had long term debt of \$2,050.3 million and short term debt of \$106.3 million as of December 31, 2018. As of December 31, 2017, we had liquidity of \$165.2 million consisting of \$151.8 million available on our Old Revolving Facility (subject to compliance with the financial covenants and representations and adjusting for the \$25 million minimum liquidity requirement) and cash and cash equivalents of \$13.4 million. We had long term debt of \$322.9 million and short term debt of \$16.5 million as of December 31, 2017.

As of December 31, 2018 and 2017, \$38.4 million and \$12.6 million, respectively, of our cash and cash equivalents were located outside of the United States. We repatriate funds from our foreign subsidiaries through dividends. All of our subsidiaries face the customary statutory limitation that distributed dividends do not exceed the amount of retained and current earnings. In addition, for our subsidiary in South Africa, the South Africa Central Bank imposes that certain solvency and liquidity ratios remain above defined levels after the dividend distribution, which historically has not materially affected our ability to repatriate cash from this jurisdiction. The cash and cash equivalents balances in South Africa were \$0.2 million and \$1.8 million as of December 31, 2018 and December 31, 2017, respectively. Upon repatriation to the United States, the foreign source portion of dividends we receive from our foreign subsidiaries is no longer subject to U.S. federal income tax as a result of the Tax Act.

Cash flow and plans to manage liquidity. Our cash flow typically fluctuates significantly between quarters due to various factors. These factors include customer order patterns, fluctuations in working capital requirements, timing of capital expenditures and other factors. We had positive cash flow from operating activities during 2018, 2017 and 2016. Although the global economic environment experienced significant swings in these periods, our working capital management and cost control initiatives allowed us to remain operating cash flow positive in both times of declining and improving operating results. Cash from operations is expected to remain at positive sustained levels due to the predictable earnings generated by our three-to-five-year sales contracts with our customers.

As of December 31, 2018, we had access to the \$250 million 2018 Revolving Facility. We had \$4.5 million of letters of credit, for a total availability on the 2018 Revolving Facility of \$245.5 million. As of December 31, 2017, we had \$39.5 million of borrowings and \$8.7 million of letters of credit, for a total of \$48.2 million drawn against the Old Revolving Credit Facility. We also had \$0.5 million of surety bonds outstanding as of both December 31, 2018 and December 31, 2017.

On February 12, 2018, we entered into the 2018 Credit Agreement, which provides for the 2018 Revolving Facility and the 2018 Term Loan Facility. On February 12, 2018, our wholly owned subsidiary, GrafTech Finance, borrowed \$1,500 million under the 2018 Term Loan Facility. The funds received were used to pay off our outstanding debt, including borrowings under our Old Credit Agreement and the Senior Notes and accrued interest relating to those borrowings and the Senior Notes, declare and pay a dividend of \$1,112.0 million to our sole pre-IPO stockholder, pay fees and expenses incurred in connection therewith and for other general corporate purposes.

On April 19, 2018, we declared a dividend in the form of the Brookfield Promissory Note to the sole pre-IPO stockholder. The \$750 million Brookfield Promissory Note was conditioned upon (i) the Senior Secured First Lien Net Leverage Ratio (as defined in the 2018 Credit Agreement), as calculated based on our final financial results for the first quarter of 2018, being equal to or less than 1.75 to 1.00, (ii) no Default or Event of Default (each as defined in the 2018 Credit Agreement) having occurred and continuing or that would result from the \$750 million Brookfield

Promissory Note and (iii) the satisfaction of the conditions described in (i) and (ii) above occurring within 60 days from the dividend record date. Upon publication of our first quarter report on Form 10-Q, these conditions were met and, as a result, the Brookfield Promissory Note became payable.

The Brookfield Promissory Note had a maturity of eight years from the date of issuance and bore interest at a rate equal to the Adjusted LIBO Rate (as defined in the Brookfield Promissory Note) plus an applicable margin equal to 4.50% per annum,

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with an additional 2.00% per annum starting from the third anniversary from the date of issuance. We were permitted to make voluntary prepayments at any time without premium or penalty. All obligations under the Brookfield Promissory Note were unsecured and guaranteed by all of our existing and future domestic wholly owned subsidiaries that guarantee, or are borrowers under, the Senior Secured Credit Facilities. No funds were lent or otherwise contributed to us by Brookfield in connection with the Brookfield Promissory Note. As a result, we received no consideration in connection with its issuance. As described below, the Brookfield Promissory Note was repaid, in full, on June 15, 2018.

On April 19, 2018, we declared a \$160 million cash dividend payable to Brookfield, the sole pre-IPO stockholder. Payment of this dividend was conditional upon (i) the Senior Secured First Lien Net Leverage Ratio (as defined in the 2018 Credit Agreement), as calculated based on our final financial results for the first quarter of 2018, being equal to or less than 1.75 to 1.00, (ii) no Default or Event of Default (as defined in the 2018 Credit Agreement) having occurred and continuing or that would result from the payment of the dividend and (iii) the payment occurring within 60 days from the dividend record date. The conditions of this dividend were met upon filing of our first quarter report on Form 10-Q and the dividend was paid on May 8, 2018.

On June 15, 2018, GrafTech entered into the First Amendment to its 2018 Credit Agreement. The First Amendment amends the 2018 Credit Agreement to provide for the additional \$750 million in aggregate principal amount of the Incremental Term Loans to GrafTech Finance. The Incremental Term Loans increase the aggregate principal amount of term loans incurred by GrafTech Finance under the 2018 Credit Agreement from \$1,500 million to \$2,250 million. The Incremental Term Loans have the same terms as those applicable to the existing term loans under the 2018 Credit Agreement, including interest rate, payment and prepayment terms, representations and warranties and covenants. The Incremental Term Loans mature on February 12, 2025, the same date as the existing term loans. GrafTech paid an upfront fee of 1.00% of the aggregate principal amount of the Incremental Term Loans on the effective date of the First Amendment. The proceeds of the Incremental Term Loans were used to repay, in full, the \$750 million in principal outstanding on the Brookfield Promissory Note.

On August 13, 2018, the Company repurchased 11,688,311 shares directly from Brookfield. These shares were retired upon repurchase. The price per share paid by the Company was equal to the price at which the underwriters purchased the shares from Brookfield in Brookfield's August 2018 public secondary offering of 23,000,000 shares of our common stock, net of underwriting commissions and discounts. GrafTech funded the share repurchase from cash on hand.

We currently pay a quarterly cash dividend of \$0.085 per share, or an aggregate of \$0.34 per share on an annualized basis. For the quarterly period ending June 30, 2018, we paid a prorated cash dividend for the period beginning on the closing date of the IPO and ending on the last day of that period totaling \$19.5 million. On September 28, 2018, and December 31, 2018 we paid our regular quarterly dividend of \$.085 per share or \$24.7 million per quarter. Additionally, on December 31, 2018, we paid a special dividend of \$0.70 per share totaling \$203.4 million.

There can be no assurance that we will pay dividends in the future in these amounts or at all. Our Board of Directors may change the timing and amount of any future dividend payments or eliminate the payment of future dividends in its sole discretion, without any prior notice to our stockholders. Our ability to pay dividends will depend upon many factors, including our financial position and liquidity, results of operations, legal requirements, restrictions that may be imposed by the terms of our current and future credit facilities and other debt obligations and other factors deemed relevant by our Board of Directors.

Potential uses of our liquidity include dividends, share repurchases, capital expenditures, acquisitions, scheduled debt repayments, optional debt prepayments and other general purposes. Continued volatility in the global economy may require additional borrowings under the 2018 Revolving Facility. An improving economy, while resulting in improved results of operations, could increase our cash requirements to purchase inventories, make capital expenditures and fund payables and other obligations until increased accounts receivable are converted into cash. A downturn could significantly and negatively impact our results of operations and cash flows, which, coupled with increased borrowings, could negatively impact our credit ratings, our ability to comply with debt covenants, our ability to secure additional financing and the cost of such financing, if available.

On February 13, 2019, we repaid \$125 million on our 2018 Term Loan Facility. We currently expect debt repayments of approximately the same amount in future quarters of 2019.

In order to seek to minimize our credit risks, we may reduce our sales of, or refuse to sell (except for cash on delivery or under letters of credit or parent guarantees), our products to some customers and potential customers. Our unrecovered trade receivables worldwide have not been material during the last two years individually or in the aggregate.

We manage our capital expenditures by taking into account quality, plant reliability, safety, environmental and regulatory requirements, prudent or essential maintenance requirements, global economic conditions, available capital resources, liquidity, long term business strategy and return on invested capital for the relevant expenditures, cost of capital and return on invested capital of the Company as a whole and other factors.

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In the event that operating cash flows fail to provide sufficient liquidity to meet our business needs, including capital expenditures, any such shortfall would need to be made up by increased borrowings under our 2018 Revolving Facility, to the extent available.

Related Party Transactions

We have engaged in transactions with affiliates or related parties during the twelve months ended December 31, 2018. These transactions include payment of dividends to Brookfield and entrance into and repayment of the Brookfield Promissory Note, and entrance into the Tax Receivable Agreement, Stockholders Rights Agreement, Registration Rights Agreement and Share Repurchase Agreement, each with Brookfield. On August 13, 2018, in conjunction with a follow-on offering, we purchased 11,688,311 shares directly from Brookfield at a price of \$19.25 per share for a total of \$225 million. Additionally, during 2016, Brookfield purchased on the open market in aggregate approximately \$53 million of the Senior Notes. We redeemed our Senior Notes on February 12, 2018.

We have also reimbursed certain costs incurred by Brookfield as required under the Investment Agreement dated May 4, 2015 between Brookfield and GrafTech, including in connection with, transactions with our current or former subsidiaries, compensatory transactions with directors and officers including employee benefits (including reimbursement to Brookfield for compensation costs incurred by it for certain personnel who devote substantially all of their working time to us), stock option and restricted stock grants, compensation deferral, stock purchases, and customary indemnification and expense advancement arrangements.

One of our independent directors purchased an aggregate of 5,000 shares of common stock in April 2018 in our IPO. Another one of our independent directors purchase an aggregate of 3,750 shares of common stock in May and June 2018.

Cash flows

Cash flows include cash flows from both continuing and discontinued operations.

The following table summarizes our cash flow activities:

	For the Year Ended		
	December 31,		
	2018	2017	2016
	(Dollars in millions)		
Cash flow provided by (used in):			
Operating activities	\$836.6	\$36.6	\$22.8
Investing activities	(67.3)	(2.2)	(10.5)
Financing activities	(731.0)	(33.0)	(8.3)

Operating activities

Cash flow provided by (used in) operating activities represents cash receipts and cash disbursements related to all of our activities other than investing and financing activities. Operating cash flow is derived by adjusting net income (loss) for:

- Non-cash items such as depreciation and amortization; impairment, post-retirement obligations and pension plan changes;

- Gains and losses attributed to investing and financing activities such as gains and losses on the sale of assets and unrealized currency transaction gains and losses; and

- Changes in operating assets and liabilities which reflect timing differences between the receipt and payment of cash associated with transactions and when they are recognized in results of operations.

The net impact of the changes in working capital (operating assets and liabilities) include the impact of changes in: receivables, inventories, prepaid expenses, accounts payable, accrued liabilities, accrued taxes, interest payable and payments of other current liabilities.

In the year ended December 31, 2018, changes in working capital resulted in a net use of funds of \$177.8 million which was impacted by:

- use of funds of \$139.2 million from the increase in accounts receivable, which was due primarily to increased sales driven by higher sales prices, partially offset by improved collection terms;

use of funds from increases in inventory of \$126.4 million due to the increased price of raw materials and higher production levels;

- source of funds of \$7.1 million from decreased prepaid and other current assets primarily resulting from commodity hedge collections and a reduction in advanced payments to suppliers;

source of funds of \$67.1 million resulting from an increase in income taxes payable driven by higher profits in 2018;

- source of funds of \$15.7 million from increases in accounts payable and other accruals primarily driven by increased raw material costs.

Other uses of cash in the year ended December 31, 2018 included cash paid for interest of \$108.0 million, \$21.4 million of cash paid for taxes and contributions to pension and other benefit plans of \$7.5 million.

In the year ended December 31, 2017, changes in working capital resulted in a net use of funds of \$20.0 million which was impacted by:

- use of funds of \$29.8 million from the increase in accounts receivable, which was due primarily to increased sales driven by higher sales prices;

- use of funds from increases in inventory of \$15.6 million primarily due to the increased price of raw materials;

- use of funds of \$10.6 million from increased prepaid and other current assets resulting from increased value added tax receivables in foreign jurisdictions; and

- source of funds of \$36.4 million from increases in accounts payable and other accruals primarily driven by customer deposits associated with our new three to five year take or pay contracts and the timing of payments for other liabilities.

Other uses of cash in the year ended December 31, 2017 included contributions to pension and other benefit plans of \$8.8 million, cash paid for interest of \$25.3 million and \$3.5 million of cash paid for taxes.

In the year ended December 31, 2016, changes in working capital resulted in a net source of funds of \$68.6 million which was impacted by:

- source of funds of \$3.4 million from the decrease in accounts receivable, which was due primarily to the timing of sales and payment collections during the year;

- source of funds from inventory reductions of \$53.5 million primarily due to the planned reduction of inventory levels built up in prior years;

- source of funds of \$15.8 million from increases in accounts payable; and

- use of funds of \$2.8 million for the settlement of rationalization related liabilities.

Other uses of cash in the year ended December 31, 2016 included contributions to pension and other benefit plans of \$11.0 million, cash paid for interest of \$23.6 million and \$3.3 million of cash paid for taxes.

Investing activities

Net cash used in investing activities was \$67.3 million in the year ended December 31, 2018 and included capital expenditures of \$68.2 million partially offset by proceeds from the sale of fixed assets of \$0.9 million.

Net cash used in investing activities was \$2.2 million in the year ended December 31, 2017 and included capital expenditures of \$34.7 million, of which \$0.5 million were maintenance capital expenditures for discontinued operations. This use of cash was partially offset by cash proceeds from the sale of our Engineered Solutions businesses in 2017 of \$27.3 million and proceeds from the sale of fixed assets of \$5.2 million.

Net cash used in investing activities was \$10.5 million in the year ended December 31, 2016 and included capital expenditures of \$27.9 million, of which \$4.7 million were maintenance capital expenditures for discontinued operations, proceeds

from the sale of fixed assets of \$1.1 million and cash inflows of \$15.9 million from the divestiture of our Fiber Materials Inc. business.

Financing activities

Net cash outflow from financing activities was \$731.0 million during the year ended December 31, 2018, which was the net impact of our February 12, 2018 refinancing and subsequent amendment, proceeds of which were used to repay outstanding debt, pay dividends of \$1,112 million to Brookfield and repay the \$750 million Brookfield Promissory Note to Brookfield. We also repurchased \$225 million of our common stock from Brookfield on August 13, 2018. Since our IPO, we have paid a conditional dividend of \$160 million to Brookfield, quarterly dividends on common stock of \$68.9 million and a special dividend on common stock of \$203.4 million.

Net cash used in financing activities was \$33.0 million for the year ended December 31, 2017, resulting from net payments on our Old Revolving Credit Facility.

Net cash used in financing activities was \$8.3 million in the year ended December 31, 2016 and included net payments on our Old Revolving Credit Facility of \$7.1 million and net payments of \$0.9 million for refinancing fees. As a part of our cash management activities, we manage accounts receivable credit risk, collections, and accounts payable vendor terms to maximize our free cash at any given time and minimize accounts receivable losses.

Financing transactions

Old Credit Facility

On April 23, 2014, the Company and certain of its subsidiaries entered into an Amended and Restated Credit Agreement ("Old Credit Agreement") with a borrowing capacity of \$400 million and a maturity date of April 2019 ("Old Revolving Facility"). On February 27, 2015, GrafTech and certain of its subsidiaries entered into a further Amended and Restated Credit Agreement that provided for, among other things, greater financial flexibility and a \$40 million senior secured delayed draw term loan facility (the "Old Term Loan Facility"). The Old Revolving Facility and Old Term Loan Facility both had maturity dates of April 2019.

On July 28, 2015, the Company and certain of its subsidiaries entered into an amendment to the Amended and Restated Credit Agreement to change the terms regarding the occurrence of a default upon a change in control (which was defined thereunder to include the acquisition by any person of more than 25 percent of the Company's outstanding shares) to exclude the acquisition of shares by Brookfield. In addition, effective upon such acquisition, the financial covenants were eased, resulting in increased availability under the Old Revolving Facility. The size of the Old Revolving Facility was also reduced from \$400 million to \$375 million. The size of the Old Term Loan Facility remained at \$40 million.

On April 27, 2016, the Company and certain of its subsidiaries entered into an amendment to the Old Revolving Facility. The size of the Old Revolving Facility was permanently reduced from \$375 million to \$225 million. New covenants were also added to the Old Revolving Facility, including a requirement to make mandatory repayments of outstanding amounts under the Old Revolving Facility and the Old Term Loan Facility with the proceeds of any sale of all or any substantial part of the assets included in the Engineered Solutions segment and a requirement to maintain minimum liquidity (consisting of domestic cash, cash equivalents and availability under the Old Revolving Facility) in excess of \$25 million. The covenants were also modified to provide for: the elimination of certain exceptions to the Company's negative covenants limiting the Company's ability to make certain investments, sell assets, make restricted payments, incur liens, incur debt and prepay or redeem other indebtedness; a restriction on the amount of cash and cash equivalents permitted to be held on the balance sheet at any one time without paying down the Old Revolving Facility and the Old Term Loan Facility; and changes to the Company's financial covenants so that until the earlier of March 31, 2019 or the Company had \$75 million in trailing twelve month EBITDA (as defined in the Old Revolving Facility), the Company was required to maintain trailing twelve month EBITDA above certain minimums ranging from (\$40 million) to \$35 million, after which the Company's existing financial covenants under the Old Revolving Facility would apply.

With this amendment, the Company had full access to the \$225 million Old Revolving Facility, subject to the \$25 million minimum liquidity requirement. As of December 31, 2017, the Company had \$39.5 million of borrowings on the Old Revolving Facility and \$8.7 million of letters of credit drawn against the Old Credit Facility.

The \$40 million Old Term Loan Facility was fully drawn on August 11, 2015. The balance of the Old Term Loan Facility was \$18.7 million as of December 31, 2017.

The interest rate applicable to the Old Revolving Facility and Old Term Loan Facility was LIBOR plus a margin ranging from 2.25% to 4.75% (depending on the Company's total senior secured leverage ratio). The borrowers paid a per annum fee ranging from 0.35% to 0.70% (depending on the Company's senior secured leverage ratio) on the undrawn portion of the commitments under the Old Revolving Facility.

As described below, the outstanding indebtedness under the Old Revolving Credit Facility and the Old Term Loan was repaid as of February 12, 2018 and all commitments thereunder have been terminated.

Refinancing

On February 12, 2018, the Company entered into a credit agreement (the "2018 Credit Agreement") among the Company, GrafTech Finance Inc., a Delaware corporation and a wholly owned subsidiary of GrafTech ("GrafTech Finance"), GrafTech Switzerland SA, a Swiss corporation and a wholly owned subsidiary of GrafTech ("Swissco"), GrafTech Luxembourg II S.à.r.l., a Luxembourg société à responsabilité limitée and a wholly owned subsidiary of GrafTech ("Luxembourg Holdco" and, together with GrafTech Finance and Swissco, the "Co Borrowers"), the lenders and issuing banks party thereto and JPMorgan Chase Bank, N.A. as administrative agent (the "Administrative Agent") and as collateral agent, which provides for (i) a \$1,500 million senior secured term facility (the "2018 Term Loan Facility") and (ii) a \$250 million senior secured revolving credit facility (the "2018 Revolving Credit Facility" and, together with the 2018 Term Loan Facility, the "Senior Secured Credit Facilities"), which may be used from time to time for revolving credit borrowings denominated in dollars or Euro, the issuance of one or more letters of credit denominated in dollars, Euro, Pounds Sterling or Swiss Francs and one or more swing line loans denominated in dollars. GrafTech Finance is the sole borrower under the 2018 Term Loan Facility while GrafTech Finance, Swissco and Lux Holdco are Co Borrowers under the 2018 Revolving Credit Facility. On February 12, 2018, GrafTech Finance borrowed \$1,500 million under the 2018 Term Loan Facility (the "2018 Term Loans"). The 2018 Term Loans mature on February 12, 2025. The maturity date for the 2018 Revolving Credit Facility is February 12, 2023.

The proceeds of the 2018 Term Loans were used to (i) repay in full all outstanding indebtedness of the Co Borrowers under the Old Credit Agreement and terminate all commitments thereunder, (ii) redeem in full the Senior Notes at a redemption price of 101.594% of the principal amount thereof plus accrued and unpaid interest to the date of redemption, (iii) pay fees and expenses incurred in connection with (i) and (ii) above and the Senior Secured Credit Facilities and related expenses, and (iv) declare and pay a dividend to the sole pre-IPO stockholder, with any remainder to be used for general corporate purposes. See Note 8 "Interest Expense" for a breakdown of expenses associated with these repayments. In connection with the repayment of the Old Credit Agreement and redemption of the Senior Notes, all guarantees of obligations under the Old Credit Agreement, the Senior Notes and related indenture were terminated, all mortgages and other security interests securing obligations under the Old Credit Agreement were released and the Old Credit Agreement and the indenture were terminated.

Borrowings under the 2018 Term Loan Facility bear interest, at GrafTech Finance's option, at a rate equal to either (i) the Adjusted LIBO Rate (as defined in the 2018 Credit Agreement), plus an applicable margin initially equal to 3.50% per annum or (ii) the ABR Rate (as defined in the 2018 Credit Agreement), plus an applicable margin initially equal to 2.50% per annum, in each case with one step down of 25 basis points based on achievement of certain public ratings of the 2018 Term Loans.

Borrowings under the 2018 Revolving Credit Facility bear interest, at the applicable Co Borrower's option, at a rate equal to either (i) the Adjusted LIBO Rate, plus an applicable margin initially equal to 3.75% per annum or (ii) the ABR Rate, plus an applicable margin initially equal to 2.75% per annum, in each case with two 25 basis point step downs based on achievement of certain senior secured first lien net leverage ratios. In addition, the Co Borrowers will be required to pay a quarterly commitment fee on the unused commitments under the 2018 Revolving Credit Facility in an amount equal to 0.25% per annum.

For borrowings under both the 2018 Term Loan Facility and the 2018 Revolving Credit Facility, if the Administrative Agent determines that adequate and reasonable means do not exist for ascertaining the Adjusted LIBO Rate or the LIBO Rate and such circumstances are unlikely to be temporary or the relevant authority has made a public statement identifying a date after which the LIBO Rate shall no longer be used for determining interest rates for loans, then the Administrative Agent and the Co-Borrowers shall endeavor to establish an alternate rate of interest, which shall be

effective so long as the majority in interest of the lenders for each Class (as defined in the 2018 Credit Agreement) of loans under the 2018 Credit Agreement do not notify the Administrative Agent otherwise. Until such an alternate rate of interest is determined, (a) any request for a borrowing denominated in dollars based on the Adjusted LIBO Rate will be deemed to be a request for a borrowing at the ABR Rate plus the applicable margin for an ABR Rate borrowing of such loan while any request for a borrowing denominated in any other currency will be ineffective and (b) any outstanding borrowings based on the Adjusted LIBO Rate denominated in dollars will be converted to a borrowing at the ABR Rate plus the applicable margin for an ABR Rate borrowing of such loan while any outstanding borrowings denominated in any other currency will be repaid.

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All obligations under the 2018 Credit Agreement are guaranteed by GrafTech, GrafTech Finance and each domestic subsidiary of GrafTech, subject to certain customary exceptions, and all obligations under the 2018 Credit Agreement of each foreign subsidiary of GrafTech that is a Controlled Foreign Corporation (within the meaning of Section 956 of the Internal Revenue Code of 1986, as amended from time to time (the "Code")) are guaranteed by GrafTech Luxembourg I S.à.r.l., a Luxembourg société à responsabilité limitée and an indirect wholly owned subsidiary of GrafTech ("Luxembourg Parent"), Luxembourg Holdco and Swiseco (collectively, the "Guarantors").

All obligations under the 2018 Credit Agreement are secured, subject to certain exceptions and Excluded Assets (as defined in the 2018 Credit Agreement), by: (i) a pledge of all of the equity securities of GrafTech Finance and each domestic Guarantor (other than GrafTech) and of each other direct, wholly owned domestic subsidiary of GrafTech and any Guarantor, (ii) a pledge on no more than 65% of the equity interests of each subsidiary that is a Controlled Foreign Corporation (within the meaning of Section 956 of the Code), and (iii) security interests in, and mortgages on, personal property and material real property of GrafTech Finance and each domestic Guarantor, subject to permitted liens and certain exceptions specified in the 2018 Credit Agreement. The obligations of each foreign subsidiary of GrafTech that is a Controlled Foreign Corporation under the 2018 Revolving Credit Facility are secured by (i) a pledge of all of the equity securities of each Guarantor that is a Controlled Foreign Corporation and of each direct, wholly owned subsidiary of any Guarantor that is a Controlled Foreign Corporation, and (ii) security interests in certain receivables and personal property of each Guarantor that is a Controlled Foreign Corporation, subject to permitted liens and certain exceptions specified in the 2018 Credit Agreement.

The 2018 Term Loans amortize at a rate equal to 5% per annum of the original principal amount of the 2018 Term Loans payable in equal quarterly installments, with the remainder due at maturity. The Co Borrowers are permitted to make voluntary prepayments at any time without premium or penalty, except in the case of prepayments made in connection with certain repricing transactions with respect to the 2018 Term Loans effected within twelve months of the closing date of the 2018 Credit Agreement, to which a 1.00% prepayment premium applies. GrafTech Finance is required to make prepayments under the 2018 Term Loans (without payment of a premium) with (i) net cash proceeds from non ordinary course asset sales (subject to customary reinvestment rights and other customary exceptions and exclusions), and (ii) commencing with the Company's fiscal year ending December 31, 2019, 75% of Excess Cash Flow (as defined in the 2018 Credit Agreement), subject to step downs to 50% and 0% of Excess Cash Flow based on achievement of a senior secured first lien net leverage ratio greater than 1.25 to 1.00 but less than or equal to 1.75 to 1.00 and less than or equal to 1.25 to 1.00, respectively. Scheduled quarterly amortization payments of the 2018 Term Loans during any calendar year reduce, on a dollar for dollar basis, the amount of the required Excess Cash Flow prepayment for such calendar year, and the aggregate amount of Excess Cash Flow prepayments for any calendar year reduce subsequent quarterly amortization payments of the 2018 Term Loans as directed by GrafTech Finance.

The 2018 Credit Agreement contains customary representations and warranties and customary affirmative and negative covenants applicable to GrafTech and restricted subsidiaries, including, among other things, restrictions on indebtedness, liens, investments, fundamental changes, dispositions, and dividends and other distributions. The 2018 Credit Agreement contains a financial covenant that requires GrafTech to maintain a senior secured first lien net leverage ratio not greater than 4.00:1.00 when the aggregate principal amount of borrowings under the 2018 Revolving Credit Facility and outstanding letters of credit issued under the 2018 Revolving Credit Facility (except for undrawn letters of credit in an aggregate amount equal to or less than \$35 million), taken together, exceed 35% of the total amount of commitments under the 2018 Revolving Credit Facility. The 2018 Credit Agreement also contains customary events of default.

Brookfield Promissory Note

On April 19, 2018, we declared a dividend in the form of a \$750 million promissory note (the "Brookfield Promissory Note") to the sole pre-IPO stockholder. The \$750 million Brookfield Promissory Note was conditioned upon (i) the Senior Secured First Lien Net Leverage Ratio (as defined in the 2018 Credit Agreement), as calculated based on our final financial results for the first quarter of 2018, being equal to or less than 1.75 to 1.00, (ii) no Default or Event of Default (each as defined in the 2018 Credit Agreement) having occurred and continuing or that would result from the \$750 million Brookfield Promissory Note and (iii) the satisfaction of the conditions occurring within 60 days from the dividend record date. Upon publication of our first quarter report on Form 10-Q, these conditions were met and, as a

result, the Brookfield Promissory Note became payable.

The Brookfield Promissory Note had a maturity of eight years from the date of issuance and bore interest at a rate equal to the Adjusted LIBO Rate (as defined in the Brookfield Promissory Note) plus an applicable margin equal to 4.50% per annum, with an additional 2.00% per annum starting from the third anniversary from the date of issuance. We were permitted to make voluntary prepayments at any time without premium or penalty. All obligations under the Brookfield Promissory Note were unsecured and guaranteed by all of our existing and future domestic wholly owned subsidiaries that guarantee, or are borrowers under, the Senior Secured Credit Facilities. No funds were lent or otherwise contributed to us by the pre-IPO stockholder in

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connection with the Brookfield Promissory Note. As a result, we received no consideration in connection with its issuance. As described below, the Promissory Note was repaid in full on June 15, 2018.

First Amendment to 2018 Credit Agreement

On June 15, 2018, the Company entered into a first amendment (the "First Amendment") to its 2018 Credit Agreement. The First Amendment amended the 2018 Credit Agreement to provide for an additional \$750 million in aggregate principal amount of incremental term loans (the "Incremental Term Loans") to GrafTech Finance. The Incremental Term Loans increased the aggregate principal amount of term loans incurred by GrafTech Finance under the 2018 Credit Agreement from \$1,500 million to \$2,250 million. The Incremental Term Loans have the same terms as those applicable to the 2018 Term Loans, including interest rate, payment and prepayment terms, representations and warranties and covenants. The Incremental Term Loans mature on February 12, 2025, the same date as the 2018 Term Loans. GrafTech paid an upfront fee of 1.00% of the aggregate principal amount of the Incremental Term Loans on the effective date of the First Amendment.

The proceeds of the Incremental Term Loans were used to repay, in full, the \$750 million of principal outstanding on the Brookfield Promissory Note.

Fixed rate obligations

As of December 31, 2018, all of our debt was based on variable interest rates. As of December 31, 2017, approximately 83% of our debt consisted of fixed rate or zero interest rate obligations.

Long-Term Contractual, Commercial and Other Obligations and Commitments. The following tables summarize our long-term contractual obligations and other commercial commitments as of December 31, 2018.

	Payments Due by Year Ending December 31,				
	Total	2019	2020-2021	2022-2023	2024+
	(Dollars in Thousands)				
Contractual and Other Obligations					
2018 Term Loan Facility (a)	\$2,194,642	\$112,644	\$225,287	\$225,287	\$1,631,424
Interest on Long-term Debt (b)	720,695	131,830	250,884	223,719	114,262
Leases	9,665	4,474	4,244	604	343
Total contractual obligations	2,925,002	248,948	480,415	449,610	1,746,029
Postretirement, pension and related benefits (c)	117,117	11,732	23,165	23,061	59,159
Committed purchase obligations (d)	53,000	53,000	—	—	—
Related party Tax Receivable Agreement (e)	86,478	—	44,380	30,381	11,717
Other long-term obligations	11,149	5,966	3,966	78	1,139
Uncertain income tax provisions	1,990	1,990	—	—	—
Total contractual and other obligations (f)	\$3,194,736	\$321,636	\$551,926	\$503,130	\$1,818,044
Other Commercial Commitments					
Guarantees (g)	932	932	—	—	—
Total other commercial commitments	\$932	\$932	\$—	\$—	\$—

The Company entered into the 2018 Credit Agreement, which provided for the 2018 Term Loan Facility and 2018 Revolving Credit Facility. The proceeds of the 2018 Term Loan Facility were used to redeem the Senior Notes, repay outstanding indebtedness under the amended and restated credit agreement dated February 27, 2015, pay fees and expenses relating to the redemption of the Senior Notes and repayment of such indebtedness and pay a

(a) dividend. The 2018 Term Loan Facility has an outstanding balance of \$2,194 million and matures on February 12, 2025. The term loan bears interest at a rate equal to either the Adjusted LIBO Rate, plus an applicable margin initially equal to 3.50% per annum or the ABR Rate, plus an applicable margin initially equal to 2.50% per annum, in each case with one step down of 75 basis points based on achievement of certain public ratings of the 2018 Term Loans (see "Liquidity and Capital Resources" for full details of this transaction).

(b) Represented estimated interest payments required on 2018 Term Loan Facility using a monthly LIBOR curve through February 2025.

(c) Represents estimated postretirement, pension and related benefits obligations based on actuarial calculations.

(d) Represents committed purchases of raw materials.

Represents Brookfield's right to receive future payments from us for 85% of the amount of cash savings, if any, in (e)U.S. federal income tax and Swiss tax that we and our subsidiaries realize as a result of the utilization of certain tax assets attributable

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to periods prior to our IPO, including certain federal net operating losses ("NOLs"), previously taxed income under Section 959 of the Code, foreign tax credits, and certain NOLs in Swissco (collectively, the "Pre IPO Tax Assets"). In addition, we will pay interest on the payments we will make to Brookfield with respect to the amount of these cash savings from the due date (without extensions) of our tax return where we realize these savings to the payment date at a rate equal to LIBOR plus 1.00% per annum. The term of the TRA commenced on April 23, 2018 and will continue until there is no potential for any future tax benefit payments.

(f) In addition, letters of credit of \$4.5 million were issued under the Revolving Facility as of December 31, 2018.

(g) Represents surety bonds, which are renewed annually, and other bank guarantees. If rates were unfavorable, we would use letters of credit under our revolving facility.

Off Balance sheet arrangements and commitments. We have not undertaken or been a party to any material off balance sheet financing arrangements or other commitments (including non exchange traded contracts), other than:

- The notional amount of foreign exchange and commodity contracts;

- Commitments under non cancelable operating leases that, as of December 31, 2018, totaled no more than \$4.5 million in each year and \$9.7 million in the aggregate and as of December 31, 2018;

- Letters of credit outstanding under the Revolving Facility of \$4.5 million as of December 31, 2018 and \$8.7 million as of December 31, 2017; and

- Surety bonds and guarantees with other banks totaling \$0.9 million

We are not affiliated with or related to any special purpose entity other than GrafTech Finance.

Costs Relating to Protection of the Environment

We have been and are subject to increasingly stringent environmental protection laws and regulations. In addition, we have an on going commitment to rigorous internal environmental protection standards. Environmental considerations are part of all significant capital expenditure decisions. The following table sets forth certain information regarding environmental expenses and capital expenditures.

	For the Year Ended		
	December 31,		
	2018	2017	2016
	(Dollars in thousands)		
Expenses relating to environmental protection	\$12,355	\$7,973	\$8,255
Capital expenditures related to environmental protection	4,080	2,080	1,693

Critical accounting policies

Critical accounting policies are those that require difficult, subjective or complex judgments by management, often as a result of the need to make estimates about the effect of matters that are inherently uncertain and may change in subsequent periods. We use and rely on estimates in determining the economic useful lives of our assets, obligations under our employee benefit plans, provisions for doubtful accounts, provisions for restructuring charges and contingencies, tax valuation allowances, evaluation of goodwill, other intangible assets, pension and postretirement benefit obligations and various other recorded or disclosed amounts, including inventory valuations. Estimates require us to use our judgment. While we believe that our estimates for these matters are reasonable, if the actual amount is significantly different than the estimated amount, our assets, liabilities or results of operations may be overstated or understated. The following accounting policies are deemed to be critical.

Business combinations and goodwill. The application of the purchase method of accounting for business combinations requires the use of significant estimates and assumptions in the determination of the fair value of assets acquired and liabilities assumed in order to properly allocate purchase price consideration between goodwill and assets that are depreciated and amortized. Our estimates of the fair values of assets and liabilities acquired are based on assumptions believed to be reasonable and, when appropriate, include assistance from independent third party appraisal firms.

As a result of our acquisition by Brookfield, we have a significant amount of goodwill. Goodwill is tested for impairment annually or more frequently if an event or circumstance indicates that an impairment loss may have been incurred. Application of the goodwill impairment test requires judgment, including the identification of reporting

units, assignment of assets and liabilities

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to reporting units, assignment of goodwill to reporting units and determination of the fair value of each reporting unit. We estimate the fair value of each reporting unit using a discounted cash flow methodology. This requires us to use significant judgment including estimation of future cash flows, which is based upon relevant market data, internal forecasts, estimation of the long term growth for our business, the useful life over which cash flows will occur and determination of the weighted average cost of capital for purposes of establishing a discount rate.

Refer to Note 1, "Business and Summary of Significant Accounting Policies", of the Notes to the Consolidated Financial Statements for information regarding our goodwill impairment testing.

Employee benefit plans. We sponsor various retirement and pension plans, including defined benefit and defined contribution plans and postretirement benefit plans that cover most employees worldwide. Excluding the defined contribution plans, accounting for these plans requires assumptions as to the discount rate, expected return on plan assets, expected salary increases and health care cost trend rate. See Note 12, "Retirement Plans and Postretirement Benefits", of the Notes to the Consolidated Financial Statements for further details.

Impairments of long lived assets. We record impairment losses on long lived assets used in operations when events and circumstances indicate that the assets might be impaired and the future undiscounted cash flows estimated to be generated by those assets are less than the carrying amount of those assets. Assets to be disposed are reported at the lower of the carrying amount or fair value less estimated costs to sell. Estimates of the future cash flows are subject to significant uncertainties and assumptions. If the actual value is significantly less than the estimated fair value, our assets may be overstated. Future events and circumstances, some of which are described below, may result in an impairment charge:

- new technological developments that provide significantly enhanced benefits over our current technology;
- significant negative economic or industry trends;
- changes in our business strategy that alter the expected usage of the related assets; and
- future economic results that are below our expectations used in the current assessments.

Accounting for income taxes. When we prepare the Consolidated Financial Statements, we are required to estimate our income taxes in each of the jurisdictions in which we operate. This process requires us to make the following assessments:

- estimate our actual current tax liability in each jurisdiction;
- estimate our temporary differences resulting from differing treatment of items for tax and accounting purposes (which result in deferred tax assets and liabilities that we include within the Consolidated Balance Sheets); and
- assess the likelihood that our deferred tax assets will be recovered from future taxable income and, if we believe that recovery is not more likely than not, a valuation allowance is established.

If our estimates are incorrect, our deferred tax assets or liabilities may be overstated or understated.

As of December 31, 2018, we had a valuation allowance of \$58.4 million against certain deferred tax assets. Our losses in certain tax jurisdictions in recent periods represented sufficient negative evidence to require a full valuation allowance. Until we determine that we will generate sufficient jurisdictional taxable income to realize our net operating losses and deferred tax assets, we continue to maintain a valuation allowance.

Revenue recognition. We adopted FASB ASC 606 effective January 1, 2018 and elected the modified retrospective transition method. Under this method, any cumulative effect of applying the new revenue standard for contracts not yet complete is recorded as an adjustment to the opening balance of retained earnings as of the beginning of 2018. The comparative information for prior years will not be revised and will continue to be reported under the accounting standards in effect for the period presented. See "Recent Accounting Pronouncements."

Under ASC 606, an entity recognizes revenue when its customer obtains control of promised goods or services, in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that we determine are within the scope of ASC 606, the following five steps are performed: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract;

(iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) we satisfy a performance obligation. We only apply the five step model to contracts when it is probable that we will collect the consideration we are entitled to in exchange for the goods or services we transfer to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, we assess the goods or services promised within each contract and determine those that are performance obligations, and assess whether each promised good or service is distinct. We then recognize as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

In 2018, our revenue streams consisted of three to five year take or pay supply contracts and short term binding and non binding purchase orders (deliveries within the year) directly with steel manufacturers. In 2017, our revenue streams consisted primarily of annual non binding purchase orders. The promises of delivery of graphite electrodes represent the distinct performance obligations to which the contract consideration is allocated, based upon the electrode stand alone selling prices for the class of customers at the time the agreements are executed. The performance obligations are considered to be satisfied at a point in time when control of the electrodes has been transferred to the customer. The company has elected to treat the transportation of the electrodes from our premises to the customer's facilities as a fulfillment activity, and outbound freight cost is accrued when the graphite electrode performance obligation is satisfied. Any variable consideration is recognized up to its unconstrained amount, i.e., up to the amount for which it is probable that a significant reversal of the variable revenue will not happen.

Discontinued operations and assets held for sale. When management commits to a plan to sell assets or asset groups and a sale is probable, we reclassify those assets or asset groups into "Assets Held for Sale." Upon reclassification to assets held for sale, we evaluate the book value of the disposal groups against their fair value, less costs to sell, and as a result may impair the assets or asset groups. As and if new information becomes available on the fair value of the assets or asset groups, we may adjust the impairment accordingly. For example, during 2016, we evaluated the fair value of the Engineered Solutions business segment utilizing the market approach (Level 3 measure). As a result, we incurred an impairment charge to our Engineered Solutions business segment of \$119.9 million to align the carrying value with estimated fair value. We continued to update this estimate and during 2017, we further reduced the estimated fair value by \$5.3 million based upon then-current information.

Once the assets of a business have been classified as held for sale, we evaluate if the divestiture represents a strategic shift in operations and if so, we exclude the results of this business from continuing operations. All results are reported as gain or loss from discontinued operations, net of tax. During the second quarter of 2016, our Engineered Solutions segment qualified as discontinued operations and as such, all results from that segment have been excluded from operations. See Note 3, "Discontinued Operations and Related Assets Held for Sale", of the Notes to the Consolidated Financial Statements.

Recent accounting pronouncements

Recently Adopted Accounting Standards

In May 2014, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") No. 2014-09, Revenue from Contracts with Customers (Topic 606) . The Company adopted ASU 2014-09 and its related amendments (collectively known as ASC 606) effective on January 1, 2018 using the modified retrospective method. Please see Note 2 "Revenue from Contracts with Customers" for the required disclosures related to the impact of adopting this standard and a discussion of the Company's updated policies related to revenue recognition.

In August 2016, the FASB issued ASU No. 2016-15, Statement of Cash Flows (Topic 230), Classification of Certain Cash Receipts and Payments, clarifying guidance on the classification of certain cash receipts and payments in the statement of cash flows. The adoption of ASU 2016-15 on January 1, 2018 did not have a material impact on our consolidated financial statements.

In March 2017, the FASB issued ASU No. 2017-07, Compensation-Retirement Benefits (Topic 715). This standard requires an entity to report the service cost component in the same line item as other compensation costs. The other components of net (benefit) cost, including our annual mark-to-market remeasurement, will be presented in the income statement separately from the service cost component and outside a subtotal of income from operations. The adoption of ASU No. 2017-07 on January 1, 2018 changed the presentation of benefit expenses, but did not have a material impact on our consolidated financial statements. The components of the net (benefit) cost are shown in Note

12, "Retirement Plans and Postretirement Benefits." The following table summarizes the adjustments made to conform prior period classifications to the new guidance:

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	For the Year Ended December 31, 2017			For the Year Ended December 31, 2016		
	As Reported	Effect of Accounting Change	As Adjusted	As Reported	Effect of Accounting Change	As Adjusted
Cost of Sales	\$462,848	\$ 206	\$463,054	\$466,990	\$ 1,212	\$468,202
Research and development	2,951	505	3,456	2,399	135	2,534
Selling and administrative expenses	49,479	3,027	52,506	57,784	731	58,515
Other (income) expense, net	1,634	(3,738)	(2,104)	(2,188)	(2,078)	(4,266)

Accounting Standards Not Yet Adopted

In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842). Under this new guidance, a company will now recognize most leases on its balance sheet as lease liabilities with corresponding right-of-use assets. This ASU is effective for fiscal years beginning after December 15, 2018. The Company plans to adopt ASU No. 2016-02 on January 1, 2019, using the modified retrospective approach with the option of not restating comparative prior periods presented in the financial statements. Under this method, we will recognize the effects of applying ASC 842 as a cumulative-effect adjustment to the opening balance of retained earnings as of the effective date of adoption of January 1, 2019. The Company has completed its evaluation of the contracts. We anticipate additional assets and liabilities of approximately \$10 million to be recorded as a result with no material adjustment to retained earnings required.

In January 2017, the FASB issued ASU No. 2017-04, Intangibles—Goodwill and Other (Topic 350). This guidance was issued to simplify the accounting for goodwill impairment. The guidance removes the second step of the goodwill impairment test, which requires that a hypothetical purchase price allocation be performed to determine the amount of impairment, if any. Under this new guidance, a goodwill impairment charge will be based on the amount by which a reporting unit's carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. The guidance will become effective on a prospective basis for the Company on January 1, 2020 with early adoption permitted for interim or annual goodwill impairment tests performed on testing dates after January 1, 2017. The adoption of this standard is not expected to have a material effect on the Company's financial position, results of operations or cash flows.

Item 7A. Quantitative and qualitative disclosures about market risk

We are exposed to market risks, primarily from changes in interest rates, currency exchange rates, energy commodity prices and commercial energy rates. From time to time, we enter into transactions that have been authorized according to documented policies and procedures in order to manage these risks. These transactions relate primarily to financial instruments described below. Since the counterparties to these financial instruments are large commercial banks and similar financial institutions, we do not believe that we are exposed to material counterparty credit risk. We do not use financial instruments for trading purposes.

Our exposure to changes in interest rates results primarily from floating rate long term debt tied to LIBOR or Euro LIBOR.

Our exposure to changes in currency exchange rates results primarily from:

- sales made by our subsidiaries in currencies other than local currencies;
- raw material purchases made by our foreign subsidiaries in currencies other than local currencies;
- and

investments in and intercompany loans to our foreign subsidiaries and our share of the earnings of those subsidiaries, to the extent denominated in currencies other than the U.S. dollar.

Our exposure to changes in energy commodity prices and commercial energy rates results primarily from the purchase or sale of refined oil products and the purchase of natural gas and electricity for use in our manufacturing operations.

Interest rate risk management. We periodically enter into agreements with financial institutions that are intended to limit our exposure to additional interest expense due to increases in variable interest rates. These instruments effectively cap our interest rate exposure. We currently do not have any such instruments outstanding.

Currency rate management. We enter into foreign currency derivatives from time to time to attempt to manage exposure to changes in currency exchange rates. These foreign currency derivatives, which include, but are not limited to, forward exchange contracts and purchased currency options, attempt to hedge global currency exposures. Forward exchange contracts are agreements to exchange different currencies at a specified future date and at a specified rate. Purchased currency options are instruments which

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give the holder the right, but not the obligation, to exchange different currencies at a specified rate at a specified date or over a range of specified dates. Forward exchange contracts and purchased currency options are carried at market value.

The outstanding foreign currency derivatives represented no net unrealized gain or loss as of December 31, 2018, and a net unrealized loss of \$0.1 million as of December 31, 2017.

Energy commodity management. We have entered into commodity derivative contracts to effectively fix some or all of our exposure to refined oil products. The outstanding commodity derivative contracts represented a net unrealized loss of \$10.7 million and net unrealized gain of \$4.7 million as of December 31, 2018 and December 31, 2017, respectively.

Sensitivity analysis. We use sensitivity analysis to quantify potential impacts that market rate changes may have on the underlying exposures as well as on the fair values of our derivatives. The sensitivity analysis for the derivatives represents the hypothetical changes in value of the hedge position and does not reflect the related gain or loss on the forecasted underlying transaction.

We had no interest rate derivative instruments outstanding as of December 31, 2018. A hypothetical increase in interest rates of 100 basis points (1%) would have increased our interest expense by \$18.1 million for the year ended December 31, 2018.

As of December 31, 2018, a 10% appreciation or depreciation in the value of the U.S. dollar against foreign currencies from the prevailing market rates would result in a corresponding decrease of \$0.6 million or a corresponding increase of \$0.6 million, respectively, in the fair value of the foreign currency hedge portfolio.

A 10% increase or decrease in the value of the underlying commodity prices that we hedge would result in a corresponding increase or decrease of \$14.2 million in the fair value of the commodity hedge portfolio as of December 31, 2018. Because of the high correlation between the hedging instrument and the underlying exposure, fluctuations in the value of the instruments are generally offset by reciprocal changes in the value of the underlying exposure.

For further information related to the financial instruments described above, see Note 1 "Business and Summary of Accounting Policies" and Note 9 "Fair Value Measurement and Derivative Instruments" to the Consolidated Financial Statements in Item 8.

Loss of Emerging Growth Company Status

On December 31, 2018, as a result of our total annual gross revenues in 2018 having exceeded \$1.07 billion, we ceased to be an "emerging growth company" as defined in Section 2(a) of the Securities Act, as modified by the Jumpstart Our Business Startups Act of 2012 (the "JOBS Act"). As an emerging growth company, we were able to take advantage of certain specified reduced disclosure and other requirements, but beginning in 2019, we are now subject to the disclosure requirements generally applicable to public companies.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies; however, we had already irrevocably elected not to avail ourselves of this exemption.

Item 8. Financial Statements and Supplementary Data

(Unless otherwise noted, all dollars are presented in thousands)

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See the Table of Contents located at the beginning of this Report for more detailed page references to information contained in this Item.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the stockholders and the Board of Directors of GrafTech International Ltd.:

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of GrafTech International Ltd. and its subsidiaries (the "Company") as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive income (loss), stockholders' equity (deficit), and cash flows for each of the three years in the period ended December 31, 2018, and the related notes (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, 2018 and 2017, and the results of its operations and its cash flows for the three years in the period ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America.

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 Public Company Accounting Oversight Board (United States) (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. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits, we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ DELOITTE & TOUCHE LLP

Cleveland, Ohio

February 22, 2019

We have served as the Company's auditor since 2015.

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

(Dollars in thousands, except share data)

	As of December 31,	
	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	\$49,880	\$13,365
Accounts and notes receivable, net of allowance for doubtful accounts of \$1,129 as of December 31, 2018 and \$1,097 as of December 31, 2017	248,286	116,841
Inventories	293,717	174,151
Prepaid expenses and other current assets	46,168	44,872
Current assets of discontinued operations	—	5,313
Total current assets	638,051	354,542
Property, plant and equipment	688,842	642,651
Less: accumulated depreciation	175,137	129,810
Net property, plant and equipment	513,705	512,841
Deferred income taxes	71,707	30,768
Goodwill	171,117	171,117
Other assets	110,911	129,835
Total assets	\$1,505,491	\$1,199,103
LIABILITIES AND STOCKHOLDERS' EQUITY (DEFICIT)		
Current liabilities:		
Accounts payable	\$88,097	\$69,110
Short-term debt	106,323	16,474
Accrued income and other taxes	82,255	9,737
Other accrued liabilities	50,452	53,226
Current liabilities of discontinued operations	—	3,412
Total current liabilities	327,127	151,959
Long-term debt	2,050,311	322,900
Other long-term obligations	72,519	68,907
Deferred income taxes	45,825	41,746
Related party payable	86,478	—
Long-term liabilities of discontinued operations	—	376
Commitments and Contingencies – Notes 11 and 13		
Stockholders' (deficit) equity:		
Preferred stock, par value \$0.01, 300,000,000 shares authorized, none issued	—	—
Common stock, par value \$0.01, 3,000,000,000 shares authorized, 290,537,612 and 302,225,923 shares issued and outstanding as of December 31, 2018 and December 31, 2017*, respectively	2,905	3,022
Additional paid – in capital	819,622	851,315
Accumulated other comprehensive (loss) income	(5,800)	20,289
Accumulated deficit	(1,893,496)	(261,411)
Total stockholders' (deficit) equity	(1,076,769)	613,215
Total liabilities and stockholders' equity (deficit)	\$1,505,491	\$1,199,103

* See Notes 1 and 15

See accompanying Notes to the Consolidated Financial Statements

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE INCOME (LOSS)

(Dollars in thousands, except per share data)

	For the Year Ended December 31,		
	2018	2017	2016
Net sales	\$1,895,910	\$ 550,771	\$ 437,963
Cost of sales	705,698	461,545	449,228
Additions to lower of cost or market inventory reserve	—	1,509	18,974
Gross profit (loss)	1,190,212	87,717	(30,239)
Research and development	2,129	3,456	2,534
Selling and administrative expenses	62,032	52,506	58,515
Impairment of long-lived assets and goodwill	—	—	2,843
Operating income (loss)	1,126,051	31,755	(94,131)
Other expense (income), net	3,361	(2,104)	(4,266)
Related party Tax Receivable Agreement expense	86,478	—	—
Interest expense	135,061	30,823	26,914
Interest income	(1,657)	(395)	(358)
Income (loss) from continuing operations before provision (benefit) for income taxes	902,808	3,431	(116,421)
Provision (benefit) for income taxes	48,920	(10,781)	(7,552)
Net income (loss) from continuing operations	853,888	14,212	(108,869)
Income (loss) from discontinued operations, net of tax*	331	(6,229)	(126,974)
Net income (loss)	\$854,219	\$ 7,983	\$ (235,843)
Basic income (loss) per share:			
Net income (loss) per share	\$2.87	\$ 0.03	\$ (0.78)
Net Income (loss) from continuing operations per share	2.87	0.05	(0.36)
Weighted average shares outstanding	297,748,327	302,225,923	302,225,923
Diluted income (loss) per share:			
Net income (loss) per share	2.87	0.03	(0.78)
Diluted net income (loss) from continuing operations per share	2.87	0.05	(0.36)
Weighted average diluted shares outstanding	297,753,770	302,225,923	302,225,923

STATEMENTS OF COMPREHENSIVE INCOME (LOSS)

Net income (loss)	\$854,219	\$ 7,983	\$ (235,843)
Other comprehensive income (loss):			
Foreign currency translation adjustments, net of tax of (\$288), \$0, and \$0, respectively	(18,391)	23,028	2,574
Commodities and foreign currency derivatives and other, net of tax of \$802, \$0, and (\$20), respectively	(7,698)	4,819	125
Other comprehensive (loss) income, net of tax:	(26,089)	27,847	2,699
Comprehensive income (loss)	\$828,130	\$ 35,830	\$ (233,144)

* Loss on discontinued operations includes a pretax impairment charge of \$119,907 in the year ended December 31, 2016. See Note 3 "Discontinued Operations and Related Assets Held for Sale"

See accompanying Notes to the Consolidated Financial Statements

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF CASH FLOWS

(Dollars in thousands)

	For the Year Ended December		
	31,		
	2018	2017	2016
Cash flow from operating activities:			
Net income (loss)	\$854,219	\$7,983	\$(235,843)
Adjustments to reconcile net income (loss) to cash provided by operations:			
Depreciation and amortization	66,413	66,443	82,891
Impairment of long-lived assets	—	5,300	122,750
Related party Tax Receivable Agreement expense	86,478	—	—
Deferred income tax provision	(37,078)	(15,695)	(12,062)
Loss on extinguishment of debt	23,827	—	—
Non-cash interest expense	5,320	6,805	6,551
Other charges, net	15,761	(9,607)	(735)
Net change in working capital*	(177,754)	(20,004)	68,630
Change in long-term assets and liabilities	(583)	(4,652)	(9,367)
Net cash provided by operating activities	836,603	36,573	22,815
Cash flow from investing activities:			
Capital expenditures	(68,221)	(34,664)	(27,858)
Cash received from divestitures	—	27,254	15,889
Derivative instrument settlements, net	—	—	377
Proceeds from the sale of fixed assets	926	5,211	1,121
Net cash used in investing activities	(67,295)	(2,199)	(10,471)
Cash flow from financing activities:			
Short-term debt (reductions) borrowings, net	(12,607)	5,110	7,363
Credit Facility borrowings	—	77,000	56,000
Credit Facility reductions	(45,692)	(114,839)	(70,469)
Proceeds from the issuance of long-term debt, net of original issue discount	2,235,000	—	—
Repayment of Senior Notes	(304,782)	—	—
Repurchase of common stock	(225,000)	—	—
Principal payments on long-term debt	(56,372)	(266)	(289)
Dividends paid to non-related-party	(55,616)	—	—
Dividends paid to related-party	(1,488,649)	—	—
Related-party promissory note repayment	(750,000)	—	—
Refinancing fees and debt issuance costs	(27,326)	—	(922)
Net cash (used in) provided by financing activities	(731,044)	(32,995)	(8,317)
Net change in cash and cash equivalents	38,264	1,379	4,027
Effect of exchange rate changes on cash and cash equivalents	(1,749)	376	656
Cash and cash equivalents at beginning of period	13,365	11,610	6,927
Cash and cash equivalents at end of period	\$49,880	\$13,365	\$11,610

See accompanying Notes to the Consolidated Financial Statements

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF CASH FLOWS (Continued)
(Dollars in thousands)

	For the Year Ended December		
	31,		
	2018	2017	2016
Supplemental disclosures of cash flow information:			
Net cash paid during the periods for:			
Interest	\$108,006	\$25,277	\$23,578
Income taxes	21,444	3,467	3,329
Non-cash financing activities:			
Dividend payable - Promissory Note**	750,000	—	—
* Net change in working capital due to the following components:			
Accounts and notes receivable, net	\$(139,180)	\$(29,755)	\$3,432
Inventories	(126,355)	(15,649)	53,548
Prepaid expenses and other current assets	7,116	(10,565)	(1,424)
Income taxes payable	67,054	2,762	313
Accounts payable and accruals	15,724	33,317	12,686
Interest payable	(2,113)	(114)	75
(Increase) decrease in working capital	\$(177,754)	\$(20,004)	\$68,630

**During the second quarter of 2018, we declared a \$750 million dividend in the form of a Promissory Note that was a non-cash transaction. See Note 7 "Debt and Liquidity" for details.

See accompanying Notes to the Consolidated Financial Statements

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY (DEFICIT)

(Dollars in thousands, except share data)

	Issued Shares of Common Stock	Common Stock	Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Retained Earnings (Accumulated Deficit)	Total Stockholders' Equity (Deficit)
Balance as of December 31, 2015	302,225,923	\$ 3,022	\$ 851,315	\$ (10,257)	\$ (33,551)	\$ 810,529
Net loss	—	—	—	—	(235,843)	(235,843)
Other comprehensive income (loss):						
Commodity and foreign currency derivatives income (loss), net of tax of \$0	—	—	—	—	—	—
Commodity and foreign currency derivatives reclassification adjustments, net of tax of (\$20)	—	—	—	125	—	125
Foreign currency translation adjustments, net of tax of \$0	—	—	—	2,574	—	2,574
Total other comprehensive income	—	—	—	2,699	—	2,699
Balance as of December 31, 2016	302,225,923	\$ 3,022	\$ 851,315	\$ (7,558)	\$ (269,394)	577,385
Net income	—	—	—	—	7,983	7,983
Other comprehensive income (loss):						
Commodity and foreign currency derivatives income (loss), net of tax of \$0	—	—	—	4,819	—	4,819
Commodity and foreign currency derivatives reclassification adjustments, net of tax of \$0	—	—	—	—	—	—
Foreign currency translation adjustments, net of tax of \$0	—	—	—	23,028	—	23,028
Total other comprehensive income	—	—	—	27,847	—	27,847
Balance as of December 31, 2017	302,225,923	\$ 3,022	\$ 851,315	\$ 20,289	\$ (261,411)	\$ 613,215
Net income	—	—	—	—	854,219	854,219
Other comprehensive income (loss):						
Commodity and foreign currency derivatives income (loss), net of tax of \$715	—	—	—	(6,866)	—	(6,866)
Commodity and foreign currency derivatives reclassification adjustments, net of tax of \$87	—	—	—	(832)	—	(832)
Foreign currency translation adjustments, net of tax of (\$288)	—	—	—	(18,391)	—	(18,391)
Total other comprehensive loss	—	—	—	(26,089)	—	(26,089)
Common stock repurchased and retired (from related party)	(11,688,311)	(117)	(32,844)	—	(192,039)	(225,000)

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Stock based compensation	—	—	1,151	—	—	1,151
Dividends paid to related party stockholder	—	—	—	—	(1,488,649)	(1,488,649)
Related-party promissory note repayment					(750,000)	(750,000)
Dividends paid to non-related party stockholders	—	—	—	—	(55,616)	(55,616)
Balance as of December 31, 2018	290,537,612	\$ 2,905	\$ 819,622	\$ (5,800)	\$ (1,893,496)	\$ (1,076,769)

See accompanying Notes to the Consolidated Financial Statements

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GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

(Dollars in thousands, except as otherwise noted)

(1) Business and Summary of Significant Accounting Policies

Discussion of Business and Structure

GrafTech International Ltd. (the "Company") is a leading manufacturer of high quality graphite electrode products essential to the production of electric arc furnace steel and other ferrous and non-ferrous metals. References herein to "GTI," "we," "our," or "us" refer collectively to GrafTech International Ltd. and its subsidiaries. On August 15, 2015, GTI became an indirect wholly owned subsidiary of Brookfield Asset Management Inc. ("Brookfield") through a tender offer to our former stockholders and subsequent merger transaction.

The Company's only reportable segment, Industrial Materials, is comprised of our two major product categories: graphite electrodes and needle coke products. Needle coke is the key raw material to producing graphite electrodes. The Company's vision is to provide the highest quality graphite electrodes at the lowest cost while providing the best customer service all while striving to be the lowest cost producer.

We previously operated an Engineered Solutions business segment. See Note 3 "Discontinued Operations and Assets Held for Sale" for further information. All results from the Engineered Solutions business have been excluded from continuing operations, unless otherwise indicated.

Summary of Significant Accounting Policies

The Consolidated Financial Statements include the financial statements of GrafTech International Ltd. and its wholly owned subsidiaries. All intercompany transactions have been eliminated in consolidation.

Cash Equivalents

We consider all highly liquid financial instruments with original maturities of three months or less to be cash equivalents. Cash equivalents consist of certificates of deposit, money market funds and commercial paper.

Revenue Recognition

The Company adopted ASC 606 on January 1, 2018. The adoption of ASC 606 represents a change in accounting principle that will more closely align revenue recognition with the delivery of the Company's goods and will provide financial statement readers with enhanced disclosures. The reported results for 2018 reflect the application of ASC 606 guidance while the reported results for 2017 and prior were prepared under the guidance of ASC 605, Revenue Recognition (ASC 605), which is also referred to herein as the "previous revenue guidance".

Prior to the adoption of ASC 606, revenue from sales of our commercial products was recognized when they met four basic criteria (1) persuasive evidence of an arrangement existed, (2) delivery had occurred, (3) the amount was determinable and (4) collection was reasonably assured. Sales were recognized when both title and the risks and rewards of ownership were transferred to the customer or services had been rendered and fees had been earned in accordance with the contract.

In accordance with ASC 606, revenue is recognized when a customer obtains control of promised goods. The amount of revenue recognized reflects the consideration to which the Company expects to be entitled to receive in exchange for these goods. See Note 2 "Revenue from Contracts with Customers" for more information.

Inventories

Inventories are stated at the lower of cost or market. Cost is principally determined using the "first-in first-out" ("FIFO") and average cost, which approximates FIFO, methods. Elements of cost in inventory include raw materials, direct labor and manufacturing overhead.

We allocate fixed production overheads to the costs of conversion based on normal capacity of the production facilities. We recognize abnormal amounts of idle facility expense, freight, handling costs, and wasted materials (spoilage) as current period charges.

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

Property, Plant and Equipment

Expenditures for property, plant and equipment are recorded at cost. Maintenance and repairs of property and equipment are expensed as incurred. Expenditures for replacements and betterments are capitalized and the replaced assets are retired. Gains and losses from the sale of property are included in cost of sales or other expense (income), net. We depreciate our assets using the straight-line method over the estimated useful lives of the assets. The ranges of estimated useful lives are as follows:

	Years
Buildings	25-40
Land improvements	20
Machinery and equipment	5-20
Furniture and fixtures	5-10

The carrying value of fixed assets is assessed when events and circumstances indicating impairment are present. Recoverability of assets to be held and used is measured by a comparison of the carrying amount of the assets to future undiscounted net cash flows expected to be generated by the assets. If the assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the assets exceeds the fair value of the assets. Assets to be disposed of are reported at the lower of the carrying amount or fair value less costs to sell.

Depreciation expense was \$53.5 million, \$50.4 million, and \$63.4 million in 2018, 2017 and 2016, respectively. Capital expenditures within accounts payable totaled \$13.7 million and \$13.6 as of December 31, 2018 and 2017, respectively.

Accounts Receivable

Trade accounts receivable primarily arise from sales of goods to customers and distributors in the normal course of business.

Allowance for Doubtful Accounts

Judgment is required in assessing the likelihood of collection of receivables, including the current creditworthiness of each customer, related aging of the past due balances and the facts and circumstances surrounding any non-payment. We evaluate specific accounts when we become aware of a situation where a customer may not be able to meet its financial obligations. The reserve requirements are based on the best facts available to us and are reevaluated and adjusted as additional information is received. Receivables are charged off when amounts are determined to be uncollectible.

Capitalized Bank Fees

We capitalize bank fees upon the incurrence of debt and record them as a contra-liability against our debt. We had capitalized bank fees of \$24.3 million and \$0.4 million as of December 31, 2018 and 2017, respectively. We amortize such amounts over the life of the respective debt instrument using the effective interest method. The estimated life may be adjusted upon the occurrence of a triggering event. Amortization of capitalized bank fees amounted to \$3.5 million and \$0.3 million and \$0.2 million in 2018, 2017 and 2016, respectively. Capitalized bank fee amortization is included in interest expense.

Derivative Financial Instruments

We do not use derivative financial instruments for trading purposes. They are used to manage well-defined commercial risks associated with commodity purchases and currency exchange rate risks. On the date that a derivative contract for a hedging instrument is entered into, the Company designates the derivative as either (1) a hedge of the exposure to changes in the fair value of a recognized asset or liability or of an unrecognized firm commitment (a fair value hedge), (2) a hedge of the exposure of a forecasted transaction or of the variability in the cash flows of a recognized asset or liability (a cash flow hedge), (3) a hedge of a net investment in a foreign operation (a net investment hedge) or 4) a contract not designated as a hedging instrument.

For a fair value hedge, both the effective and ineffective portions of the change in the fair value of the derivative are recorded in earnings and reflected in the Consolidated Statement of Operations on the same line as the gain or loss on the hedged item attributable to the hedged risk. For a cash flow hedge, the effective portion of the

change in the fair value of the derivative is recorded in accumulated other comprehensive loss in the consolidated balance sheet. When the underlying hedged transaction is realized, the gain or loss included in accumulated other comprehensive loss is recorded in earnings and reflected in the Consolidated Statement of Operations on the same line as the gain or loss on the hedged item attributable to the hedged risk. For a net investment hedge, the effective portion of the change in the fair value of the derivative is recorded in cumulative translation adjustment, which is a component of accumulated other comprehensive loss in the consolidated balance sheet.

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GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

We formally document our hedge relationships, including the identification of the hedging instruments and the related hedged items, as well as our risk management objectives and strategies for undertaking the hedge transaction. Derivatives are recorded at fair value in other current and long-term assets and other current and long-term liabilities in the consolidated balance sheet. We also formally assess, both at inception and at least quarterly thereafter, whether a derivative used in a hedging transaction is highly effective in offsetting changes in either the fair value or the cash flows of the hedged item. When it is determined that a derivative ceases to be highly effective, we discontinue hedge accounting.

Foreign Currency Derivatives

We enter into foreign currency derivatives from time to time to manage exposure to changes in currency exchange rates. These instruments, which include, but are not limited to, forward exchange contracts and purchased currency options, attempt to hedge global currency exposures, relating to non-dollar denominated debt and identifiable foreign currency receivables, payables and commitments held by our foreign and domestic subsidiaries. Forward exchange contracts are agreements to exchange different currencies at a specified future date and at a specified rate. Purchased foreign currency options are instruments which give the holder the right, but not the obligation, to exchange different currencies at a specified rate at a specified date or over a range of specified dates. The result is the creation of a range in which a best and worst price is defined, while minimizing option cost. Forward exchange contracts and purchased currency options are carried at fair value.

These contracts may be designated as Cash-Flow or Fair Value hedges to the extent that they are effective and are accounted for as described in section above (“Derivative Financial Instruments”). For derivatives that are not designated as a hedge, any gain or loss is immediately recognized in Cost of Sales on the Consolidated Statements of Operations. Derivatives used in this manner relate to risks resulting from assets or liabilities denominated in a foreign currency.

Commodity Derivative Contracts

We have entered into derivative contracts for refined oil products. These contracts are entered into to protect against the risk that eventual cash flows related to these products will be adversely affected by future changes in prices. All commodity contracts are carried at fair value and are treated as hedges to the extent they are effective. Changes in their fair values are included in accumulated other comprehensive income (loss) in the Consolidated Balance Sheets until settlement. Realized gains and losses resulting from settlement are recognized in accumulated other comprehensive income (loss) and are recorded in cost of sales on the Consolidated Statements of Operations when the underlying hedged item is realized.

Research and Development

Expenditures relating to the development of new products and processes, including significant improvements to existing products, are expensed as incurred.

Income Taxes

We file a consolidated United States (“U.S.”) federal income tax return for GTI and its eligible domestic subsidiaries. Our non-U.S. subsidiaries file income tax returns in their respective local jurisdictions. We account for income taxes under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to temporary differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and tax benefit carry forwards. Deferred tax assets and liabilities at the end of each period are determined using enacted tax rates. A valuation allowance is established or maintained, when, based on currently available information and other factors, it is more likely than not that all or a portion of a deferred tax asset will not be realized.

Under the guidance on accounting for uncertainty in income taxes, we recognize the benefit from an uncertain tax position only if it is more likely than not that the tax position will be sustained on examination by taxing authorities, based on the technical merits of the position. The tax benefits recognized in the financial statements from such a position are measured based on the largest benefit that has a greater than fifty percent likelihood of being realized upon ultimate settlement. The guidance on accounting for uncertainty in income taxes also provides guidance on derecognition, classification, interest and penalties on income taxes, and accounting in interim periods.

As a result of the enactment of the Tax Act of 2017, the Company is required to make an accounting policy election of either (1) treating taxes due on future U.S. inclusions in taxable income related to Global Intangible Low Tax Income ("GILTI") as a current period expense when incurred (the "period cost method") or (2) factoring such amounts into the Company's measurement of its deferred taxes (the "deferred method"). The Company's accounting policy will be to treat taxes due on future U.S. inclusions in taxable income related to GILTI as a current period expense when incurred. See Note 14 "Income Taxes" for more information.

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GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

Retirement Plans and Postretirement Benefits

We use actuarial methods and assumptions to account for our defined benefit pension plans and our postretirement benefits. We immediately recognize the change in the fair value of plan assets and net actuarial gains and losses annually in the fourth quarter of each year with a mark-to-market adjustment ("MTM Adjustment") and whenever a plan is remeasured (e.g. due to a significant curtailment, settlement, etc.). Pension and postretirement benefits expense includes the MTM adjustment, actuarially computed cost of benefits earned during the current service period, the interest cost on accrued obligations, the expected return on plan assets based on fair market values, and adjustments due to plan settlements and curtailments. Contributions to the qualified U.S. retirement plan are made in accordance with the requirements of the Employee Retirement Income Security Act of 1974.

Postretirement benefits and benefits under the non-qualified retirement plan have been accrued, but not funded. The estimated cost of future postretirement life insurance benefits is determined by the Company with assistance from independent actuarial firms using the "projected unit credit" actuarial cost method. Such costs are recognized as employees render the service necessary to earn the postretirement benefits. We record our balance sheet position based on the funded status of the plan.

Additional information with respect to benefits plans is set forth in Note 12, "Retirement Plans and Postretirement Benefits."

Environmental, Health and Safety Matters

Our operations are governed by laws addressing protection of the environment and worker safety and health. These laws provide for civil and criminal penalties and fines, as well as injunctive and remedial relief, for noncompliance and require remediation at sites where hazardous substances have been released into the environment.

We have been in the past, and may become in the future, the subject of formal or informal enforcement actions or proceedings regarding noncompliance with these laws or the remediation of company-related substances released into the environment. Historically, such matters have been resolved by negotiation with regulatory authorities resulting in commitments to compliance, abatement or remediation programs and in some cases payment of penalties.

Historically, neither the commitments undertaken nor the penalties imposed on us have been material.

Environmental considerations are part of all significant capital expenditure decisions. Environmental remediation, compliance and management expenses were approximately \$12.4 million, \$8.0 million and \$8.3 million in 2018, 2017 and 2016, respectively. A charge to income is recorded when it is probable that a liability has been incurred and the cost can be reasonably estimated. When payments are fixed or determinable, the liability is discounted using a rate at which the payments could be effectively settled. The accrued liability relating to environmental remediation was \$4.2 million as of December 31, 2018 and \$2.1 million as of December 31, 2017. The increase in the liability was the result of a revised estimate for asset retirement obligations related to landfills.

Our environmental liabilities do not take into consideration possible recoveries of insurance proceeds. Because of the uncertainties associated with environmental remediation activities at sites where we may be potentially liable, future expenses to remediate sites could be considerably higher than the accrued liability.

Foreign Currency Translation and Remeasurement

We translate the financial statements of foreign subsidiaries, whose local currency is their functional currency, to U.S. dollars using period-end exchange rates for assets and liabilities and weighted average exchange rates for each period for revenues, expenses, gains and losses. Differences arising from exchange rate changes are included in accumulated other comprehensive loss on the Consolidated Balance Sheets until such time as the operations of such non-U.S. subsidiaries are sold or substantially or completely liquidated.

For our Mexican, Swiss and Russian subsidiaries, whose functional currency is the U.S. dollar, we remeasure non-monetary balance sheet accounts and the related income statement accounts at historical exchange rates.

Resulting gains and losses arising from the fluctuations in currency for monetary accounts are recognized in other (income) expense, net, in the Consolidated Statements of Operations. Gains and losses arising from fluctuations in currency exchange rates on transactions denominated in currencies other than the functional currency are recognized in earnings as incurred.

We have non-dollar denominated intercompany loans between some of our foreign subsidiaries. These loans are subject to remeasurement gains and losses due to changes in currency exchange rates. Certain of these loans had been deemed to be essentially permanent prior to settlement and, as a result, remeasurement gains and losses on these loans were recorded as a component of accumulated other comprehensive income (loss) in the stockholders' equity section of the Consolidated Balance Sheets. The remaining loans are deemed to be temporary and, as a result, remeasurement gains and losses on these loans are recorded as currency (gains/losses) in other (income) expense, net, on the Consolidated Statements of Operations.

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GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

Goodwill and Other Intangible Assets

Goodwill is the excess of the acquisition cost of businesses over the fair value of the identifiable net assets acquired. We do not recognize deferred income taxes for the difference between the assigned value and the tax basis related to nondeductible goodwill. Goodwill is not amortized; however, impairment testing is performed annually or more frequently if circumstances indicate that impairment may have occurred. We perform the annual goodwill impairment test at December 31.

The annual goodwill impairment testing may begin with a qualitative assessment of potential impairment indicators in order to determine whether it is necessary to perform the two-step goodwill impairment test.

The impairment test for goodwill uses a two-step approach, which is performed at the reporting unit level. Step one compares the fair value of the reporting unit to its carrying value. The fair value for each reporting unit with goodwill is determined in accordance with accounting guidance on determining fair value, which requires consideration of the income, market, and cost approaches as applicable. If the carrying value exceeds the fair value, there is potential impairment and step two must be performed. Step two compares the carrying value of the reporting unit's goodwill to its implied fair value (i.e., fair value of the reporting unit less the fair value of the unit's assets and liabilities, including identifiable intangible assets). If the implied fair value of goodwill is less than the carrying amount of goodwill, an impairment is recognized.

Other amortizable intangible assets, which consist primarily of trademarks and trade names, customer-related intangibles and technological know-how, are amortized over their estimated useful lives using the straight line or sum-of-the-years digits method. The estimated useful lives for each major category of amortizable intangible assets are:

	Years
Trade name	5-10
Technology and know-how	5-9
Customer related intangible	5-14

Additional information about goodwill and other intangibles is set forth in Note 6 "Goodwill and Other Intangible Assets."

Major Maintenance and Repair Costs

We perform scheduled major maintenance of the storage and processing units at our Seadrift plant (referred to as "overhaul"). Time periods between overhauls vary by unit. We also perform an annual scheduled significant maintenance and repair shutdown of the plant (referred to as "turnaround").

Costs of overhauls and turnarounds include plant personnel, contract services, materials, and rental equipment. We defer these costs when incurred and use the straight-line method to amortize them over the period of time estimated to lapse until the next scheduled overhaul of the applicable storage or processing unit. Under this policy \$9.8 million was deferred in 2018 and no costs were deferred in 2017. Amortization of deferred maintenance costs totaled \$3.1 million, \$3.3 million and \$7.0 million in 2018, 2017 and 2016, respectively.

Earnings per share

The calculation of basic earnings per share is based on the number of common shares outstanding after giving effect to the stock split effected on April 12, 2018 and common stock repurchase on August 13, 2018. Diluted earnings per share recognizes the dilution that would occur if stock options or restricted shares were exercised or converted into common shares. See Note 15 "Earnings Per Share".

Use of Estimates

The preparation of financial statements in conformity with U.S. generally accepted accounting principles ("GAAP") requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent liabilities at the date of the Consolidated Financial Statements and the reported amounts of revenue and expenses. Significant estimates and assumptions are used for, but are not limited to inventory valuation, pension and other post-retirement benefits, allowance for doubtful accounts, contingent liabilities, accruals and valuation allowances, asset impairment, and environmental-related accruals. Actual results could differ from our estimates.

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

Discontinued Operations and Assets Held for Sale

When Management commits to a plan to sell assets or asset groups and a sale is probable, we reclassify those assets or asset groups into "Assets Held for Sale". Upon reclassification to assets held for sale, we evaluate the book value of the disposal groups against their fair value less costs to sell and as a result may impair the assets / asset groups. As and if new information becomes available on the fair value of the assets/asset groups, we may adjust accordingly the impairment.

Once the assets of a business have been classified as held for sale, we evaluate if the divestiture represents a strategic shift in operations and if so, we exclude the results of this business from continuing operations. All results are reported as gain or loss from discontinued operations, net of tax. During the second quarter of 2016, our Engineered Solutions business qualified as discontinued operations and as such, all its results have been excluded from continuing operations. See Note 3 "Discontinued Operations and Related Assets Held for Sale".

Subsequent Events

We evaluate events that occur after the balance sheet date but before financial statements are issued to determine if a material event requires our amending the financial statements or disclosing the event. See Note 18 "Subsequent Events" for further details.

Recent Accounting Standards

Recently Adopted Accounting Standards

In May 2014, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") No. 2014-09, Revenue from Contracts with Customers (Topic 606). The Company adopted ASU 2014-09 and its related amendments (collectively known as ASC 606) effective on January 1, 2018 using the modified retrospective method. Please see Note 2 "Revenue from Contracts with Customers" for the required disclosures related to the impact of adopting this standard and a discussion of the Company's updated policies related to revenue recognition.

In August 2016, the FASB issued ASU No. 2016-15, Statement of Cash Flows (Topic 230), Classification of Certain Cash Receipts and Payments, clarifying guidance on the classification of certain cash receipts and payments in the statement of cash flows. The adoption of ASU 2016-15 on January 1, 2018 did not have a material impact on our consolidated financial statements.

In March 2017, the FASB issued ASU No. 2017-07, Compensation-Retirement Benefits (Topic 715). This standard requires an entity to report the service cost component in the same line item as other compensation costs. The other components of net (benefit) cost, including our annual mark-to-market remeasurement, will be presented in the income statement separately from the service cost component and outside a subtotal of income from operations. The adoption of ASU No. 2017-07 on January 1, 2018 changed the presentation of benefit expenses, but did not have a material impact on our consolidated financial statements. The components of the net (benefit) cost are shown in Note 12, "Retirement Plans and Postretirement Benefits." The following table summarizes the adjustments made to conform prior period classifications to the new guidance:

	For the Year Ended December 31, 2017		For the Year Ended December 31, 2016			
	As Reported	Effect of Accounting Change	As Adjusted	As Reported	Effect of Accounting Change	As Adjusted
Cost of Sales	\$461,339	\$ 206	\$461,545	\$448,016	\$ 1,212	\$449,228
Research and development	2,951	505	3,456	2,399	135	2,534
Selling and administrative expenses	49,479	3,027	52,506	57,784	731	58,515
Other (income) expense, net	1,634	(3,738)	(2,104)	(2,188)	(2,078)	(4,266)

Accounting Standards Not Yet Adopted

In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842). Under this new guidance, a company will now recognize most leases on its balance sheet as lease liabilities with corresponding right-of-use assets. This ASU is effective for fiscal years beginning after December 15, 2018. The Company plans to adopt ASU No. 2016-02 on

January 1, 2019, using the modified retrospective approach with the option of not restating comparative prior periods presented in the financial statements.

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Under this method, we will recognize the effects of applying ASC 842 as a cumulative-effect adjustment to the opening balance of retained earnings as of the effective date of adoption of January 1, 2019. The Company has completed its evaluation of the contracts. We anticipate additional assets and liabilities of approximately \$10 million to be recorded as a result with no material adjustment to retained earnings required.

In January 2017, the FASB issued ASU No. 2017-04, Intangibles—Goodwill and Other (Topic 350). This guidance was issued to simplify the accounting for goodwill impairment. The guidance removes the second step of the goodwill impairment test, which requires that a hypothetical purchase price allocation be performed to determine the amount of impairment, if any. Under this new guidance, a goodwill impairment charge will be based on the amount by which a reporting unit's carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. The guidance will become effective on a prospective basis for the Company on January 1, 2020 with early adoption permitted for interim or annual goodwill impairment tests performed on testing dates after January 1, 2017. The adoption of this standard is not expected to have a material effect on the Company's financial position, results of operations or cash flows.

(2) Revenue from Contracts with Customers

The Company adopted ASC 606 on January 1, 2018. The adoption of ASC 606 represents a change in accounting principle that will more closely align revenue recognition with the delivery of the Company's goods and will provide financial statement readers with enhanced disclosures. The reported results for 2018 reflect the application of ASC 606 guidance while the reported results for 2017 and 2016 were prepared under the guidance of ASC 605, Revenue Recognition (ASC 605), which is also referred to herein as the "previous revenue guidance".

Financial Statement Impact of Adopting ASC 606

The Company adopted ASC 606 effective January 1, 2018 using the modified retrospective method. Under this method, we could elect to apply the cumulative effect method to either all contracts as of the date of initial application or only to contracts that are not complete as of that date. We elected to apply the modified retrospective method to contracts that are not complete as of the date of initial application. The cumulative effect of applying the new guidance to all contracts with customers that were not completed as of January 1, 2018 was to be recorded as an adjustment to accumulated deficit as of the adoption date. As a result of using the modified retrospective method, there were no adjustments that were made to accounts on the Company's consolidated balance sheet as of January 1, 2018.

Impact of the adoption of ASC 606 on accounting policies

In accordance with ASC 606, revenue is recognized when a customer obtains control of promised goods. The amount of revenue recognized reflects the consideration to which the Company expects to be entitled to receive in exchange for these goods.

To achieve this core principle, the following five steps are performed: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) we satisfy a performance obligation.

The Company sells the majority of its products directly to steel manufacturers located in various jurisdictions. The Company's contracts consist of longer-term take-or-pay sales contracts of graphite electrodes with terms of up to five years and short-term purchase orders (deliveries within one year). Collectability is assessed based on the customer's ability and intention to pay, reviewing a variety of factors including the customer's historical payment experience and published credit and financial information. Additionally, for multi-year contracts, we may require the customer to post a bank guarantee, guarantee of a parent, a letter of credit or a significant pre-payment.

The promises of delivery of graphite electrodes represent the distinct performance obligations of our contracts. A small portion of our sales consist of deliveries of by-products of the manufacturing processes, such as graphite powders, naphtha and gasoil.

Given their nature, the Company's performance obligations are satisfied at a point in time when control of the products has been transferred to the customer. In most cases, control transfer is deemed to happen at the delivery point of the products defined under the incoterms, usually at time of loading the truck or the vessel. The Company has elected to

treat the transportation activity as a fulfilment activity instead of as a distinct performance obligation, and outbound freight cost is accrued when the product delivery promises are satisfied.

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The transaction price is determined based on the consideration to which the Company will be entitled in exchange for transferring goods to the customer. Taxes assessed by a governmental authority that are both imposed on and concurrent with a specific revenue-producing transaction and collected by the Company from a customer are excluded from the transaction price.

Variable consideration is included in the transaction price if, in the Company's judgment, it is probable that a significant future reversal of cumulative revenue under the contract will not occur. The Company's contracts and customary practices involve few rebates or discounts. The Company provides a limited warranty on its products and may issue credit notes or replace products free of charge for valid quality claims; historically, quality claims have been insignificant and the Company records appropriate accruals for the estimated credit notes based on the historical statistical experience. Certain contracts provide for limited rebates when deliveries are late versus committed dates. These rebates are accrued for based on historical statistics of late deliveries on the contracts to which those terms apply.

Contracts that contain multiple distinct performance obligations require an allocation of the transaction price to each performance obligation based on a relative stand-alone selling price basis. The Company regularly reviews market conditions and internally approved pricing guidelines to determine stand-alone selling prices for the different types of its customer contracts. The stand-alone prices as known at contract inception are utilized as the basis to allocate the transaction price to the distinct performance obligations. The allocation of the transaction price to the performance obligations remains unchanged if stand-alone selling prices change after contract inception.

The Company expenses sales commissions as earned as their amortization period would not extend beyond the year in which they are incurred. These costs are recorded within selling and administrative expense.

Disaggregation of Revenue

The following table provides information about disaggregated revenue by type of product and contract for 2018:

	For the Year Ended December 31, 2018 (Dollars in thousands)
Graphite Electrodes - Three-to-five-year contracts	\$1,341,557
Graphite Electrodes - Short-term contracts	500,834
By-products	53,519
Total Revenues	\$1,895,910

Impact of New Revenue Guidance on Financial Statement Line Items

There would be no differences to the reported consolidated balance sheet, statement of operations and cash flows, as of and for the twelve months ended December 31, 2018, had the previous revenue guidance still been in effect.

Contract Balances

Receivables, net of allowances for doubtful accounts, were \$248.3 million as of December 31, 2018 and \$116.8 million as of December 31, 2017. Accounts receivables are recorded when the right to consideration becomes unconditional. Payment terms on invoices range from 30 to 120 days depending on the customary business practices of the jurisdictions in which we do business.

Certain short-term and longer-term sales contracts require up-front payments prior to the Company's fulfillment of any performance obligation. These contract liabilities are recorded as current or long-term deferred revenue, depending on the lag between the pre-payment and the expected delivery of the related products. Additionally, under ASC 606, deferred revenue originates from contracts where the allocation of the transaction price to the performance obligations based on their relative stand-alone selling prices results in the timing of revenue recognition being different from the timing of the invoicing. In this case, deferred revenue is amortized into revenue based on the transaction price allocated to the remaining performance obligations.

Current deferred revenue is included in "Other accrued liabilities" and long-term deferred revenue is included in "Other long-term obligations" on the Consolidated Balance Sheets. The following table provides information about deferred revenue from contracts with customers (in thousands):

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	Current deferred revenue (Dollars in thousands)	Long-Term deferred revenue
Balance as of December 31, 2017	\$20,784	\$ —
Increases due to billings	15,548	8,241
Revenue recognized	(30,803)	—
Foreign currency impact	(149)	(525)
Balance as of December 31, 2018	\$5,380	\$ 7,716

Transaction Price Allocated to the Remaining Performance Obligations

The following table presents estimated revenues expected to be recognized in the future related to performance obligations that are unsatisfied (or partially unsatisfied) at the end of the reporting period (in thousands). The estimated revenues do not include contracts with original duration of one year or less.

	Three-to-five-year take-or-pay contracts (Dollars in thousands)
2019	\$ 1,404,618
2020	1,327,449
2021	1,172,536
2022	1,127,105
Thereafter	8,715
Total	\$ 5,040,423

In addition to the expected remaining revenue to be recognized with the longer-term sales contracts, the Company recorded \$1,341.6 million of revenue pursuant to these contracts in the twelve months ended December 31, 2018.

(3) Discontinued Operations and Related Assets Held for Sale

On February 26, 2016, the Company announced that it had initiated a strategic review of its Engineered Solutions business segment to better direct its resources and simplify its operations. Any potential sale of assets was prohibited by its revolving facility without approval of the requisite lenders thereunder. On April 27, 2016, GrafTech and certain of its subsidiaries entered into an amendment to the revolving facility (see Note 7 "Debt and Liquidity") which, among other things, permits the sale of assets with the restriction that the proceeds be utilized to pay down revolver borrowings. As of June 30, 2016, the Engineered Solutions segment qualified for reporting as discontinued operations as its divestiture represented a strategic shift for the Company.

During 2016, we evaluated the fair value of the Engineered Solutions business segment utilizing the market approach (Level 3 measure). As a result, we incurred an impairment charge to our Engineered Solutions business segment of \$120 million to align the carrying value with estimated fair value. We continued to update this estimate and during 2017, we further reduced the estimated fair value by \$5.3 million based upon current information at that time.

On November 30, 2016, we completed the sale of our Fiber Materials Inc. ("Fiber Materials") business, which was a business line within our former Engineered Solutions business. The sale resulted in cash proceeds of \$15.9 million and a loss of \$0.2 million. We have the ability to realize up to \$8.5 million of additional proceeds based on the earnings of the Fiber Materials business over the 24 months following the transaction. We have elected to record this contingent consideration as it is realized and accordingly, it has not been recognized to date. Based on the 2017 and preliminary 2018 results of Fiber Materials, we do not expect any material additional proceeds from this contingent consideration.

On July 3, 2017, we completed the sale of our Advanced Energy Technologies ("AET") business. AET was a product line within our Engineered Solutions business that had been classified as held for sale since the second quarter of 2016. The sale resulted in cash proceeds of \$28.5 million.

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On September 30, 2017, we completed the sale of the majority of the U.S. assets of our GrafTech Advanced Graphite Materials ("GAGM") business, which was a component of our Engineered Solutions business. The sale of the Italian GAGM assets closed on October 5, 2017. In the jurisdictions where the GAGM assets were not acquired, we initiated the wind-down of the business. The sale was structured as a non-cash transaction with the buyer assuming certain liabilities associated with the assets acquired. In addition, GrafTech retained certain current assets of GAGM, mostly receivables, which were substantially realized in the fourth quarter of 2017.

As a result of the sales described above, we recorded a gain of \$6.1 million in 2017. The disposition of the Engineered Solutions business is now substantially complete and in accordance with our Credit Facility, all cash proceeds from these sales were used to pay down our revolving facility and term loan.

As of December 31, 2018, we have ceased reporting discontinued operations and have included all remaining assets and liabilities within continuing operations.

The following tables summarize the results of the Engineered Solutions business segment, reclassified as discontinued operations:

	For the Year Ended December 31,		
	2018	2017	2016
	(Dollars in thousands)		
Net sales	\$2,574	\$82,299	\$115,336
Cost of sales	3,310	74,723	98,440
Gross (loss) profit	(736)	7,576	16,896
Research and development	—	1,429	3,145
Selling and administrative expenses	(628)	12,239	19,022
(Gain) loss on sale of assets	(508)	(6,091)	198
Rationalizations	—	(35)	(405)
Impairment	—	5,300	119,907
	400	(5,266)	(124,971)
Other expense (income)	30	(115)	(66)
Interest expense	—	1,133	3,258
Income (loss) from discontinued operations before income taxes	370	(6,284)	(128,163)
Benefit for income taxes on discontinued operations	(39)	(55)	(1,189)
Income (loss) from discontinued operations	\$331	\$(6,229)	\$(126,974)
Basic and diluted income (loss) from discontinued operations per share	\$—	\$(0.02)	\$(0.42)

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The significant components of our Statements of Cash Flows for discontinued operations are as follows:

	For the Year Ended	
	December 31	
	2018	2017
	(Dollars in thousands)	
Depreciation and amortization	\$—	\$2,418
Impairment	—	5,300
(Gain) loss on sale of assets	(508)	6,091
Net change in inventory	502	15,217
Cash received from divestitures	—	27,254
Credit facility reductions	—	(27,254)
Deferred income taxes	40	(55)
Capital expenditures	—	558

The following table summarizes the carrying value of the assets and liabilities of discontinued operations as of December 31, 2018 and 2017.

	As of December 31, 2018	As of December 31, 2017
	(Dollars in thousands)	
Assets of discontinued operations:		
Accounts receivable	\$—	\$ 3,351
Inventories	—	502
Prepaid expenses and other current assets	—	1,137
Net property, plant and equipment	—	226
Other assets	—	97
Total assets of discontinued operations	\$—	\$ 5,313
Liabilities of discontinued operations:		
Accounts payable	\$—	\$ 512
Accrued income and other taxes	—	158
Other accrued liabilities	—	2,742
Total current liabilities of discontinued operations	—	3,412
Other long-term obligations	—	376
Total liabilities of discontinued operations	\$—	\$ 3,788

(4) Stock Based and Other Management Compensation

Our Omnibus Equity Incentive Plan permits the granting of options, and other stock-based awards (including restricted stock units and deferred share units). As of December 31, 2018, the aggregate number of shares authorized under the plans since their initial adoption was 15,000,000. Shares issued upon vesting of awards or exercise of options are new share issuances. Upon the vesting or payment of stock awards, an employee may elect receipt of the full share amount and either pay the resulting taxes or sell shares in the open market to cover the tax obligation. During 2018 our Board of Directors granted 979,790 stock options, 42,243 deferred share units and 6,740 restricted stock units under our Omnibus Equity Incentive Plan.

Accounting for Stock-Based Compensation

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Stock-based compensation expense recognized was \$1.2 million in 2018. A majority of the expense, \$1.0 million, was recorded as "Selling and Administrative Expenses" in the Consolidated Statement of Operations, with the remaining expenses incurred as cost of sales. There was no stock-based compensation expense recognized in 2017 and 2016.

As of December 31, 2018, unrecognized compensation cost related to non-vested stock options, deferred share units and restricted stock units represents \$5.4 million, which will be recognized over a weighted average period of 4.3 years.

Deferred Share and Restricted Stock Units. Deferred share units represent one share of our common stock and will be delivered as shares of our common stock when the recipient ceases to provide services to the Company. Compensation expense for deferred share units and restricted stock share awards is based on the closing price of our common stock on the date of grant. The weighted average grant date fair value of deferred share units and restricted stock units was approximately \$12.88 per share at December 31, 2018.

Deferred share units and restricted stock unit awards activity under the Omnibus Equity Incentive Plan for 2018 was as follows:

	Number of Shares	Weighted- Average Grant Date Fair Value
Outstanding unvested as of January 1, 2018	—	\$ —
Granted	48,983	13.94
Vested	(21,413)	15.29
Outstanding unvested as of December 31, 2018	27,570	\$ 12.88

During 2018, we granted 48,983 shares of deferred share units and restricted stock units to certain directors, officers and employees at prices ranging from \$15.00 to \$19.44. Of the total deferred share units granted, 21,413 were granted to our Board of Directors and vested immediately upon grant. The remaining deferred share units and restricted stock units vest over a period of two to five years.

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Stock Options. Compensation expense for stock options is based on the estimated fair value of the option on the date of the grant. We calculate the estimated fair value of the option using the Black-Scholes option-pricing model. During 2018, we granted 979,790 options to certain of our officers and employees. The weighted-average fair value of the options granted in 2018 was \$6.08. The weighted average assumptions used in our Black-Scholes option-pricing model for options granted in 2018 are:

	For the Year Ended December 31, 2018
Dividend yield	1.70% - 2.27%
Expected volatility	45 %
Risk-free interest rate	2.84% - 2.98%
Expected term in years	6.5 years

Dividend Yield. Our dividend yield estimate is based on our expected dividends and the stock price on the grant date.

Expected Volatility. We estimate the volatility of our common stock at the date of grant based on the historical volatility of comparable companies over the most recent period commensurate with the expected life of the award.

Risk-Free Interest Rate. We base the risk-free interest rate on the implied yield currently available on U.S. Treasury zero-coupon issues with an equivalent remaining term equal to the expected life of the award.

Expected Term In Years. The expected life of awards granted represents the time period that the awards are expected to be outstanding. We determined the expected term of the grants using the “simplified” method as described by the SEC, since we do not have a history of stock option awards to provide a reliable basis for estimating such term. The stock options vest over a five year period, with one-fifth of the award vesting on the anniversary date of the grant in each of the next five years. Options outstanding at December 31, 2018, have a weighted average remaining contractual life of 9.3 years, a weighted average remaining vesting period of 2.3 years, and an aggregate intrinsic value of zero. There were no options exercised during 2018.

Stock options outstanding and exercisable under our plans at December 31, 2018 are:

Range of Exercise Prices	Options Outstanding		Options Exercisable	
	Number Outstanding	Weighted Average Remaining Contractual Life in Years	Weighted Average Exercise Prices	Weighted Average Exercise Prices
\$15.00-\$20.00	968,720	9.3	\$15.68	—

Stock option awards activity under the Omnibus Equity Incentive Plan for 2018 was as follows:

	Number of Shares	Weighted- Average Exercise Price
Outstanding unvested as of January 1, 2018	—	\$ —
Granted	979,790	15.67
Forfeited	(11,070)	15.00
Outstanding unvested as of December 31, 2018	968,720	\$ 15.68

As of December 31, 2018, we have 193,744 options expected to vest in the next year. No options were exercisable as of December 31, 2018.

Incentive Compensation Plans

We have a global incentive program for our worldwide salaried and hourly employees, the Incentive Compensation Program (the “ICP”), which includes a stockholder-approved executive incentive compensation plan. The ICP is based primarily

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on earnings before income taxes and achieving cash flow targets and, to a lesser extent, strategic targets. The balance of our accrued liability for ICP was \$10.4 million at December 31, 2018 and \$8.9 million as of December 31, 2017.

(5) Segment Reporting

We previously operated two reportable business segments, Industrial Materials and Engineered Solutions. During the second quarter of 2016 the Company decided to sell the businesses that comprised our Engineered Solutions segment to focus on our Industrial Materials segment. Accordingly, the Engineered Solutions business qualified as held for sale status and the related results have been excluded from continuing operations. See Note 3 "Discontinued Operations and Related Assets Held for Sale" for significant components of the results of our Engineered Solutions segment.

Our Industrial Materials segment manufactures high quality graphite electrodes essential to the production of electric arc furnace steel and other ferrous and non-ferrous metals. Petroleum needle coke, a crystalline form of carbon derived from decant oil, is the primary raw material used in the production of graphite electrodes. We utilize substantially all the needle coke that we produce internally to manufacture our graphite electrodes and as a result more than 95% of our revenues from external customers are derived from the sale of graphite electrodes and graphite electrode by-products from our manufacturing processes.

In 2018, one customer accounted for more than 10% of our net sales. Due to the increased demand for our products, we believe this customer does not pose a significant concentration of risk, as sales to this customer could be replaced by demand from other customers.

The following tables summarize information as to our continuing operations in different geographic areas.

	2018	2017	2016
	(Dollars in thousands)		
Net sales:			
U.S.	\$429,599	\$103,890	\$74,526
Americas	367,561	129,103	116,944
Asia Pacific	131,578	46,329	41,302
Europe, Middle East, Africa	967,172	271,449	205,191
Total	\$1,895,910	\$550,771	\$437,963

	At December 31,	
	2018	2017
	(Dollars in thousands)	
Long-lived assets (a):		
U.S.	\$169,301	\$177,298
Mexico	146,790	147,959
Brazil	3,320	3,547
France	91,022	80,035
Spain	103,121	103,819
Other countries	151	183
Total	\$513,705	\$512,841

(a) Long-lived assets represent fixed assets, net of accumulated depreciation.

(6) Goodwill and Other Intangible Assets

We are required to review goodwill and indefinite-lived intangible assets annually for impairment. Goodwill impairment is tested at the reporting unit level on an annual basis and between annual tests if an event occurs or circumstances change that would more likely than not reduce the fair value of a reporting unit below its carrying value. For the years ended December 31, 2018 and 2017 an assessment for potential impairment was performed and an impairment adjustment was not required.

The following table represents the changes in the carrying value of goodwill and intangibles from December 31, 2016 through December 31, 2018:

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	Total (Dollars in Thousands)
Balance as of December 31, 2016	\$ 171,117
Adjustments	—
Balance as of December 31, 2017	171,117
Adjustments	—
Balance as of December 31, 2018	\$ 171,117

The following table summarizes acquired intangible assets with determinable useful lives by major category which are included in "Other Assets" on our consolidated balance sheets:

	As of December 31, 2018			As of December 31, 2017		
	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
	(Dollars in Thousands)					
Trade name	\$22,500	\$(7,721)	\$14,779	\$22,500	\$(5,512)	\$16,988
Technology and know-how	55,300	(23,503)	31,797	55,300	(17,265)	38,035
Customer related intangible	64,500	(15,070)	49,430	64,500	(10,637)	53,863
Total finite-lived intangible assets	\$142,300	\$(46,294)	\$96,006	\$142,300	\$(33,414)	\$108,886

Amortization expense of intangible assets was \$12.9 million, \$13.6 million, \$14.3 million in 2018, 2017 and 2016, respectively. Estimated annual amortization expense for the next five years will approximate \$12.2 million in 2019, \$11.4 million in 2020, \$10.7 million in 2021, \$10.1 million in 2022 and \$9.2 million in 2023.

(7) Debt and Liquidity

The following table presents our long-term debt:

	As of December 31, 2018 (Dollars in thousands)	As of December 31, 2017
Old Credit Facility (Old Revolving Facility and Old Term Loan Facility)	\$ —	\$ 58,192
Senior Notes	—	280,586
2018 Credit Facility (2018 Term Loan and 2018 Revolving Facility)	2,155,883	—
Other Debt	751	596
Total Debt	2,156,634	339,374
Less: Short-term Debt	(106,323)	(16,474)
Long-term Debt	\$ 2,050,311	\$ 322,900

Old Revolving Facility and Term Loan Facility

On April 23, 2014, the Company and certain of its subsidiaries entered into an amended and restated credit agreement governing a revolving facility with a borrowing capacity of \$400 million and a maturity date of April 2019. On February 27, 2015, GrafTech and certain of its subsidiaries entered into a further amended and restated credit agreement that provided for, among other things, greater financial flexibility and a \$40 million senior secured delayed draw term loan facility.

On July 28, 2015, GrafTech and certain of its subsidiaries entered into an amendment to the amended and restated credit agreement to change the terms regarding the occurrence of a default upon a change in control (which is defined thereunder to include the acquisition by any person of more than 25% of GrafTech's outstanding shares) to exclude the acquisition of shares by Brookfield. In addition, effective upon such acquisition, the financial covenants were eased, resulting in increased availability under the revolving facility. The size of the revolving facility was also reduced from \$400 million to \$375 million. The size of the term loan facility remained at \$40 million.

On April 27, 2016, GrafTech and certain of its subsidiaries entered into an amendment to the revolving facility. The size

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of the revolving facility was permanently reduced from \$375 million to \$225 million. New covenants were also added to the revolving facility, including a requirement to make mandatory repayments of outstanding amounts under the revolving facility and the term loan facility with the proceeds of any sale of all or any substantial part of the assets included in the Engineered Solutions segment and a requirement to maintain minimum liquidity (consisting of domestic cash, cash equivalents and availability under the revolving facility) in excess of \$25 million. The covenants were also modified to provide for: the elimination of certain exceptions to the Company's negative covenants limiting the Company's ability to make certain investments, sell assets, make restricted payments, incur liens and incur debt; a restriction on the amount of cash and cash equivalents permitted to be held on the balance sheet at any one time without paying down the revolving facility and the term loan facility; and changes to the Company's financial covenants so that until the earlier of March 31, 2019 or the Company has \$75 million in trailing twelve month EBITDA (as defined in the revolving facility), the Company is required to maintain trailing twelve month EBITDA above certain minimums ranging from (\$40 million) to \$35 million after which the Company's existing financial covenants under the revolving facility will apply.

With this amendment, the Company had full access to the \$225 million revolving facility, subject to the \$25 million minimum liquidity requirement. As of December 31, 2017, the Company had \$39.5 million of borrowings and \$8.7 million of letters of credit, for a total of \$48.2 million drawn against the revolving facility. See "Refinancing" below. The \$40 million term loan facility was fully drawn on August 11, 2015, in connection with the repayment of the Senior Subordinated Notes in 2015. See "Refinancing" below.

The interest rate applicable to the revolving facility and term loan facility was LIBOR plus a margin ranging from 2.25% to 4.75% (depending on our total senior secured leverage ratio). The borrowers were required to pay a per annum fee ranging from 0.35% to 0.70% (depending on our senior secured leverage ratio) on the undrawn portion of the commitments under the Revolving Facility.

In the event that operating cash flows fail to provide sufficient liquidity to meet our business needs, including capital expenditures, any such shortfall would need to be made up by increased borrowings under our revolving facility, to the extent available. In accordance with our credit facility, we used cash proceeds from the sale of our Engineered Solutions businesses to repay borrowings outstanding under the revolving facility and the term loan.

As of December 31, 2017, we were in compliance with all financial and other covenants contained in the revolving facility, as applicable.

Senior Notes

On November 20, 2012, the Company issued \$300 million principal amount of 6.375% Senior Notes due 2020 (the "Senior Notes"). The Senior Notes were the Company's senior unsecured obligations and rank pari passu with all of the Company's existing and future senior unsecured indebtedness. The Senior Notes were guaranteed on a senior unsecured basis by each of the Company's existing and future subsidiaries that guarantee certain other indebtedness of the Company or another guarantor.

The Senior Notes bore interest at a rate of 6.375% per year, payable semi-annually in arrears on May 15 and November 15 of each year. The Senior Notes were to mature on November 15, 2020.

The Company was entitled to redeem some or all of the Senior Notes at any time on or after November 15, 2016, at the redemption prices set forth in the indenture. In addition, prior to November 15, 2016, the Company could redeem some or all of the Senior Notes at a price equal to 100% of the principal amount thereof, plus accrued and unpaid interest, if any, plus a "make whole" premium determined as set forth in the indenture.

If, prior to maturity, a change in control (as defined in the indenture) of the Company occurred and thereafter certain downgrades of the ratings of the Senior Notes as specified in the indenture occurred, the Company would be required to offer to repurchase any or all of the Senior Notes at a repurchase price equal to 101% of the aggregate principal amount of the Senior Notes, plus any accrued and unpaid interest. On August 17, 2015 a change in control occurred due to our acquisition by Brookfield. However, the downgrade of the ratings of the Senior Notes, as specified in the

indenture, did not occur. Therefore, the company was not and will not be required to offer to repurchase the Senior Notes as a result of the merger.

The indenture for the Senior Notes also contained covenants that, among other things, limited the ability of the Company and certain of its subsidiaries to: (i) create liens or use assets as security in other transactions; (ii) engage in certain sale/leaseback transactions; and (iii) merge, consolidate or sell, transfer, lease or dispose of substantially all of their assets.

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The indenture for the Senior Notes also contained customary events of default, including (i) failure to pay principal or interest on the Senior Notes when due and payable, (ii) failure to comply with covenants or agreements in the indenture or the Senior Notes which failures are not cured or waived as provided in the indenture, (iii) failure to pay indebtedness of the Company, any Subsidiary Guarantor or Significant Subsidiary (each, as defined in the indenture) within any applicable grace period after maturity or acceleration and the total amount of such indebtedness unpaid or accelerated exceeds \$50.0 million, (iv) certain events of bankruptcy, insolvency, or reorganization, (v) failure to pay any judgment or decree for an amount in excess of \$50.0 million against the Company, any Subsidiary Guarantor or any Significant Subsidiary that is not discharged, waived or stayed as provided in the indenture, (vi) cessation of any Subsidiary Guarantee (as defined in the indenture) to be in full force and effect or denial or disaffirmance by any subsidiary guarantor of its obligations under its subsidiary guarantee, and (vii) a default under the Company's Senior Subordinated Notes which were repaid in 2015. In the case of an event of default, the principal amount of the Senior Notes plus accrued and unpaid interest may be accelerated.

Refinancing

On February 12, 2018, the Company entered into a credit agreement (the "2018 Credit Agreement") among the Company, GrafTech Finance Inc., a Delaware corporation and a wholly owned subsidiary of GrafTech ("GrafTech Finance"), GrafTech Switzerland SA, a Swiss corporation and a wholly owned subsidiary of GrafTech ("Swissco"), GrafTech Luxembourg II S.à.r.l., a Luxembourg société à responsabilité limitée and a wholly owned subsidiary of GrafTech ("Luxembourg Holdco" and, together with GrafTech Finance and Swissco, the "Co Borrowers"), the lenders and issuing banks party thereto and JPMorgan Chase Bank, N.A. as administrative agent (the "Administrative Agent") and as collateral agent, which provides for (i) a \$1,500 million senior secured term facility (the "2018 Term Loan Facility") and (ii) a \$250 million senior secured revolving credit facility (the "2018 Revolving Credit Facility" and, together with the 2018 Term Loan Facility, the "Senior Secured Credit Facilities"), which may be used from time to time for revolving credit borrowings denominated in dollars or Euro, the issuance of one or more letters of credit denominated in dollars, Euro, Pounds Sterling or Swiss Francs and one or more swing line loans denominated in dollars. GrafTech Finance is the sole borrower under the 2018 Term Loan Facility while GrafTech Finance, Swissco and Lux Holdco are Co Borrowers under the 2018 Revolving Credit Facility. On February 12, 2018, GrafTech Finance borrowed \$1,500 million under the 2018 Term Loan Facility (the "2018 Term Loans"). The 2018 Term Loans mature on February 12, 2025. The maturity date for the 2018 Revolving Credit Facility is February 12, 2023.

The proceeds of the 2018 Term Loans were used to (i) repay in full all outstanding indebtedness of the Co Borrowers under the Old Credit Agreement and terminate all commitments thereunder, (ii) redeem in full the Senior Notes at a redemption price of 101.594% of the principal amount thereof plus accrued and unpaid interest to the date of redemption, (iii) pay fees and expenses incurred in connection with (i) and (ii) above and the Senior Secured Credit Facilities and related expenses, and (iv) declare and pay a dividend to the sole pre-IPO stockholder, with any remainder to be used for general corporate purposes. See Note 8 "Interest Expense" for a breakdown of expenses associated with these repayments. In connection with the repayment of the Old Credit Agreement and redemption of the Senior Notes, all guarantees of obligations under the Old Credit Agreement, the Senior Notes and related indenture were terminated, all mortgages and other security interests securing obligations under the Old Credit Agreement were released and the Old Credit Agreement and the indenture were terminated.

Borrowings under the 2018 Term Loan Facility bear interest, at GrafTech Finance's option, at a rate equal to either (i) the Adjusted LIBO Rate (as defined in the 2018 Credit Agreement), plus an applicable margin initially equal to 3.50% per annum or (ii) the ABR Rate (as defined in the 2018 Credit Agreement), plus an applicable margin initially equal to 2.50% per annum, in each case with one step down of 25 basis points based on achievement of certain public ratings of the 2018 Term Loans.

Borrowings under the 2018 Revolving Credit Facility bear interest, at the applicable Co Borrower's option, at a rate equal to either (i) the Adjusted LIBO Rate, plus an applicable margin initially equal to 3.75% per annum or (ii) the ABR Rate, plus an applicable margin initially equal to 2.75% per annum, in each case with two 25 basis point step downs based on achievement of certain senior secured first lien net leverage ratios. In addition, the Co Borrowers will

be required to pay a quarterly commitment fee on the unused commitments under the 2018 Revolving Credit Facility in an amount equal to 0.25% per annum.

For borrowings under both the 2018 Term Loan Facility and the 2018 Revolving Credit Facility, if the Administrative Agent determines that adequate and reasonable means do not exist for ascertaining the Adjusted LIBO Rate or the LIBO Rate and such circumstances are unlikely to be temporary or the relevant authority has made a public statement identifying a date after which the LIBO Rate shall no longer be used for determining interest rates for loans, then the Administrative Agent and the Co-Borrowers shall endeavor to establish an alternate rate of interest, which shall be effective so long as the majority in interest of the lenders for each Class (as defined in the 2018 Credit Agreement) of loans under the 2018 Credit Agreement do not notify the Administrative Agent otherwise. Until such an alternate rate of interest is determined, (a) any request for a borrowing denominated

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in dollars based on the Adjusted LIBO Rate will be deemed to be a request for a borrowing at the ABR Rate plus the applicable margin for an ABR Rate borrowing of such loan while any request for a borrowing denominated in any other currency will be ineffective and (b) any outstanding borrowings based on the Adjusted LIBO Rate denominated in dollars will be converted to a borrowing at the ABR Rate plus the applicable margin for an ABR Rate borrowing of such loan while any outstanding borrowings denominated in any other currency will be repaid.

All obligations under the 2018 Credit Agreement are guaranteed by GrafTech Finance and each domestic subsidiary of GrafTech, subject to certain customary exceptions, and all obligations under the 2018 Credit Agreement of each foreign subsidiary of GrafTech that is a Controlled Foreign Corporation (within the meaning of Section 956 of the Internal Revenue Code of 1986, as amended from time to time (the "Code")) are guaranteed by GrafTech Luxembourg I S.à.r.l., a Luxembourg société à responsabilité limitée and an indirect wholly owned subsidiary of GrafTech ("Luxembourg Parent"), Luxembourg Holdco and Swissco (collectively, the "Guarantors").

All obligations under the 2018 Credit Agreement are secured, subject to certain exceptions and Excluded Assets (as defined in the 2018 Credit Agreement), by: (i) a pledge of all of the equity securities of GrafTech Finance and each domestic Guarantor (other than GrafTech) and of each other direct, wholly owned domestic subsidiary of GrafTech and any Guarantor, (ii) a pledge on no more than 65% of the equity interests of each subsidiary that is a Controlled Foreign Corporation (within the meaning of Section 956 of the Code), and (iii) security interests in, and mortgages on, personal property and material real property of GrafTech Finance and each domestic Guarantor, subject to permitted liens and certain exceptions specified in the 2018 Credit Agreement. The obligations of each foreign subsidiary of GrafTech that is a Controlled Foreign Corporation under the Revolving Credit Facility are secured by (i) a pledge of all of the equity securities of each Guarantor that is a Controlled Foreign Corporation and of each direct, wholly owned subsidiary of any Guarantor that is a Controlled Foreign Corporation, and (ii) security interests in certain receivables and personal property of each Guarantor that is a Controlled Foreign Corporation, subject to permitted liens and certain exceptions specified in the 2018 Credit Agreement.

The 2018 Term Loans amortize at a rate equal to 5% per annum of the original principal amount of the 2018 Term Loans payable in equal quarterly installments, with the remainder due at maturity. The Co Borrowers are permitted to make voluntary prepayments at any time without premium or penalty, except in the case of prepayments made in connection with certain repricing transactions with respect to the 2018 Term Loans effected within twelve months of the closing date of the 2018 Credit Agreement, to which a 1.00% prepayment premium applies. GrafTech Finance is required to make prepayments under the 2018 Term Loans (without payment of a premium) with (i) net cash proceeds from non ordinary course asset sales (subject to customary reinvestment rights and other customary exceptions and exclusions), and (ii) commencing with the Company's fiscal year ending December 31, 2019, 75% of Excess Cash Flow (as defined in the 2018 Credit Agreement), subject to step downs to 50% and 0% of Excess Cash Flow based on achievement of a senior secured first lien net leverage ratio greater than 1.25 to 1.00 but less than or equal to 1.75 to 1.00 and less than or equal to 1.25 to 1.00, respectively. Scheduled quarterly amortization payments of the 2018 Term Loans during any calendar year reduce, on a dollar for dollar basis, the amount of the required Excess Cash Flow prepayment for such calendar year, and the aggregate amount of Excess Cash Flow prepayments for any calendar year reduce subsequent quarterly amortization payments of the 2018 Term Loans as directed by GrafTech Finance.

The 2018 Credit Agreement contains customary representations and warranties and customary affirmative and negative covenants applicable to GrafTech and restricted subsidiaries, including, among other things, restrictions on indebtedness, liens, investments, fundamental changes, dispositions, and dividends and other distributions. The 2018 Credit Agreement contains a financial covenant that requires GrafTech to maintain a senior secured first lien net leverage ratio not greater than 4.00:1.00 when the aggregate principal amount of borrowings under the 2018 Revolving Credit Facility and outstanding letters of credit issued under the 2018 Revolving Credit Facility (except for undrawn letters of credit in an aggregate amount equal to or less than \$35 million), taken together, exceed 35% of the total amount of commitments under the 2018 Revolving Credit Facility. The 2018 Credit Agreement also contains customary events of default.

Brookfield Promissory Note

On April 19, 2018, we declared a dividend in the form of a \$750 million promissory note (the “Brookfield Promissory Note”) to the sole pre-IPO stockholder. The \$750 million Brookfield Promissory Note was conditioned upon (i) the Senior Secured First Lien Net Leverage Ratio (as defined in the 2018 Credit Agreement), as calculated based on our final financial results for the first quarter of 2018, being equal to or less than 1.75 to 1.00, (ii) no Default or Event of Default (each as defined in the 2018 Credit Agreement) having occurred and continuing or that would result from the \$750 million Brookfield Promissory Note and (iii) the satisfaction of the conditions occurring within 60 days from the dividend record date. Upon publication of our first quarter report on Form 10-Q, these conditions were met and, as a result, the Brookfield Promissory Note became payable.

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The Brookfield Promissory Note had a maturity of eight years from the date of issuance and bore interest at a rate equal to the Adjusted LIBO Rate (as defined in the Brookfield Promissory Note) plus an applicable margin equal to 4.50% per annum, with an additional 2.00% per annum starting from the third anniversary from the date of issuance. We were permitted to make voluntary prepayments at any time without premium or penalty. All obligations under the Brookfield Promissory Note were unsecured and guaranteed by all of our existing and future domestic wholly owned subsidiaries that guarantee, or are borrowers under, the Senior Secured Credit Facilities. No funds were lent or otherwise contributed to us by the pre-IPO stockholder in connection with the Brookfield Promissory Note. As a result, we received no consideration in connection with its issuance. As described below, the Promissory Note was repaid in full on June 15, 2018.

First Amendment to 2018 Credit Agreement

On June 15, 2018, the Company entered into a first amendment (the "First Amendment") to its 2018 Credit Agreement. The First Amendment amended the 2018 Credit Agreement to provide for an additional \$750 million in aggregate principal amount of incremental term loans (the "Incremental Term Loans") to GrafTech Finance. The Incremental Term Loans increased the aggregate principal amount of term loans incurred by GrafTech Finance under the 2018 Credit Agreement from \$1,500 million to \$2,250 million. The Incremental Term Loans have the same terms as those applicable to the 2018 Term Loans, including interest rate, payment and prepayment terms, representations and warranties and covenants. The Incremental Term Loans mature on February 12, 2025, the same date as the 2018 Term Loans. GrafTech paid an upfront fee of 1.00% of the aggregate principal amount of the Incremental Term Loans on the effective date of the First Amendment.

The proceeds of the Incremental Term Loans were used to repay, in full, the \$750 million of principal outstanding on the Brookfield Promissory Note.

(8) Interest Expense

The following table presents an analysis of interest expense:

	For the Year Ended		
	December 31		
	2018	2017	2016
	(Dollars in thousands)		
Interest incurred on debt	\$100,844	\$24,060	\$20,408
Related Party Promissory Note interest expense	5,090	—	—
Senior Note redemption premium	4,782	—	—
Accretion of fair value adjustment on Senior Notes	19,414	6,454	6,305
Accretion of original issue discount on 2018 Term Loans	1,455	—	—
Amortization of debt issuance costs	3,476	309	201
Total interest expense	\$135,061	\$30,823	\$26,914

Interest rates

The 2018 Credit Agreement had an effective interest rate of 6.02% as of December 31, 2018. The Old Revolving Facility and Old Term Loan Facility had an effective interest rate of 4.57% as of December 31, 2017 and the Senior Notes had a fixed interest rate of 6.375%, both of which were repaid on February 12, 2018 as part of our refinancing (See Note 7 "Debt and Liquidity").

As a result of our February 12, 2018 refinancing, we paid a prepayment premium for the redemption of our Senior Notes totaling \$4.8 million. The accretion of the August 15, 2015 fair value adjustment to our Senior Notes totaling \$19.4 million in 2018, included accelerated accretion of \$18.7 million resulting from the prepayment. Amortization of debt issuance costs included \$0.3 million of accelerated amortization related to the refinancing.

(9) Fair Value Measurements and Derivative Instruments

Fair Value Measurements

Depending on the inputs, we classify each fair value measurement as follows:

Level 1 – based upon quoted prices for identical instruments in active markets,

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Level 2 – based upon quoted prices for similar instruments, prices for identical or similar instruments in markets that are not active, or model-derived valuations of all of whose significant inputs are observable, and

Level 3 – based upon one or more significant unobservable inputs.

The following section describes key inputs and assumptions used in valuation methodologies of our assets and liabilities measured at fair value on a recurring basis:

Cash and cash equivalents, short-term notes and accounts receivable, accounts payable and other current payables – The carrying amount approximates fair value because of the short maturity of these instruments.

Debt – The fair value of our debt as of December 31, 2018 approximated book value of \$2,156.6 million. The fair value of our debt as of December 31, 2017 was \$359.2 million versus a book value of \$339.4 million. The fair values of the Senior Notes and the revolving facility were determined using level 2 and level 3 inputs, respectively.

Assets held for sale – Assets held for sale values are determined using Level 3 fair value inputs. These represent management's estimate of fair value based upon current quotes from participants in the sales process.

Foreign currency derivatives – Foreign currency derivatives are carried at market value using Level 2 inputs. We had outstanding loss of \$0.1 million as of December 31, 2018 and 2017.

Commodity derivative contracts – Commodity derivative contracts are carried at fair value. We determine the fair value using observable, quoted refined oil product prices that are determined by active markets and therefore classify the commodity derivative contracts as Level 2. We had outstanding gains of \$0.3 million and outstanding losses of \$11.0 million as of December 31, 2018 and outstanding gains of \$5.3 million and outstanding losses of \$0.6 million losses as of December 31, 2017.

Additional fair value information related to our Pension funds' assets can be found in Note 12 "Retirement Plans and Postretirement Benefits".

Derivative Instruments

We use derivative instruments as part of our overall foreign currency and commodity risk management strategies to manage the risk of exchange rate movements that would reduce the value of our foreign cash flows and to minimize commodity price volatility. Foreign currency exchange rate movements create a degree of risk by affecting the value of sales made and costs incurred in currencies other than the US dollar.

Certain of our derivative contracts contain provisions that require us to provide collateral. Since the counterparties to these financial instruments are large commercial banks and similar financial institutions, we do not believe that we are exposed to material counterparty credit risk. We do not anticipate nonperformance by any of the counter-parties to our instruments.

Foreign currency derivatives

We enter into foreign currency derivatives from time to time to attempt to manage exposure to changes in currency exchange rates. These foreign currency instruments, which include, but are not limited to, forward exchange contracts and purchased currency options, attempt to hedge global currency exposures such as foreign currency denominated debt, sales, receivables, payables, and purchases.

We had no foreign currency cashflow hedges outstanding as of December 31, 2018 and December 31, 2017 and therefore, no unrealized gains or losses reported under accumulated other comprehensive income (loss).

As of December 31, 2018, we had outstanding Mexican peso, South African rand, euro, Swiss franc and Japanese yen currency contracts, with aggregate notional amounts of \$19.6 million. As of December 31, 2017, we had outstanding Mexican peso, South African rand, euro, Swiss franc and Japanese yen currency contracts, with aggregate notional amounts of \$18.9 million. The foreign currency derivatives outstanding as of December 31, 2018 and December 31, 2017 had maturity dates in January 2019 and January 2018, respectively, and were not designated as hedging instruments.

Commodity derivative contracts

We have entered into commodity derivative contracts for refined oil products. These contracts are entered into to protect against the risk that eventual cash flows related to these products will be adversely affected by future changes in prices. In the fourth quarter of 2017, we began to enter into three-to five-year take-or-pay contracts with many of

our customers and began to hedge the cash flows related to these contracts. As of December 31, 2018, we had outstanding commodity derivative contracts with a notional amount of \$142.1 million and maturities from January 2019 to June 2022. As of December 31, 2017, we had outstanding commodity derivative contracts with a notional amount of \$143.9 million with maturities from January 2018 to June

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2022. Within Accumulated Other Comprehensive income (loss), we had a net unrealized pre-tax loss of \$10.7 million and a net unrealized pre-tax gain of \$4.7 million as of December 31, 2018 and 2017, respectively.

Net Investment Hedges

We use certain intercompany debt to hedge a portion of our net investment in our foreign operations against currency exposure (net investment hedge). Intercompany debt designated in foreign currency and designated as a non-derivative net investment hedging instrument was \$9.5 million and \$14.8 million as of December 31, 2018 and 2017, respectively. Within our currency translation adjustment portion of other comprehensive income (loss), we recorded a gain of \$2.2 million in 2018, and a loss of \$1.4 million in 2017, resulting from these net investment hedges. The fair value of all derivatives is recorded as assets or liabilities on a gross basis in our Consolidated Balance Sheets. At December 31, 2018 and 2017, the fair value of our derivatives and their respective balance sheet locations are presented in the following table:

	Asset Derivatives		Liability Derivatives	
	Location	Fair Value	Location	Fair Value
As of December 31, 2018	(Dollars in thousands)			
Derivatives designated as cash flow hedges:				
Commodity derivative contracts	Prepaid and other current assets	\$90	Other accrued liabilities	\$4,630
	Other long-term assets	260	Other long-term obligations	6,393
Total fair value		\$350		\$11,023
As of December 31, 2017				
Commodity derivative contracts	Prepaid and other current assets	\$2,518	Other accrued liabilities	\$—
	Other long-term assets	2,808	Other long-term obligations	581
Total fair value		\$5,326		\$581

	Asset Derivatives		Liability Derivatives	
	Location	Fair Value	Location	Fair Value
As of December 31, 2018	(Dollars in Thousands)			
Derivatives not designated as hedges:				
Foreign currency derivatives	Prepaid and other current assets	\$ —	Other current liabilities	\$ 43
As of December 31, 2017				
Derivatives not designated as hedges:				
Foreign currency derivatives	Prepaid and other current assets	\$ 9	Other current liabilities	\$ 90

As a result of the settlement of commodity derivative contracts, as of December 31, 2018 and December 31, 2017, net realized pre-tax gains of \$7.0 million and \$0.1, respectively, were reported in Accumulated Other Comprehensive Income (loss) and will be released to earnings within the next 12 months.

The location and amount of realized (gains) losses on derivatives are recognized in the Statements of Operations when the hedged item impacts earnings and are as follows for the years ended 2018, 2017 and 2016:

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		Amount of (Gain)/Loss Recognized		
		2018	2017	2016
Location of (Gain)/Loss Recognized in the Consolidated Statement of Operations				
Derivatives designated as cash flow hedges:		(Dollars in thousands)		
Commodity forward derivatives	Cost of sales	\$ (919)	\$ —	\$ —
Location of (Gain)/Loss Recognized in the Consolidated Statement of Operations		Amount of (Gain)/Loss Recognized		
Derivatives not designated as hedges:		2018	2017	2016
		(Dollars in thousands)		
Foreign currency derivatives	Cost of sales, Other expense/(income)	\$ (522)	\$ (1,565)	\$ 549

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(10) Supplementary Balance Sheet Detail

The following tables present supplementary balance sheet details:

	As of December 31, 2018	As of December 31, 2017
	(Dollars in thousands)	
Inventories:		
Raw materials and supplies	\$99,935	\$39,434
Work in process	125,767	85,852
Finished goods	68,015	48,865
	\$293,717	\$174,151
Prepaid expenses and other current assets:		
Prepaid expenses	\$10,720	\$9,505
Value added tax and other indirect taxes receivable	19,242	18,627
Spare parts inventory	11,507	11,010
Other current assets	4,699	5,730
	\$46,168	\$44,872
Property, plant and equipment:		
Land and improvements	\$45,947	\$46,599
Buildings	68,680	59,608
Machinery and equipment and other	532,084	495,069
Construction in progress	42,131	41,375
	\$688,842	\$642,651
Other accrued liabilities:		
Payrolls (including incentive programs)	\$17,284	\$14,196
Employee benefits	6,977	4,684
Deferred Revenue	5,380	20,784
Other	20,811	13,562
	\$50,452	\$53,226
Other long term obligations:		
Postretirement benefits	\$16,192	\$20,508
Pension and related benefits	33,718	36,116
Other	22,609	12,283
	\$72,519	\$68,907

The following table presents an analysis of the allowance for doubtful accounts:

	2018	2017	2016
Balance at beginning of year	\$1,097	\$326	\$244
Additions	122	771	129
Deductions	(90)	—	(47)
Balance at end of year	\$1,129	\$1,097	\$326

(11) Commitments

Lease commitments under non-cancelable operating leases extending for one year or more will require the following future payments:

	(Dollars in thousands)
2019	\$ 4,474
2020	2,747
2021	1,497
2022	334
2023	269
After 2023	343

Total lease expenses under non-cancelable operating leases extending one year or more approximated \$4.9 million in 2018, \$5.3 million in 2017 and \$3.6 million in 2016.

(12) Retirement Plans and Postretirement Benefits

Retirement Plans

On February 26, 1991, we formed our own retirement plan covering substantially all our U.S. employees. Under our plan, covered employees earned benefit payments based primarily on their service credits and wages subsequent to February 26, 1991.

Prior to that date, substantially all our U.S. employees were participants in the U.S. retirement plan of Union Carbide Corporation ("Union Carbide"). While service credit was frozen, covered employees continued to earn benefits under the Union Carbide plan based on their final average wages through February 26, 1991, adjusted for salary increases (not to exceed six percent per annum) through January 26, 1995, the date Union Carbide ceased to own a minimum 50% of the equity of GTI. The Union Carbide plan is responsible for paying retirement and death benefits earned as of February 26, 1991.

Effective January 1, 2002, we established a defined contribution plan for U.S. employees. Certain employees had the option to remain in our defined benefit plan for an additional period of up to five years. Employees not covered by this option had their benefits under our defined benefit plan frozen as of December 31, 2001, and began participating in the defined contribution plan.

Effective March 31, 2003, we curtailed our qualified benefit plan and the benefits were frozen as of that date for the U.S. employees who had the option to remain in our defined benefit plan. We also closed our non-qualified U.S. defined benefit plan for the participating salaried workforce. The employees began participating in the defined contribution plan as of April 1, 2003.

Pension coverage for employees of foreign subsidiaries is provided, to the extent deemed appropriate, through separate plans. Obligations under such plans are systematically provided for by depositing funds with trustees, under insurance policies or by book reserves.

The components of our consolidated net pension costs are set forth in the following table:

	For the Year Ended December 31,					
	2018		2017		2016	
	U.S.	Foreign	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)					
Service cost	\$ 1,315	\$ 674	\$ 1,305	\$ 710	\$ 1,325	\$ 698
Interest cost	4,709	253	5,352	199	5,744	243
Expected return on assets	(5,679)	(330)	(5,268)	(299)	(4,940)	(298)
Mark-to-market loss (gain)	2,473	503	(4,140)	(53)	(2,322)	(220)
Pension costs	\$ 2,818	\$ 1,100	\$ (2,751)	\$ 557	\$ (193)	\$ 423

The mark-to-market loss in 2018 was the result of less than expected return on plan assets, partially offset by a favorable change to the discount rate. The mark-to-market gain in 2017 was the result of better than expected returns on assets, partially offset by an unfavorable change to the discount rate. The mark-to-market gain in 2016 was the result

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of better than expected returns on plan assets and favorable changes to the mortality tables, partially offset by unfavorable changes to the discount rate.

The reconciliation of the beginning and ending balances of our pension plans' benefit obligations, fair value of assets, and funded status at December 31, 2018 and 2017 are:

	As of December 31, 2018		As of December 31, 2017	
	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)			
Changes in Benefit Obligation:				
Net Benefit Obligation at beginning of period	\$ 139,746	\$ 20,407	\$ 140,230	\$ 18,237
Service cost	1,315	674	1,305	710
Interest cost	4,709	253	5,352	199
Participant contributions	—	392	—	252
Foreign currency exchange changes	—	(339)	—	1,069
Actuarial (gain) loss	(8,297)	711	3,212	63
Benefits paid	(10,488)	234	(10,353)	(123)
Net benefit obligation at end of period	\$ 126,985	\$ 22,332	\$ 139,746	\$ 20,407
Changes in Plan Assets:				
Fair value of plan assets at beginning of period	\$ 109,845	\$ 13,618	\$ 100,905	\$ 11,871
Actual return on plan assets	(5,091)	538	12,620	415
Foreign currency exchange rate changes		(154)	—	545
Employer contributions	5,579	726	6,673	658
Participant contributions		392	—	252
Benefits paid	(10,488)	234	(10,353)	(123)
Fair value of plan assets at end of period	\$ 99,845	\$ 15,354	\$ 109,845	\$ 13,618
Funded status (underfunded):	\$(27,140)	\$(6,978)	\$(29,901)	\$(6,789)
Amounts recognized in accumulated other comprehensive loss:				
Prior service credit	\$—	\$—	\$—	\$—
Amounts recognized in the statement of financial position:				
Non-current assets		\$ 147	\$—	\$—
Current liabilities	(430)	(117)	(433)	(146)
Non-current liabilities	(26,710)	(7,008)	(29,468)	(6,643)
Net amount recognized	\$(27,140)	\$(6,978)	\$(29,901)	\$(6,789)

The accumulated benefit obligation for all defined benefit pension plans was \$147.6 million and \$158.6 million as of December 31, 2018 and 2017, respectively.

Plan Assets

The accounting guidance on fair value measurements specifies a hierarchy based on the observability of inputs used in valuation techniques (Level 1, 2 and 3). See Note 9, "Fair Value Measurements and Derivative Instruments," for a discussion of the fair value hierarchy.

The following describes the methods and significant assumptions used to estimate the fair value of the investments: Cash and cash equivalents – Valued at cost. Cash equivalents are valued at net asset value as provided by the administrator of the fund.

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Foreign government bonds – Valued by the trustees using various pricing services of financial institutions.

Debt securities – Valued by the trustee at year-end using various pricing services of financial institutions, including Interactive Data Corporation, Standard & Poor's and Telekurs.

Equity securities – Valued at the closing price reported on the active market on which the security is traded.

Fixed insurance contract – Valued at the present value of the guaranteed payment streams.

Investment contracts – Valued at the total cost of annuity contracts purchased, adjusted for market differences from the date of purchase to year-end.

Collective trusts – Valued at the net asset value provided by the administrator of the fund (the practical expedient). The net asset value is primarily based on quoted market prices of the underlying securities for which quoted market prices of the underlying securities of the funds. Some of the underlying investments include securities for which quoted market prices are not available and are valued using data obtained by the trustee from the best available source or market value. This method may produce a fair value calculation that may not be indicative of net realizable value or reflective of future fair values. Furthermore, although we believe its valuation method is appropriate and consistent with other market participants, the use of different methodologies or assumptions to determine fair value of certain financial instruments could result in a different fair value measurement at the reporting date.

The fair value of other plan assets by category is summarized below (dollars in thousands):

	As of December 31, 2018			
	Level 1	Level 2	Level 3	Total
U.S. Plan Assets				
Cash and cash equivalents	\$ 1,978	\$ —	\$ —	\$ 1,978
International Plan Assets				
Foreign government bonds	\$ —	\$ 958	\$ —	\$ 958
Fixed insurance contracts	—	—	14,396	14,396
Total assets in the fair value hierarchy	\$ —	\$ 958	\$ 14,396	\$ 15,354
Investments measured at net asset value				\$ 97,867
Total	\$ 1,978	\$ 958	\$ 14,396	\$ 115,199

	As of December 31, 2017			
	Level 1	Level 2	Level 3	Total
U.S. Plan Assets				
Cash and cash equivalents	\$ 2,094	\$ —	\$ —	\$ 2,094
International Plan Assets				
Foreign government bonds	\$ —	\$ 831	\$ —	\$ 831
Fixed insurance contracts	—	—	12,787	12,787
Total assets in the fair value hierarchy	\$ —	\$ 831	\$ 12,787	\$ 13,618
Investments measured at net asset value				\$ 107,751
Total	\$ 2,094	\$ 831	\$ 12,787	\$ 123,463

The following table presents the changes for those financial instruments classified within Level 3 of the valuation hierarchy for international plan pension assets for the years ended December 31, 2017 and 2018 (dollars in thousands):

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	Fixed Insurance Contracts
Balance at December 31, 2016	\$ 11,142
Gain / contributions / currency impact	1,651
Distributions	(6)
Balance at December 31, 2017	12,787
Gain / contributions / currency impact	1,619
Distributions	(10)
Balance at December 31, 2018	\$ 14,396

We annually re-evaluate assumptions and estimates used in projecting pension assets, liabilities and expenses. These assumptions and estimates may affect the carrying value of pension assets, liabilities and expenses in our Consolidated Financial Statements. Assumptions used to determine net pension costs and projected benefit obligations are:

Pension Benefit Obligations Key Assumptions	As of December 31,	
	2018	2017
Weighted average assumptions to determine benefit obligations:		
Discount rate	3.71 %	3.20 %
Rate of compensation increase	1.74 %	1.57 %

Pension Cost Key Assumptions

Weighted average assumptions to determine net cost:		
Discount rate	3.20 %	3.61 %
Expected return on plan assets	4.94 %	4.95 %
Rate of compensation increase	1.57 %	1.57 %

We adjust our discount rate annually in relation to the rate at which the benefits could be effectively settled. Discount rates are set for each plan in reference to the yields available on AA-rated corporate bonds of appropriate currency and duration. The appropriate discount rate is derived by developing an AA-rated corporate bond yield curve in each currency. The discount rate for a given plan is the rate implied by the yield curve for the duration of that plan's liabilities. In certain countries, where little public information is available on which to base discount rate assumptions, the discount rate is based on government bond yields or other indices and approximate adjustments to allow for the differences in weighted durations for the specific plans and/or allowance for assumed credit spreads between government and AA rated corporate bonds.

The expected return on assets assumption represents our best estimate of the long-term return on plan assets and generally was estimated by computing a weighted average return of the underlying long-term expected returns on the different asset classes, based on the target asset allocations. The expected return on assets assumption is a long-term assumption that is expected to remain the same from one year to the next unless there is a significant change in the target asset allocation, the fees and expenses paid by the plan or market conditions.

The rate of compensation increase assumption is generally based on salary increases.

Plan Assets. The following table presents our retirement plan weighted average asset allocations at December 31, 2018, by asset category:

	Percentage of Plan Assets as of December 31, 2018			
	US		Foreign	
Equity securities and return seeking assets	20	%	—	%
Fixed income, debt securities, or cash	80	%	100	%
Total	100	%	100	%

Investment Policy and Strategy. The investment policy and strategy of the U.S. plan is to invest approximately 20% in equities and return seeking assets and approximately 80% in fixed income securities. Rebalancing is undertaken

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monthly. To the extent we maintain plans in other countries, target asset allocation is 100% fixed income investments. For each plan, the investment policy is set within both asset return and local statutory requirements.

Information for our pension plans with an accumulated benefit obligation in excess of plan assets at December 31, 2017 and 2018 follows:

	2018		2017	
	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)			
Accumulated benefit obligation	\$126,985	\$20,601	\$139,746	\$18,843
Fair value of plan assets	99,845	14,396	109,845	13,618

Information for our pension plans with a projected benefit obligation in excess of plan assets at December 31, 2017 and 2018 follows:

	2018		2017	
	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)			
Projected benefit obligation	\$126,985	\$21,520	\$139,746	\$20,407
Fair value of plan assets	99,845	14,396	109,845	13,618

Following is our projected future pension plan cash flow by year:

	U.S.	Foreign
	(Dollars in thousands)	
Expected contributions in 2019:		
Expected employer contributions	\$ 684	\$ 744
Expected employee contributions	—	—
Estimated future benefit payments reflecting expected future service for the years ending December 31:		
2019	9,240	858
2020	9,221	755
2021	9,221	824
2022	9,182	824
2023	9,136	955
2024-2028	43,993	8,223

Post-Employment Benefit Plans

We provide life insurance benefits for eligible retired employees. These benefits are provided through various insurance companies. We accrue the estimated net postretirement benefit costs during the employees' credited service periods.

In July 2002, we amended our U.S. postretirement medical coverage. In 2003 and 2004, we discontinued the Medicare Supplement Plan (for retirees 65 years or older or those eligible for Medicare benefits). This change applied to all U.S. active employees and retirees. In June 2003, we announced the termination of the existing early retiree medical plan for retirees under age 65, effective December 31, 2005. In addition, we limited the amount of retiree's life insurance after December 31, 2004. These modifications are accounted for prospectively. The impact of these changes is being amortized over the average remaining period to full eligibility of the related postretirement benefits.

During 2009, we amended one of our U.S. plans to eliminate the life insurance benefit for certain non-pooled participants.

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The components of our consolidated net postretirement costs are set forth in the following table:

	For the Year Ended December 31,					
	2018		2017		2016	
	U.S.	Foreign	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)					
Service cost	\$—	\$ 1	\$—	\$2	\$—	\$4
Interest cost	264	700	333	653	360	764
Plan amendment / curtailment	—	—	—	—	—	(993)
Mark-to-market (gain) loss	(1,028)	47	(1,257)	742	(191)	(225)
Post-employment benefits (benefit) cost	\$(764)	\$ 748	\$(924)	\$ 1,397	\$ 169	\$(450)

The reconciliation of beginning and ending balances of benefit obligations under, fair value of assets of, and the funded status of, our postretirement plans is set forth in the following table:

Postretirement Benefits	As of		As of	
	December 31, 2018		December 31, 2017	
	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)			
Changes in Benefit Obligation:				
Net benefit obligation at beginning of period	\$8,461	\$12,172	\$10,175	\$10,700
Service cost	—	1	—	2
Interest cost	264	700	333	653
Foreign currency exchange rates	—	(1,333)	—	931
Actuarial (gain) loss	(1,028)	47	(1,257)	742
Gross benefits paid	(532)	(926)	(790)	(856)
Plan amendment	—	—	—	—
Net benefit obligation at end of period	\$7,165	\$10,661	\$8,461	\$12,172
Changes in Plan Assets:				
Fair value of plan assets at beginning of period	\$—	\$—	\$—	\$—
Employer contributions	532	926	790	856
Gross benefits paid	(532)	(926)	(790)	(856)
Fair value of plan assets at end of period	\$—	\$—	\$—	\$—
Funded status:	\$(7,165)	\$(10,661)	\$(8,461)	\$(12,172)
Amounts recognized in accumulated other comprehensive loss:				
Prior service credit	\$—	\$—	\$—	\$—
Amounts recognized in the statement of financial position:				
Current liabilities	\$(783)	\$(851)	\$(855)	\$(912)
Non-current liabilities	(6,382)	(9,810)	(7,606)	(11,260)
Net amount recognized	\$(7,165)	\$(10,661)	\$(8,461)	\$(12,172)

We annually re-evaluate assumptions and estimates used in projecting the postretirement liabilities and expenses. These assumptions and estimates may affect the carrying value of postretirement plan liabilities and expenses in our Consolidated Financial Statements. Assumptions used to determine net postretirement benefit costs and postretirement projected benefit obligation are set forth in the following table:

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Postretirement Benefit Obligations

	2018	2017
Weighted average assumptions to determine benefit obligations:		
Discount rate	5.57%	5.07%
Health care cost trend on covered charges:		
Initial	6.53%	6.86%
Ultimate	6.05%	6.23%
Years to ultimate	8	8

Postretirement Benefit Costs

	2018	2017
Weighted average assumptions to determine net cost:		
Discount rate	5.07%	4.80%
Health care cost trend on covered charges:		
Initial	6.86%	6.80%
Ultimate	6.23%	5.96%
Years to ultimate	7	7

Assumed health care cost trend rates have a significant effect on the amounts reported for our postretirement benefits. A one-percentage point change in assumed health care cost trend rates would have the following effects at December 31, 2018:

	One Percentage Point Increase		One Percentage Point Decrease	
	U.S.	Foreign	U.S.	Foreign
	(Dollars in thousands)			
Effect on total service cost and interest cost components	\$1	\$ 32	\$(1)	\$(66)
Effect on benefit obligations	\$14	\$ 506	\$(14)	\$(442)

Discount rates are set for each plan in reference to the yields available on AA-rated corporate bonds of appropriate currency and duration. The appropriate discount rate is derived by developing an AA-rated corporate bond yield curve in each currency. The discount rate for a given plan is the rate implied by the yield curve for the duration of that plan's liabilities. In certain countries, where little public information is available on which to base discount rate assumptions, the discount rate is based on government bond yields or other indices and approximate adjustments to allow for the differences in weighted durations for the specific plans and/or allowance for assumed credit spreads between government and AA-rated corporate bonds.

The following table represents projected future postretirement cash flow by year:

	U.S.	Foreign
	(Dollars in thousands)	
Expected contributions in 2019:		
Expected employer contributions	\$ 783	\$ 851
Expected employee contributions	—	—
Estimated future benefit payments reflecting expected future service for the years ending December 31:		
2019	783	851
2020	724	866
2021	663	891
2022	607	904
2023	554	899
2024-2025	2,174	4,769

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Savings Plan

Our employee savings plan provides eligible employees the opportunity for long-term savings and investment. The plan allows employees to contribute up to 5% of pay as a basic contribution and an additional 45% of pay as supplemental contribution. In 2018, 2017 and 2016, the contributions to our Savings Plan were \$1.3 million, \$1.6 million and \$2.5 million, respectively.

(13)Contingencies

Legal Proceedings

We are involved in various investigations, lawsuits, claims, demands, environmental compliance programs and other legal proceedings arising out of or incidental to the conduct of our business. While it is not possible to determine the ultimate disposition of each of these matters, we do not believe that their ultimate disposition will have a material adverse effect on our financial position, results of operations or cash flows.

Litigation has been pending in Brazil brought by employees seeking to recover additional amounts and interest thereon under certain wage increase provisions applicable in 1989 and 1990 under collective bargaining agreements to which employers in the Bahia region of Brazil were a party (including our subsidiary in Brazil). Prior to October 1, 2015, we were not party to such litigation. Companies in Brazil have recently settled claims arising out of these provisions and, in May 2015, the litigation was remanded, in favor of the employees, by the Brazil Supreme Court to the lower courts for further proceedings which included procedural aspects of the case, such as admissibility of instruments filed by the parties. On October 1, 2015, an action was filed by current and former employees against our subsidiary in Brazil to recover amounts under such provisions, plus interest thereon, which amounts together with interest could be material to us. In the first quarter of 2017, the state court ruled in favor of the employees. We have appealed this ruling and intend to vigorously defend it. As of December 31, 2018, we are unable to assess the potential loss associated with these proceedings as the claims do not currently specify the number of employees seeking damages or the amount of damages being sought.

Product Warranties

We generally sell products with a limited warranty. We accrue for known warranty claims if a loss is probable and can be reasonably estimated. We also accrue for estimated warranty claims incurred based on a historical claims charge analysis. Product warranties were not impacted by purchase price accounting adjustments. Claims accrued but not yet paid and the related activity within the reserve for 2017 and 2018 are as follows:

(Dollars in Thousands)

Balance as of December 31, 2016	\$	969	
Product warranty charges/adjustments	(149)	
Payments and settlements	(471)	
Balance as of December 31, 2017	\$	349	
Product warranty charges/adjustments	1,510		
Payments and settlements	(331)	
Balance as of December 31, 2018	\$	1,528	

Tax Receivable Agreement

On April 23, 2018, the Company entered into a tax receivable agreement (the "TRA") that provides Brookfield, as the sole pre-IPO stockholder, the right to receive future payments from us for 85% of the amount of cash savings, if any, in U.S. federal income tax and Swiss tax that we and our subsidiaries realize as a result of the utilization of certain tax assets attributable to periods prior to our IPO, including certain federal net operating losses ("NOLs"), previously taxed income under Section 959 of the Code, foreign tax credits, and certain NOLs in Swissco (collectively, the "Pre IPO Tax Assets"). In addition, we will pay interest on the payments we will make to Brookfield with respect to the amount of these cash savings from the due date (without extensions) of our tax return where we realize these savings to the payment date at a rate equal to LIBOR plus 1.00% per annum. The term of the TRA commenced on April 23, 2018 and will continue until there is no potential for any future tax benefit payments.

There was no liability recognized on the date we entered into the TRA as there was a full valuation allowance recorded against our deferred tax assets. During the second quarter of 2018, it was determined that the conditions were appropriate for the Company to release a valuation allowance of certain tax assets as we exited our three year cumulative loss position. This release resulted in the recording of a \$86.5 million liability related to the TRA on the Consolidated Statements of Operations as "Related party Tax Receivable Agreement Expense."

Long-term Incentive Plan

The long-term incentive plan ("LTIP") was adopted by the Company effective as of August 17, 2015, as amended and restated as of March 15, 2018. The purpose of the plan is to retain senior management personnel of the Company, to incentivize them to make decisions with a long-term view and to influence behavior in a way that is consistent with maximizing value for the pre-IPO stockholder of the Company in a prudent manner. Each participant is allocated a number of profit units, with a maximum of 30,000 profit units (or Profit Units) available under the plan. Awards of Profit Units generally vest in equal increments over a five-year period beginning on the first anniversary of the grant date and subject to continued employment with the Company through each vesting date. Any unvested Profit Units that have not been previously forfeited will accelerate and become fully vested upon a "Change in Control" (as defined below).

Profit Units will generally be settled in a lump sum payment within 30 days following a Change in Control based on the "Sales Proceeds" (as defined below) received by Brookfield Capital Partners IV, L.P. (or, together with its affiliates, Brookfield Capital IV) in connection with the Change in Control. The LTIP defines "Change in Control" as any transaction or series of transactions (including, without limitation, the consummation of a combination, share purchases, recapitalization, redemption, issuance of capital stock, consolidation, reorganization or otherwise) pursuant to which (a) a Person not affiliated with Brookfield Capital IV acquires securities representing more than seventy percent (70%) of the combined voting power of the outstanding voting securities of the Company or the entity surviving or resulting from such transaction, (b) following a public offering of the Company's stock, Brookfield Capital IV has ceased to have a beneficial ownership interest in at least 30% of the Company's outstanding voting securities (effective on the first of such date), or (c) the Company sells all or substantially all of the assets of the Company and its subsidiaries on a consolidated basis. It is intended that the occurrence of a Change in Control in which Sales Proceeds exceed the Threshold Value would constitute a "substantial risk of forfeiture" within the meaning of Section 409A of the Code. The LTIP defines "Threshold Value" as, as of any date of determination, an amount equal to \$855,000,000, (which represents the amount of the total invested capital of Brookfield Capital IV as of August 17, 2015), plus the dollar value of any cash or other consideration contributed to or invested in the Company by Brookfield Capital IV after August 17, 2015. The Threshold Value shall be determined by the Board of Directors in its sole discretion. The LTIP defines "Sales Proceeds" as, as of any date of determination, the sum of all proceeds actually received by the Brookfield Capital IV, net of all Sales Costs (as defined below), (i) as consideration (whether cash or equity) upon the Change in Control and (ii) as distributions, dividends, repurchases, redemptions or otherwise as a holder of such equity interests in the Company. Proceeds that are not paid upon or prior to or in connection with the Change in Control, including earn-outs, escrows and other contingent or deferred consideration shall become "Sale Proceeds" only as and when such proceeds are received by Brookfield Capital IV. "Sales Costs" means any costs or expenses (including legal or other advisor costs), fees (including investment banking fees), commissions or discounts payable directly by Brookfield Capital IV in connection with, arising out of or relating to a Change in Control, as determined by the Board of Directors in its sole discretion.

Given the successful completion of the IPO in the second quarter, it is reasonably possible that a Change in Control, as defined above, may ultimately happen and that the awarded Profit Units will be subsequently paid out to the participants. Assuming 100% vesting of the awarded Profit Units and depending on Brookfield's sales proceeds, the potential liability triggered by a Change in Control is estimated to be in the range of \$65 million to \$90 million. As of December 31, 2018, the awards are 60% vested.

(14) Income Taxes

The following table summarizes the U.S. and non-U.S. components of income (loss) from continuing operations before provision for income taxes:

For the Year Ended December 31,		
2018	2017	2016

(Dollars in thousands)

U.S.	\$(68,032)	\$(26,981)	\$(44,971)
Non-U.S.	970,840	30,412	(71,450)
	\$902,808	\$3,431	\$(116,421)

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Income tax expense (benefit) consists of the following:

	For the Year Ended December		
	31,		
	2018	2017	2016
U.S income taxes:			
Current	\$787	\$(1,066)	\$(878)
Deferred	(52,145)	38	1,152
	(51,358)	(1,028)	274
Non-U.S. income taxes:			
Current	85,252	5,924	5,389
Deferred	15,026	(15,677)	(13,215)
	100,278	(9,753)	(7,826)
Total income tax expense (benefit)	\$48,920	\$(10,781)	\$(7,552)

The tax expense changed from a benefit of \$(7.6) million and \$(10.8) million for the years ended December 31, 2016 and 2017 to a tax expense of \$48.9 million for the year ended December 31, 2018 primarily due to the increase in earnings, the shift in the jurisdictional mix of earnings and losses from year to year, and offset by a partial release of a valuation allowance recorded against the deferred tax asset related to certain U.S. tax attributes. Certain jurisdictions shifted from pre-tax losses in 2016 and 2017 to pretax earnings in 2018.

Tax Cuts and Jobs Act

On December 22, 2017, the U.S. government enacted the Tax Cuts and Jobs Act ("Tax Act"), which significantly revises the U.S. corporate income tax system. These changes include a federal statutory rate reduction from 35% to 21%, the elimination or reduction of certain domestic deductions and credits and limitations on the deductibility of interest expense and executive compensation. The Tax Act also transitions international taxation from a worldwide system to a modified territorial system and includes base erosion prevention measures which have the effect of subjecting certain earnings of our foreign subsidiaries to U.S. taxation as GILTI. In general, these changes were effective beginning in 2018. The Tax Act also includes a one time mandatory deemed repatriation or transition tax on the accumulated previously untaxed foreign earnings of our foreign subsidiaries.

For the fourth quarter of 2017, we were able to reasonably estimate certain Tax Act effects and, therefore, recorded provisional adjustments associated with the deemed repatriation transition tax and remeasurement of certain deferred tax asset and liabilities.

Due to the complexities involved in accounting for the enactment of the Tax Act, SAB No. 118 allowed the Company to record provisional amounts in earnings for the year ended December 31, 2017. SAB No. 118 provides that where reasonable estimates can be made, the provisional accounting should be based on such estimates and when no reasonable estimate can be made, the provisional accounting may be based on the tax law in effect before the Tax Act. On October 15, 2018, the Company's U.S. tax returns for 2017 were filed and the changes to the provisional tax positions reflected in those returns compared to the estimates recorded in the Company's earnings for the year ended December 31, 2017 were recorded in 2018. These adjustments were immaterial to the Company's financial statements. On August 1, 2018, the U.S. Department of Treasury and the Internal Revenue Service ("IRS") issued proposed regulations under code section 965 and on January 15, 2019, the IRS issued final 965 regulations. The Company continues to analyze the effects of the Tax Act and newly issued final regulations on its financial statements. The final impact of the Tax Act and the regulations may differ from the amounts that have been recognized, due to, among other things, changes in the Company's interpretation of the Tax Act, additional legislative or administrative actions to clarify the intent of the statutory language provided that they differ from the Company's current interpretation, any changes in accounting standards for income taxes or related interpretations in response to the Tax Act, or any updates or changes to estimates utilized to calculate the impacts, including changes to current year earnings estimates and applicable foreign exchange rates. We estimate that any change will be immaterial to the Company's financial statements at this time.

The Company has determined the impact of the GILTI provisions under the Tax Act and has recorded the estimate of this impact in the financial results of 2018. As these GILTI provisions under the Tax Act are complex and subject to continuing regulatory interpretation by the IRS, the Company will continue to evaluate the impact. The Company is required to make an accounting policy election of either (1) treating taxes due on future U.S. inclusions in taxable income related to GILTI as a current

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period expense when incurred (the “period cost method”) or (2) factoring such amounts into the Company’s measurement of its deferred taxes (the “deferred method”). As of December 31, 2018, the Company’s accounting policy will be to treat taxes due on future U.S. inclusions in taxable income related to GILTI as a current period expense when incurred.

Income tax expense (benefit) differed from the amounts computed by applying the U.S. federal income tax rate of 35% to income before expense (benefit) for taxes as set forth in the following table:

	For the Year Ended December		
	31,		
	2018	2017	2016
	(Dollars in thousands)		
Tax at statutory U.S. federal rate	\$189,590	\$1,201	\$(40,747)
Impact of U.S. Tax Cut and Jobs Act - GILTI	93,739	—	—
Impact of the 2017 Tax Act - transition tax	—	39,628	—
Impact of the 2017 Tax Act - tax rate change	—	52,228	—
Impact of Tax Receivable Agreement	18,160	—	—
Valuation allowance, net	(93,125)	(89,269)	35,091
State taxes, net of federal tax benefit	1,529	3,437	(2,324)
U.S. tax impact of foreign earnings (net of foreign tax credits)	792	1,151	51
Investment in subsidiary impairment deduction	—	—	(10,114)
Establishment/resolution of uncertain tax positions	(345)	(840)	(513)
Adjustment for foreign income taxed at different rates	(95,822)	(2,359)	12,738
Foreign tax credits	(65,046)	(17,956)	(175)
Other	(552)	1,998	(1,559)
Provision (benefit) for income taxes	\$48,920	\$(10,781)	\$(7,552)

The company has been granted a tax holiday in Brazil, which expires in 2024. The availability of the tax holiday in Brazil did not have a significant impact on the current tax year.

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The tax effects of temporary differences that give rise to significant components of the deferred tax assets and deferred tax liabilities at December 31, 2018 and December 31, 2017 are set forth in the following table.

	As of December 31,	
	2018	2017
	(Dollars in thousands)	
Deferred tax assets:		
Postretirement and other employee benefits	\$ 18,395	\$ 19,392
Foreign tax credit and other carryforwards	111,325	175,229
Capitalized research and experimental costs	7,695	9,417
Environmental reserves	976	493
Inventory	14,251	7,933
Original issue discount	—	2,603
Long-term contract option amortization	1,144	1,204
Provision for rationalization charges	351	502
Other	4,270	1,536
Total gross deferred tax assets	158,407	218,309
Less: valuation allowance	(58,446)	(150,839)
Total deferred tax assets	99,961	67,470
Deferred tax liabilities:		
Fixed assets	\$ 59,521	\$ 68,098
Debt discount amortization / Deferred financing fees	—	3,191
Inventory	7,751	5,128
Goodwill and acquired intangibles	3,668	—
Other	3,138	2,031
Total deferred tax liabilities	74,078	78,448
Net deferred tax asset (liability)	\$ 25,883	\$ (10,978)

Net non-current deferred tax assets are separately stated as deferred income taxes in the amount of \$30.8 million as of December 31, 2017 and \$71.7 million as of December 31, 2018. Net non-current deferred tax liabilities are separately stated as deferred income taxes in the amount of \$41.7 million at December 31, 2017 and \$45.8 million at December 31, 2018.

During 2016, an affiliate of Brookfield, purchased on the open market in aggregate approximately \$53 million of GrafTech's traded senior notes. This related party transaction generated a gain due to the discount at which the senior note was trading. This gain was taxable to GrafTech in 2016 and generated a deferred tax asset for an original issuance discount of approximately \$6.5 million. This deferred tax asset was \$2.6 million at December 31, 2017. The GrafTech senior notes were retired in 2018 and the related deferred tax asset was also released.

We continue to assess the need for valuation allowances against deferred tax assets based on determinations of whether it is more likely than not that deferred tax benefits will be realized through the generation of future taxable income. Appropriate consideration is given to all available evidence, both positive and negative, in assessing the need for a valuation allowance. Examples of positive evidence would include a strong earnings history, an event or events that would increase our taxable income through a continued reduction of expenses, and tax planning strategies that would indicate an ability to realize deferred tax assets. Examples of negative evidence would include cumulative losses in recent years and history of tax attributes expiring unused. In circumstances where the significant positive evidence does not outweigh the negative evidence in regards to whether or not a valuation allowance is required, we have established and maintained valuation allowances on those net deferred tax assets. The recognition of the valuation allowance does not result in or limit the Company's ability to utilize these tax assets in the future.

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
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Valuation allowance activity for the years ended December 31, 2017 and 2018 was as follows:

	(Dollars in thousands)
Balance as of December 31, 2015	\$ 165,539
Charged to income	78,469
Translation adjustment	583
Changes attributable to movement in underlying assets	250
Balance as of December 31, 2016	\$ 244,841
Credited to income	(87,194)
Translation adjustment	207
Changes attributable to movement in underlying assets	(7,015)
Balance as of December 31, 2017	\$ 150,839
Credited to income	(93,125)
Translation adjustment	(302)
Changes attributable to movement in underlying assets	1,034
Balance as of December 31, 2018	\$ 58,446

In the fourth quarter of 2017, with the enactment of the Tax Act, additional taxable income was derived as a result of inclusion of accumulated previously untaxed foreign earnings of GrafTech's foreign subsidiaries. This additional taxable income led to the utilization of the U.S. net operating loss carryforward in 2017 and a partial release of the valuation allowance against the U.S. deferred tax assets. The valuation allowance was further reduced by the U.S. tax rate decrease from 35% to 21% as a result of the Tax Act. During 2018, we determined that sufficient positive evidence existed that allowed us to conclude that a full valuation allowance was no longer required to be recorded against the deferred tax assets related to the U.S. tax attributes. This positive evidence was primarily supplied by the company exiting a cumulative loss period in the U.S. as well as sufficient US current and forecasted taxable income that would utilize the U.S. tax attributes. As a result, a partial release (to reflect only the economic benefit of the attributes) of the valuation allowance against federal net operating losses and state losses was recorded in 2018 while a full release of the valuation allowance against the federal foreign tax credit carryforward, other federal deferred tax assets was also recorded. A valuation allowance of \$35.8 million is included in the December 31, 2018 balance reflected above as there is not sufficient positive evidence that the deferred tax asset related to the U.S. net operating loss will generate more than its estimated economic benefit.

In March of 2017, \$19.5 million of foreign tax credit expired. During the fourth quarter of 2017, we increased our foreign tax credit carryforward by \$37.7 million, as a result of additional foreign taxable income derived in connection with the new U.S. tax legislation that was enacted on December 22, 2017. As of December 31, 2018 we have a total foreign tax credit carryforward of \$38.9 million. As indicated above, a valuation allowance is no longer recorded against this foreign tax credit carryforward. These tax credit carryforwards begin to expire as of March 15, 2025. In addition, we have a federal net operating loss carryforward of \$25.2 million and state net operating losses carryforwards of \$320.3 million (net of federal benefit), which can be carried forward from 5 to 20 years. These net operating losses carryforwards generate a deferred tax asset of \$59.3 million as of December 31, 2018. We also have U.S. non-net operating loss related deferred tax assets of \$3.0 million as of December 31, 2018. The federal net operating loss carryforward is limited by IRC §382.

We have non-U.S. loss and tax credit carryforwards on a gross tax effected basis of \$10.1 million, which can be carried forward from 7 years to indefinitely.

During the fourth quarter of 2017, GrafTech Switzerland moved from a cumulative loss position to a cumulative profit position, as well as a current year utilization of its net operating loss carryforward. This positive evidence and utilization led to a full release of the valuation allowance against the GrafTech Switzerland deferred tax asset in 2017.

As of December 31, 2018, we had unrecognized tax benefits of \$2.0 million, which, if recognized, would have a favorable impact on our effective tax rate. We have elected to report interest and penalties related to uncertain tax

positions as income tax expense. Accrued interest and penalties were \$0.8 million as of December 31, 2016 (an increase of \$0.1 million), \$0.8 million as of December 31, 2017 (an increase of \$0.0 million) and \$0.9 million as of December 31, 2018 (an increase of \$0.1 million). A reconciliation of the beginning and ending amount of unrecognized tax benefits is as follows:

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GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
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	(Dollars in thousands)
Balance as of December 31, 2016	\$ 3,338
Additions for tax positions of prior years	114
Lapse of statutes of limitations	(989)
Foreign currency impact	29
Balance as of December 31, 2017	\$ 2,492
Reductions for tax positions of prior years	(100)
Lapse of statutes of limitations	(373)
Settlements	(21)
Foreign currency impact	(8)
Balance as of December 31, 2018	\$ 1,990

It is reasonably possible that a reduction of unrecognized tax benefits of up to \$2.0 million may occur within 12 months due to settlements and the expiration of statutes of limitation.

We file income tax returns in the U.S. federal jurisdiction, and various state and foreign jurisdictions. All U.S. federal tax years prior to 2015 are generally closed by statute or have been audited and settled with the applicable domestic tax authorities. All other jurisdictions are still open to examination beginning after 2012.

As of December 31, 2018, the Company has accumulated undistributed earnings generated by our foreign subsidiaries of approximately \$1.6 billion. Because \$998.3 million of such earnings have previously been subject to the one-time transition tax on foreign earnings required by the Tax Act, any additional taxes due with respect to such earnings or the excess of the amount for financial reporting over the tax basis of our foreign investments would generally be limited to foreign and state taxes. We intend, however, to indefinitely reinvest these earnings and expect future U.S. cash generation to be sufficient to meet future U.S. cash needs.

(15) Stockholders' Equity

The following information should be read in conjunction with the Consolidated Statement of Stockholders' Equity.
 Stock Split

On April 12, 2018, the Company effected a 3,022,259.23 to one stock split of the Company's then outstanding common stock. We have retroactively applied this split to all share presentations, as well as "Net income (loss) per share" and "Income (loss) from continuing operations per share" calculations for the periods presented.

Conditional Dividend to Pre-IPO Stockholder

On April 19, 2018, we declared a \$160 million cash dividend payable to Brookfield, the sole pre-IPO stockholder. Payment of this dividend was conditional upon (i) the Senior Secured First Lien Net Leverage Ratio (as defined in the 2018 Credit Agreement), as calculated based on our final financial results for the first quarter of 2018, being equal to or less than 1.75 to 1.00, (ii) no Default or Event of Default (as defined in the 2018 Credit Agreement) having occurred and continuing or that would result from the payment of the dividend and (iii) the payment occurring within 60 days from the dividend record date. The conditions of this dividend were met upon filing of our first quarter report on Form 10-Q and the dividend was paid on May 8, 2018.

Brookfield Promissory Note

On April 19, 2018, we declared a dividend in the form of the Brookfield Promissory Note to the sole pre-IPO stockholder. This note was repaid on June 15, 2018 with proceeds from our Incremental Term Loans. See Note 7 "Debt and Liquidity".

Initial Public Offering

On April 23, 2018, we completed the IPO of 35,000,000 shares of our common stock at a price of \$15 per share. This offering represented a sale of 11.6% of our sole pre-IPO stockholder's ownership in the Company.

GRAFTECH INTERNATIONAL LTD. AND SUBSIDIARIES
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

On April 26, 2018, we closed the sale of an additional 3,097,525 shares of common stock at a price to the public of \$15 per share from the pre-IPO stockholder, as a result of the partial exercise by the underwriters in our IPO of their overallotment option. After giving effect to the partial exercise of the overallotment option, the total number of shares of common stock sold by the pre-IPO stockholder was 38,097,525.

The Company did not receive any proceeds related to the offering. We have incurred \$5.1 million of legal, accounting, printing and other fees associated with this offering through December 31, 2018, which was recorded in "Selling and administrative" expenses in the Consolidated Statements of Operations.

Dividends

The Board of Directors declared and paid a dividend of \$0.0645 per share for the first quarter of 2018 totaling \$19.5 million, which was paid on June 29, 2018 and represented a prorated quarterly dividend of \$0.085 (or \$0.34 per annum) per share of our common stock prorated from the date of our IPO, April 23, 2018 to June 30, 2018. We paid our regular quarterly dividends of \$0.85 per share on September 28 and December 31, 2018. Additionally, we paid a special dividend to stockholders of \$0.70 per share on December 31, 2018.

Follow-on Offering and Common Stock Repurchase

On August 13, 2018, Brookfield completed an underwritten public secondary offering (the "Offering") of 23,000,000 shares of our common stock at a price to the public of \$20.00 per share. The Company did not receive any proceeds related to the Offering. Pursuant to a share repurchase agreement with Brookfield, we concurrently repurchased 11,688,311 shares directly from Brookfield. The price per share paid by us in the repurchase was equal to the price at which the underwriters purchased the shares from Brookfield in the Offering net of underwriting commissions and discounts. We funded the share repurchase from cash on hand. The terms and conditions of the share repurchase were reviewed and approved by the audit committee of our board of directors, which is comprised solely of independent directors. All repurchased shares were retired.

The balance in our accumulated other comprehensive income (loss) is set forth in the following table:

	As of December 31, 2018	As of December 31, 2017
	(Dollars in thousands)	
Foreign currency translation adjustments, net of tax	\$ (2,922)	\$ 15,468
Commodities and foreign currency derivatives, net of tax	(2,878)	4,821
Total accumulated comprehensive (loss) income	\$ (5,800)	\$ 20,289

(16) Earnings per Share

The following table shows the information used in the calculation of our basic and diluted earnings per share calculation as of December 31, 2018 and December 31, 2017. See Note 15 "Stockholders' Equity" for details on our April 12, 2018 stock split and our common stock repurchase on August 13, 2018.

	For the Year Ended December 31,		
	2018	2017	2016
Weighted average common shares outstanding for basic calculation	297,748,327	302,225,923	302,225,923
Add: Effect of stock options and restricted stock	5,443	—	—
Weighted average common shares outstanding for diluted calculation	297,753,770	302,225,923	302,225,923

Basic earnings per common share are calculated by dividing net income (loss) by the weighted average number of common shares outstanding. Diluted earnings per share are calculated by dividing net income (loss) by the sum of the weighted average number of common shares outstanding plus the additional common shares that would have been outstanding if potentially dilutive securities had been issued.

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The weighted average common shares outstanding for the diluted earnings per share calculation excludes consideration of stock options covering 650,432 shares in 2018, as these shares are anti-dilutive.

(17) Summary of quarterly financial data (Unaudited)

The following summarizes certain consolidated operating results by quarter for 2018 and 2017. 2017 periods presented have been revised for the change in accounting for pension and OPEB presentation. This change had no impact on Net income or Net income per share.

	2018				2017			
	March 31	June 30	September 30	December 31	March 31	June 30	September 30	December 31
	(Dollars in thousands, except per share amounts)							
As Reported:								
Net Sales	\$451,899	\$456,332	\$454,890	\$532,789	\$104,739	\$116,314	\$137,245	\$192,473
Gross profit	306,750	290,422	274,610	318,430	1,085	9,679	16,561	60,598
Research and development	429	581	518	601	829	943	1,338	(159)
Selling and administrative expenses	15,876	16,239	14,234	15,683	11,683	12,195	13,322	12,280
Other expense (income), net	2,005	(974)	1,502	828	3,067	1,186	(643)	(1,976)
Related party Tax Receivable	—	61,801	—	24,677	—	—	—	—
Agreement Expense								
Net income (loss)	223,673	201,448	199,466	229,632	(26,344)	(17,383)	(3,919)	55,628
Net income (loss) per share	\$0.74	\$0.67	\$0.67	\$0.79	\$(0.09)	\$(0.06)	\$(0.01)	\$0.18
Effect of Change:								
Net Sales	\$—	\$—	\$—	\$—	\$—	\$—	\$—	\$—
Gross profit	—	—	—	—	201	201	201	(809)
Research and development	—	—	—	—	(9)	(10)	(9)	532
Selling and administrative expenses	—	—	—	—	(27)	(26)	(29)	3,109
Other expense (income), net	—	—	—	—	237	237	239	(4,450)
Net income (loss)	—	—	—	—	—	—	—	—
Net income (loss) per share	\$—	\$—	\$—	\$—	\$—	\$—	\$—	\$—
Revised:								
Net Sales	\$451,899	\$456,332	\$454,890	\$532,789	\$104,739	\$116,314	\$137,245	\$192,473
Gross profit	306,750	290,422	274,610	318,430	1,286	9,880	16,762	59,789
Research and development	429	581	518	601	820	933	1,329	373
Selling and administrative expenses	15,876	16,239	14,234	15,683	11,656	12,169	13,293	15,389
Other expense (income), net	2,005	(974)	1,502	828	3,304	1,423	(404)	(6,426)
Related party Tax Receivable	—	61,801	—	24,677	—	—	—	—

Agreement Expense									
Net income (loss)	223,673	201,448	199,466	229,632	(26,344)	(17,383)	(3,919)		55,628
Net income (loss) per share	\$0.74	\$0.67	\$0.67	\$0.79	\$(0.09)	\$(0.06)	\$(0.01)		\$0.18

(18) Subsequent Events

On February 7, 2019, the Board of Directors declared a dividend of \$.085 per share to stockholders of record as of the close of business on February 28, 2019, to be paid on March 29, 2019.

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

None.

Item 9A. Controls and Procedures

Disclosure Controls and Procedures

Management is responsible for establishing and maintaining adequate disclosure controls and procedures at the reasonable assurance level. Disclosure controls and procedures are designed to ensure that information required to be disclosed by a reporting company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by it in the reports that it files under the Exchange Act is accumulated and communicated to management, including the Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we have evaluated the effectiveness of the design and operation of our disclosure controls and procedures as of December 31, 2018. Based on that evaluation, our Chief Executive Officer and Chief Financial Officer concluded that these controls and procedures are effective at the reasonable assurance level as of December 31, 2018.

Management's Annual Report on Internal Control Over Financial Reporting and Attestation Report of Independent Registered Public Accounting Firm

This annual report does not include a report of management's assessment regarding internal control over financial reporting or an attestation report of the company's registered public accounting firm due to a transition period established by rules of the Securities and Exchange Commission for newly public companies.

Changes in Internal Control over Financial Reporting

There has been no change in the Company's internal controls over financial reporting during the Company's most recent fiscal quarter that has materially affected, or is reasonably likely to materially affect, the Company's internal controls over financial reporting.

Item 9B. Other Information

None.

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PART III

Items 10 to 14 (inclusive).

Except as set forth in Part I, the information required by Items 10, 11, 12, 13 and 14 will appear in the definitive GrafTech International Ltd. Proxy Statement for the Annual Meeting of Stockholders to be held on April 29, 2019, which will be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 and is incorporated by reference in this Annual Report pursuant to General Instruction G(3) of Form 10-K (other than the portions thereof not deemed to be “filed” for the purpose of Section 18 of the Securities Exchange Act of 1934).

PART IV

Item 15. Exhibits and Financial Statement Schedules

The following documents are filed as part of this report.

(a) (1) Financial Statements

The financial statements are set forth under Item 8 of this Annual Report on Form 10-K.

(2) Financial Statement Schedules

None.

(3) Exhibits

The exhibits listed in the following table have been filed with, or incorporated by reference into, this Annual Report.

Exhibit Number	Description of Exhibit
2.1	<u>Agreement and Plan of Merger dated as of May 17, 2015 among GrafTech International Ltd., BCP IV GrafTech Holdings LP and Athena Acquisition Subsidiary, Inc. (incorporated by reference to Exhibit 2.1 to GrafTech International Ltd.’s Current Report on Form 8 K filed May 18, 2015).</u>
3.1	<u>Amended and Restated Certificate of Incorporation of GrafTech International Ltd. (incorporated by reference to Exhibit 3.1 to GrafTech International Ltd.’s Registration Statement on Form S 1/A (Registration No. 333 223791) filed April 13, 2018).</u>
3.2	<u>Amended and Restated By Laws of GrafTech International Ltd. (incorporated by reference to Exhibit 3.2 to GrafTech International Ltd.’s Registration Statement on Form S 1/A (Registration No. 333 223791) filed April 13, 2018).</u>
4.1	<u>Registration Rights Agreement by and between GrafTech International Ltd. and BCP GrafTech Holdings LP (incorporated by reference to Exhibit 4.1 to GrafTech International Ltd.’s Form 10 Q filed on August 3, 2018).</u>
4.2	<u>Stockholder Rights Agreement by and between GrafTech International Ltd. and BCP IV GrafTech Holdings LP (incorporated by reference to Exhibit 4.2 to GrafTech International Ltd.’s Form 10 Q filed on August 3, 2018).</u>
10.1	<u>Credit Agreement, dated February 12, 2018, among GrafTech International Ltd., GrafTech Finance Inc., GrafTech Switzerland SA and GrafTech Luxembourg II S.À.R.L., as co borrowers, the lenders and issuing banks party thereto and JPMorgan Chase Bank, N.A., as Administrative Agent and Collateral Agent (incorporated by reference to Exhibit 10.1 to GrafTech International Ltd.’s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).</u>
10.2	<u>First Amendment to the Credit Agreement, dated June 15, 2018, among GrafTech International Ltd., GrafTech Finance Inc., GrafTech Switzerland SA, GrafTech Luxembourg II S.À.R.L. as co borrowers, the lenders and issuing banks party thereto and JPMorgan Chase Bank, N.A., as Administrative Agent and Collateral Agent (incorporated by reference to Exhibit 10.1 to GrafTech International Ltd.’s Form 10 Q filed on August 3, 2018).</u>
10.3	<u>Guarantee Agreement, dated February 12, 2018, among GrafTech International Ltd., GrafTech Finance Inc., the other subsidiaries of GrafTech International Ltd. from time to time party thereto and JPMorgan Chase Bank, N.A., as Administrative Agent (incorporated by reference to Exhibit 10.2 to GrafTech International Ltd.’s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).</u>

10.4 Collateral Agreement, dated as of February 12, 2018, among GrafTech International Ltd., GrafTech Finance Inc., the other grantors party thereto and JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.3 to GrafTech International Ltd.'s Registration Statement on Form S-1 (Registration No. 333-223791) filed March 20, 2018).

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- 10.5 European Guarantee and Luxembourg Security Agreement, dated as of February 12, 2018, by GrafTech Luxembourg I S.À.R.L., GrafTech Luxembourg II S.À.R.L., GrafTech Switzerland SA and JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.4 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.6 Pledge Agreement, dated as of February 12, 2018, by GrafTech Switzerland SA in favor of JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.5 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.7 Pledge Agreement, dated as of February 12, 2018, by GrafTech Luxembourg I S. À.R.L in favor of JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.6 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.8 Pledge Agreement, dated as of February 12, 2018, by GrafTech Luxembourg II S.À.R.L in favor of JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.7 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.9 Patent Security Agreement, dated as of February 12, 2018, among GrafTech International Holdings Inc., as Grantor, and JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.8 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.10 Trademark Security Agreement, dated as of February 12, 2018, among GrafTech International Holdings Inc., as Grantor, and JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.9 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.11 Copyright Security Agreement, dated as of February 12, 2018, among GrafTech International Holdings, Inc., as Grantor, and JPMorgan Chase Bank, N.A., as Collateral Agent (incorporated by reference to Exhibit 10.10 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.12 Share Pledge Agreement, dated February 12, 2018, between GrafTech Luxembourg I S.À.R.L., as Pledgor, and JPMorgan Chase Bank, N.A., as Collateral Agent, in the presence of GrafTech Luxembourg II S.À.R.L. (incorporated by reference to Exhibit 10.11 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.13 Share Pledge Agreement, dated as of February 12, 2018, between GrafTech International Holdings Inc., as Pledgor, and JPMorgan Chase Bank, N.A., as Collateral Agent, in the presence of GrafTech Luxembourg I S.À.R.L. (incorporated by reference to Exhibit 10.12 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.14 Swiss Security Agreement, dated as of February 12, 2018, by GrafTech Switzerland SA and JPMorgan Chase Bank, N.A., as the Assignee and Collateral Agent (incorporated by reference to Exhibit 10.13 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.15 Form of Tax Receivable Agreement between GrafTech International Ltd. and Brookfield Capital Partners IV GP, Ltd. (incorporated by reference to Exhibit 10.14 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.16+ Form of Indemnification Agreement with Directors and Executive Officers (incorporated by reference to Exhibit 10.15 to GrafTech International Ltd.'s Registration Statement on Form S 1/A (Registration No. 333 223791) filed March 26, 2018).
- 10.17+ GrafTech International Holdings Inc. Compensation Deferral Program as amended and restated (January 1, 2005) (incorporated by reference to Exhibit 10.10.0 to GrafTech International Ltd.'s Annual Report on Form 10 K filed February 27, 2009).
- 10.21+ Employment Agreement, effective March 1, 2018, between GrafTech International Holdings Inc. and David J. Rintoul (incorporated by reference to Exhibit 10.20 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).
- 10.22+ GrafTech International Ltd. Incentive Compensation Plan (incorporated by reference to Exhibit 10.21 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20,

2018).

GrafTech International Ltd. Long Term Incentive Plan, amended and restated as of March 15, 2018

10.24+ (incorporated by reference to Exhibit 10.23 to GrafTech International Ltd.'s Registration Statement on Form S 1 (Registration No. 333 223791) filed March 20, 2018).

GrafTech International Ltd. Omnibus Equity Incentive Plan (incorporated by reference to Exhibit 10.24 to

10.25+ GrafTech International Ltd.'s Registration Statement on Form S 1/A (Registration No. 333 223791) filed April 4, 2018).

Form of Stock Option Agreement for the GrafTech International Ltd. Omnibus Equity Incentive Plan

10.26+ (incorporated by reference to Exhibit 10.25 to GrafTech International Ltd.'s Registration Statement on Form S 1/A (Registration No. 333 223791) filed April 4, 2018).

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- 10.27+ Form of Stock Option Agreement under the GrafTech International Ltd. Omnibus Equity Incentive Plan for David Rintoul (incorporated by reference to Exhibit 10.26 to GrafTech International Ltd.'s Registration Statement on Form S-1/A (Registration No. 333-223791) filed April 4, 2018).
- 10.28+ Form of Deferred Share Unit Agreement under the GrafTech International Ltd. Omnibus Equity Incentive Plan for Non-Employee Directors (incorporated by reference to Exhibit 10.27 to GrafTech International Ltd.'s Registration Statement on Form S-1/A (Registration No. 333-223791) filed April 4, 2018).
- 10.29+ Form of Deferred Share Unit Agreement under the GrafTech International Ltd. Omnibus Equity Incentive Plan for David Rintoul (incorporated by reference to Exhibit 10.28 to GrafTech International Ltd.'s Registration Statement on Form S-1/A (Registration No. 333-223791) filed April 4, 2018).
- 10.30+ GrafTech International Ltd. Director Deferred Fee Plan (incorporated by reference to Exhibit 10.30 to GrafTech International Ltd.'s Registration Statement on Form S-1 (Registration No. 333-226609) filed August 6, 2018).
- 10.31 Share Repurchase Agreement, dated as of August 7, 2018, by and between GrafTech International Ltd. and BCP IV GrafTech Holdings LP (incorporated by reference to Exhibit 10.31 to GrafTech International Ltd.'s Registration Statement on Form S-1/A (Registration No. 333-226609) filed August 8, 2018).
- 10.32*+ Amendment to Deferred Share Unit Agreement under the GrafTech International Ltd. Omnibus Equity Incentive Plan for David Rintoul.
- 10.33*+ Amended and Restated GrafTech International Ltd. Director Deferred Fee Plan, amended as of November 1, 2018.
- 10.34*+ Form of Deferred Share Unit Agreement under the GrafTech International Ltd. Omnibus Equity Incentive Plan for Non-Employee Directors (adopted November 1, 2018).
- 10.35*+ Summary of Modifications to Employment Agreement, effective March 1, 2018, between GrafTech International Holdings Inc. and David J. Rintoul
- 21.1* List of subsidiaries of GrafTech International Ltd.
- 23.1* Consent of Deloitte & Touche LLP, Independent Registered Public Accounting Firm.
- 31.1* Certification pursuant to Rule 13a-14(a) under the Exchange Act by David J. Rintoul, President and Chief Executive Officer (Principal Executive Officer).
- 31.2* Certification pursuant to Rule 13a-14(a) under the Exchange Act by Quinn J Coburn, Vice President and Chief Financial Officer (Principal Financial Officer).
- 32.1* Certification pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 by David J. Rintoul, President and Chief Executive Officer (Principal Executive Officer).
- 32.2* Certification pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 by Quinn J Coburn, Vice President and Chief Financial Officer (Principal Financial Officer).
- 101.INS XBRL Instance Document
- 101.SCH XBRL Taxonomy Extension Schema Document
- 101.CAL XBRL Taxonomy Extension Calculation Linkbase Document
- 101.DEF XBRL Taxonomy Extension Definition Linkbase Document
- 101.LAB XBRL Taxonomy Extension Label Linkbase Document
- 101.PRE XBRL Taxonomy Extension Presentation Linkbase Document

* Filed herewith

+ Indicates management contract or compensatory plan or arrangement

Item 16. Form 10-K Summary

Not applicable

SIGNATURES

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

GRAFTECH INTERNATIONAL LTD.

February 22, 2019 By: /s/ David J. Rintoul
 David J. Rintoul
 Title: President and Chief Executive Officer

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Signatures	Title	Date
/s/ David J. Rintoul David J. Rintoul	President, Chief Executive Officer and Director (Principal Executive Officer)	February 22, 2019
/s/ Quinn J. Coburn Quinn J. Coburn	Chief Financial Officer, Vice President Finance and Treasurer (Principal Financial and Accounting Officer)	February 22, 2019
/s/ Denis A. Turcotte Denis A. Turcotte	Chairman and Director	February 22, 2019
/s/ Jeffrey C. Dutton Jeffrey C. Dutton	Director	February 22, 2019
/s/ Ron A. Bloom Ron A. Bloom	Director	February 22, 2019
/s/ Brian L. Acton Brian L. Acton	Director	February 22, 2019
/s/ Michel L. Dumas Michel L. Dumas	Director	February 22, 2019
/s/ Anthony R. Taccone Anthony R. Taccone	Director	February 22, 2019

