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Magnesium

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During 2019, U.S. reported consumption of primary magnesium increased slightly from that in 2018 (tables 1, 3). Magnesium exports decreased by 20% from those in 2018, and total magnesium imports for consumption increased by 26% compared with those in 2018 (table 1). Imports continued to provide a significant share of the U.S. supply of primary magnesium because there has been only one domestic producer since 2001. Since 1998, the U.S. share of the world's primary magnesium capacity has decreased to 3% from 30%. During that time period, two of three domestic producers closed and China had a greater-than-thirteenfold increase in capacity and production. Excluding production in the United States, worldwide primary magnesium production was 1.12 million metric tons (Mt) in 2019, 12% more than the revised 1.0 Mt in 2018 (table 8). Production increased in China by 12% [by 107,000 metric tons (t)], Kazakhstan by 47% (8,000 t), and Turkey by 75% (3,000 t) compared with that in 2018, accounting for most of the increase in global production. China, with 86% of global capacity, accounted for 87% of global production (excluding the United States) (tables 7, 8).

Import prices for magnesium generally increased throughout 2019 in the United States. The U.S. spot dealer import price for magnesium at yearend 2019 was 34% more than that at yearend 2018. The S&P Global Platts Metals Week annual average U.S. spot Western magnesium price of $2.45 per pound in 2019 was 13% more than the 2018 annual average price. The Platts Metals Week spot magnesium price at yearend in Europe was $0.97 per pound. The monthly average price in Europe increased from $1.18 per pound at the beginning of the year and peaked at $1.22 per pound in March, then generally decreased throughout the rest of the year. The price at yearend 2019 in Europe was 19% lower than at yearend 2018 (table 4).

U.S. reported consumption of primary magnesium increased slightly to 51,700 t in 2019 from the revised 50,700 t in 2018. Increased magnesium consumption for aluminum alloys accounted for most of the increased consumption (table 3). Production of secondary magnesium decreased by 8% in 2019 compared with that in 2018 (tables 1, 2).

Magnesium is the eighth most abundant element in the Earth's crust and the third most abundant dissolved element in seawater. Magnesium metal is recovered from the mineral dolomite and lake brines. Magnesium's light weight and ease of casting make it desirable for transportation products. Magnesium readily alloys with aluminum to make aluminum products stronger and easier to machine. Magnesium's strong affinity for halides such as chlorine and fluorine make it useful for reducing metal halides, such as those of beryllium, hafnium, titanium, uranium, and zirconium to metal. Magnesium's chemical properties also make it useful to remove sulfur from iron and steel.

This industry analysis report discusses the magnesium metal industry which includes primary and secondary magnesium. The magnesium compounds industry is reviewed in the Magnesium Compounds chapter of the U.S. Geological Survey Minerals Yearbook, volume I, Metals and Minerals.

Legislation and Government Programs

Sulfur hexafluoride (SF_6), a cover gas used to protect molten magnesium from oxidation, has been identified as a potential factor in global warming. The molten magnesium processes that use cover gas for melt protection are primary production; secondary production; die, permanent mold, and sand casting; wrought products production; and anode production. The long atmospheric life (about 3,000 years) of SF_6 and its high potential as a greenhouse gas [23,900 times the global warming potential of carbon dioxide (CO_2)] resulted in a call for voluntary reductions in emissions. In 1999, the U.S. magnesium industry, the International Magnesium Association, and the U.S. Environmental Protection Agency (EPA) began a voluntary SF_6 emissions reduction partnership. According to the EPA, SF_6 emissions by the magnesium industry in 2018 (the latest year for which data were available) were equivalent to 1.1 teragram of CO_2, unchanged from the amount emitted in 2017 and the revised amount emitted in 2016. Although the magnesium industry continued efforts to use SF_6 alternatives [such as Novec™ 612 (dodecafluoro-2-methyl-3-pentanone), HFC-134a, and sulfur dioxide] as part of the industry-EPA partnership, use of alternatives did not increase during 2018. Emissions of HFC-134a in 2018 were equivalent to 0.1 teragram of CO_2, unchanged from that in 2017 and 2016. These alternatives have lower global warming potential than SF_6 and tend to decompose quickly during their exposure to the molten metal (U.S. Environmental Protection Agency, 2019, p. 4–86 to 4–90; 2020, p. 4–96 to 4–101).

In 2008, the EPA listed the magnesium production facility at Rowley, UT, owned by US Magnesium LLC (Salt Lake City, UT) as a Superfund site. US Magnesium appealed the decision but, in January 2011, the U.S. Circuit Court of Appeals for the District of Columbia denied the appeal. US Magnesium had argued that the EPA had overestimated the risk of pollutants from the facility entering the air and soil. Designation of the facility as a Superfund site gave the EPA the authority to investigate the site to determine if a cleanup was necessary. The designated site encompasses 1,830 hectares (4,530 acres) on the southwest edge of the Great Salt Lake. Sampling was completed in September 2015 by the EPA as part of a site study. A report of the results was published in October 2016, but cleanup activities had not started by yearend 2019 (Fahys, 2011; U.S. Environmental Protection Agency, 2021).

On May 2, 2019, the U.S. International Trade Commission (USITC) issued a preliminary determination that Dead Sea Magnesium Ltd. (DSM) received countervailable subsidies

for magnesium produced in Israel at the rate of 7.48%. In October 2018, US Magnesium filed a complaint alleging dumping and subsidies of magnesium from Israel during the period of January 1, 2017, to December 31, 2017. On July 2, 2019, the USITC issued a preliminary determination that DSM would be subject to an antidumping duty for magnesium produced in Israel at the rate of 193.24%. In July 2019, the U.S. Department of Commerce, International Trade Administration (ITA) assigned preliminary antidumping and countervailing duties of 193.24% and 7.48%, respectively, on magnesium produced in Israel by DSM. On November 22, 2019, the ITA issued a final determination that DSM would be subject to antidumping and countervailing duties on magnesium produced in Israel at the rate of 218.98% and 13.77%, respectively. However, on December 18, 2019, the USITC issued its final determination that magnesium imports from Israel produced by DSM did not injure or threaten injury to the industry in the United States. After the ITA determination, the antidumping and countervailing duties on magnesium produced by DSM were revoked (McBeth, 2018a, 2019a, c, e, h; U.S. Department of Commerce, International Trade Administration, 2019a, b).

In June 2019, the ITA completed an administrative review on imports of pure magnesium from China for Tianjin Magnesium International Co. Ltd. (TMI) and Tianjin Magnesium Metal Co. Ltd. (TMM) for May 17, 2017, through April 30, 2018. The review determined that TMI and TMM did not export magnesium to the United States during the review period, and the antidumping duty of 339.6% ad valorem would remain on imports of pure magnesium from TMI and TMM. Magnesium from all other producers in China that did not have an individual rate would have a duty rate of 111.73% ad valorem (U.S. Department of Commerce, International Trade Administration, 2013, 2019c).

Production

Because there was only one primary magnesium producer operating in the United States, production data were withheld by the U.S. Geological Survey (USGS) to avoid disclosing company proprietary data. US Magnesium, the sole producer of primary magnesium in the United States, recovered magnesium electrolytically from brines harvested from the Great Salt Lake at its 63,500-metric-ton-per-year (t/yr) plant in Rowley, UT.

Secondary magnesium ingot was produced from scrap by two companies in the United States, Advanced Magnesium Alloys Corp. (Anderson, IN) and MagPro LLC (Camden, TN). Magnesium scrap also was consumed at a foundry by Meridian Magnesium Products Co. in Eaton Falls, MI. Magnesium contained in aluminum alloy scrap was recovered at numerous secondary aluminum smelters. Domestic secondary magnesium metal recovery from magnesium and aluminum scrap decreased by 8% compared with that in 2018. About 66% of the secondary magnesium recovered was contained in aluminum alloys and about 34% was contained in magnesium alloy castings, ingot, and other forms (table 2).

Western Magnesium Inc. (Canada) (formerly Nevada Clean Magnesium Inc.) continued testing a process to recover magnesium from dolomite samples from the Tami-Mosi deposit near Ely, NV. The company was searching for a site to construct a pilot plant and a commercial-scale 30,000-t/yr magnesium smelter. A construction schedule was not available (Western Magnesium Inc., 2019).

Consumption

Data for magnesium metal consumption were collected by the USGS from two voluntary surveys of U.S. operations. Of the 42 companies canvassed for magnesium consumption data, 43% responded, representing about 60% of the magnesium-base scrap consumption reported in table 2 and the primary magnesium consumption reported in table 3. Data for the 24 nonrespondents were estimated based on prior-year consumption levels and other factors.

Primary magnesium consumption in 2019 increased slightly compared with that in 2018, which was attributed to increased consumption for aluminum alloys (by 8%) that offset minor decreases in other uses (table 3). Consumption of primary and secondary magnesium in castings was essentially unchanged compared with that in 2018 (tables 2, 3). Total light-vehicle sales in the United States in 2019 were 17.1 million units, slightly less than the 17.3 million units in 2018 (Lassa, 2019, 2020). Decreased automobile production was offset by increased magnesium content in castings for automobiles and the restart of production at a diecasting plant in Eaton Falls, MI, after an explosion forced a temporary shutdown in 2018 (Lacy, 2018).

The increase of primary magnesium consumption in aluminum alloys (8%) corresponded with increased primary aluminum production compared with that in 2018 (table 3). The decrease in secondary magnesium recovered from new aluminum scrap (14%) was attributed to decreased aluminum scrap generated from manufacturers as industrial production declined in some sectors (table 2). Decreased secondary magnesium recovered from old aluminum scrap (12%) was attributed to lower magnesium content in the form of old aluminum scrap consumed to produce secondary aluminum (table 2). The principal applications for magnesium in the United States in 2019 were diecasting (44%), alloying aluminum (32%), and desulfurization of iron and steel (14%) (table 3). Recovery of secondary magnesium scrap from castings in 2019 was unchanged at 33,300 t. Secondary magnesium recovery decreased by 8% compared with that in 2018, attributed to decreased magnesium recovery from aluminum-base new and old scrap, which decreased by 14% and 12%, respectively (table 2).

In November, Spartan Light Metal Products Corp. completed construction of a new diecasting plant in Mexico, MO, near Spartan's existing diecasting plant. Construction of the project started in September 2018. Spartan manufactured diecast products from aluminum and magnesium for customers in the automobile industry and other consumer markets. The new capacity would be used mostly to produce magnesium diecastings for electric vehicles. The capacity of the new plant was not available (Spartan Light Metal Products Corp., 2018; Korte Co., 2019).

Research and Development

Research at the U.S. Department of Energy's Center for Functional Nanomaterials was developing batteries with anodes made of magnesium metal. Magnesium anodes have the potential to store five times as much energy in the same space as graphite anodes. Magnesium anodes enable faster charging and discharging at freezing temperatures than graphite anodes. Replacing graphite anodes in lithium-ion batteries could enable faster acceleration and longer range for electric vehicles. Further research needed to be conducted before commercial application of the new technology was feasible (U.S. Department of Energy, 2019).

Prices

The Platts Metals Week U.S. spot Western magnesium price range was $2.20 to $2.30 per pound at the beginning of the year and generally increased throughout the year to $2.70 to $2.90 per pound for an annual average price of $2.45 per pound in 2019, 13% higher than the annual average price in 2018. According to traders and producers, however, U.S. spot Western prices were not representative of the prices paid for most magnesium consumed, as nearly all primary magnesium was purchased through annual contracts (Cowden, 2013; McBeth, 2013, 2014). Prices for material contracted in September to early October 2018 for delivery in 2019 ranged from $1.60 to $1.70 per pound, but after the complaint by US Magnesium was filed against DSM with the USITC, contract prices ranged from $1.80 to $2.10 per pound (McBeth, 2018b, 2019g).

Contract negotiations for deliveries in 2020 were generally delayed until December 2019 as most buyers, brokers, and producers waited for the ruling on the antidumping and countervailing duty investigation of imports from Israel. Contracted prices for pure magnesium ranged from $2.40 per pound to $2.75 per pound, but only a few contracts were made at the low end of the range, with $2.60 per pound more common. Contract prices for magnesium produced in the United States and other countries were similar. Many consumers reported increasing their share of secondary magnesium in their 2020 purchase plans, citing the increased prices for pure primary magnesium. Once the final determination was made that imports from Israel had not caused injury to the industry in the United States, prices did not decrease significantly despite the duties being removed from imports produced by DSM. During the last part of December, spot prices for pure magnesium decreased to about $2.35 per pound from $2.45 per pound (McBeth, 2019h, j, 2020).

The U.S. spot dealer prices for imported magnesium increased throughout the year from an average range of $1.90 to $2.00 per pound at the beginning of January to $2.45 to $2.65 per pound at the end of December. The annual average spot dealer import magnesium price was $2.32 per pound, 48% higher than that in 2018. The antidumping and countervailing duty investigations that were initiated in November 2018 on magnesium imports from Israel and the subsequent rulings by the USITC were cited for tight supplies and increasing prices throughout the year (McBeth, 2018b, 2019i).

The annual average magnesium price in Europe was $2,426 per metric ton, 5% less than that in 2018. The average magnesium price in Europe at the start of January was $2,600 per metric ton, and the price generally increased through March peaking at $2,700 per metric ton in March, but then decreased throughout the remainder of the year and averaged $2,138 per metric ton at the end of December. The price increase in Europe during the first several months of the year was attributed to concerns about decreased supply from China after mine accidents there resulted in safety inspections and mine shutdowns, decreasing raw materials available for magnesium producers. Prices in Europe decreased for the rest of the year after concerns about production disruptions in China subsided. The average magnesium price in China was $2,525 per metric ton in January and the price generally increased to $2,600 per metric ton in April. Published prices for magnesium in China were discontinued after April. Prices in Europe generally followed the trend of prices in China, which was the source of most magnesium consumed in Europe (Leung, 2019b; McBeth, 2019b, f).

Foreign Trade

Total U.S. magnesium exports in 2019 were 20% less than those in 2018 (table 5). Canada (42%), Mexico (26%), and Brazil (11%) were the principal destinations. In 2019, U.S. exports of magnesium alloys decreased by 45% and metal exports decreased slightly. Exports of semifabricated products and scrap increased by 50% and 19%, respectively, from those in 2018 (table 5). Total magnesium imports for consumption in 2019 were 26% more than those in 2018. Israel was the leading source of imported magnesium metal (37%). Russia was the second-ranked supplier of magnesium metal imports (28%), and Turkey was the third-ranked supplier (21%). Mexico and Canada supplied 24% and 23%, respectively, of semifabricated magnesium product imports in 2019. Since 2001, when the United States imposed antidumping duties on magnesium from China, only minor amounts of primary magnesium ingot have been imported from China; however, China supplied 15% of semifabricated magnesium products to the United States in 2019. Taiwan was the leading supplier of magnesium alloys (45%), followed by Germany (19%), and the United Kingdom (11%). Scrap accounted for 55% of total magnesium imports, with Canada (36%), Mexico (17%), and China (15%) as the leading sources of scrap imports (table 6).

World Review

Global production of primary magnesium (excluding the United States) was 1.12 Mt, 12% more than the revised amount produced in 2018 (table 8).

Australia.—In August, Latrobe Magnesium Ltd. completed a feasibility study for a 3,000-t/yr primary magnesium plant in the Latrobe Valley, Victoria, which would use fly ash having a high magnesium content as the feed material. Construction was expected to begin in March 2021, and initial production would start about 18 months later. Future expansion to 40,000 t/yr was being considered (Latrobe Magnesium Ltd., 2019, 2020, p. 22).

Canada.—Alliance Magnesium Inc. continued planning for the construction of the first phase of a smelter in Asbestos, Quebec, to produce primary magnesium from asbestos mine tailings and secondary magnesium from scrap. Construction was expected to start in 2020 and be completed in about 18 months. Primary magnesium capacity of the first module would be 5,000 t/yr, and expansion to 50,000 t/yr was planned. Secondary magnesium capacity was not available. In 2017, magnesium production started from a 25-kilogram-per-day pilot plant to produce ingot samples for testing by potential customers (Alliance Magnesium Inc., 2017, 2018, 2019).

Mag One Products Inc. continued planning for the construction of a smelter near Danville, Quebec, to produce high-purity magnesium oxide from asbestos mine tailings. Mag One Products planned to further process the magnesium oxide to magnesium metal. The plant would have an initial magnesium capacity of 5,000 t/yr, and total production capacity would be scaled to market demand. The plant would produce ferronickel and high-purity silica as byproducts. A construction schedule was not available (Mag One Products Inc., 2019a–c).

West High Yield Resources Inc. submitted a mine permit application for its proposed Record Ridge project in British Columbia. A technical report on magnesium recovery from the Record Ridge serpentine deposit also was completed. West High Yield proposed developing a mine to produce magnesium and magnesium oxide from serpentine. The technical report concluded that hydrochloric acid could be used to recover magnesium chloride from the serpentine and then magnesium hydroxide and magnesium oxide could be produced from the magnesium chloride. In addition to producing magnesium compounds, West High Yield proposed to produce magnesium metal from the magnesium oxide if feasible. A construction schedule was not available (West High Yield Resources Inc., 2019a, b).

China.—China's magnesium production was estimated to be 970,000 t in 2019, 12% more than the revised amount in 2018 (table 8). Production in Shaanxi Province was 518,000 t, 20% more than that in 2018. Production in Shanxi Province was 117,000 t, 18% more than that in 2018. These increases were partially offset by decreased production in Ningxia Hui Autonomous Region, which produced 59,000 t, 11% less than that in the prior year. Total magnesium product exports from China were 455,400 t, 11% more than those in 2018 (Lee, 2019; Leung, 2019d, 2020).

Increased safety enforcement at mines throughout China was announced after accidents in the first quarter of the year killed 20 workers at a coal mine and 21 workers at a silver mine. In June, the State Administrator of Worker Safety announced strict enforcement of mine safety regulations and would shut down all mines that did not comply with the standards by yearend. Mines that produced dolomite, the ore used for magnesium production in the Pidgeon process, were specified in the announcement. Although confirmation as to whether dolomite mines were shut down was not available, dolomite shortages were not expected because of the abundant supply from numerous mines. Shortages of coal were cited for some magnesium producers decreasing production in Shaanxi Province in March (Lee and Leung, 2019; Leung, 2019b).

In order to comply with environmental standards, many magnesium smelters in China made renovations which resulted in temporary shutdowns. These shutdowns generally were for brief periods of time and tended to be conducted during the summer when many smelters historically decreased production because of hot weather. Increased production prior to the shutdowns enabled producers to fill customer orders until production resumed (Leung, 2019a).

The National Development and Reform Commission revised industrial policies to restrict new magnesium capacity from being built. New primary magnesium smelters with a capacity of less than 50,000 t/yr and that used obsolete technology would be prohibited. Overcapacity and environmental concerns were cited for the policy (Leung and Lee, 2019). Magnesium smelting capacity in Fugu County, Shaanxi Province, was projected to increase to 1 million metric tons per year (Mt/yr) from 800,000 t/yr by yearend 2025, according to the Shaanxi E-Commerce Centre of Magnesium. About 50% of China's magnesium smelting capacity was held by 34 producers in Fugu County. Numerous ferrosilicon producers and abundant supplies of waste gas from coking furnaces in the region enabled low-cost magnesium production in Fugu. Additional capacity was expected in Shaanxi Province as producers relocated to take advantage of the lower costs for raw materials (Leung, 2019f). Longmen Magnesium Co. Ltd. was constructing a 60,000-t/yr magnesium smelter in Yuncheng, Shaanxi Province. Completion was expected in 2020 (Leung, 2019e).

Qinghai Salt Lake Magnesium Co. Ltd. (QSLM) experienced production issues at its 100,000-t/yr smelter in Golmud, Qinghai Province, that produced magnesium from lake brines. Production was halted in April after technical issues resulted in low production volumes and magnesium that did not meet specifications because of contamination by nickel. Engineering inspections of the smelter were conducted to identify and correct the source of nickel contamination and other problems, but production was not restarted by yearend because of financial issues. Qinghai Salt Lake Industry Co. Ltd. (QSLIC), the parent company of QSLM, entered a restructuring plan in August. On December 31, Qinghai Huixin Asset Management Co. Ltd. acquired all non-potassium assets of QSLIC, including QSLM. Magontec Ltd. (Australia) was forced to use magnesium ingot from other sources to produce magnesium alloys at its 56,000-t/yr casthouse adjacent to the QSLM smelter to fill customer orders. Because of the supply disruption from QSLM, Magontec's casthouse produced at approximately 15% of its capacity for the year (Magontec Ltd., 2020, p. 2–3, 6–7).

Turkey.—In May, production restarted at the primary magnesium plant in Eskisehir. The 15,000-t/yr smelter, previously owned by Esan Eczacıbaşı Endüstriyel Hammaddeler San. ve Tic. A.Ş, shut down in May 2018 but reopened after being purchased by Kar Maden San. Ve Tic. A.Ş. By mid-July the plant was producing at a rate of about 9,000 t/yr and was estimated to reach a rate of 12,000 t/yr by yearend (McBeth, 2018a, 2019c, d).

Outlook

Consumption of magnesium in the United States and the rest of the world is expected to decline with decreased economic activity resulting from the coronavirus disease 2019 (COVID-19) pandemic that emerged late in 2019. Once economic activity increases after the pandemic, magnesium consumption is expected to increase as its use in the automobile industry increases and new applications are developed.

Consumption of magnesium for primary aluminum alloys in the United States will be dependent on domestic aluminum smelter production levels, which are greatly influenced by being able to obtain power at rates competitive with those in other parts of the world. In October, Alcoa Corp. announced that it would conduct an economic review of its smelting capacity which could lead to the shutdown of primary aluminum smelting capacity in the United States and therefore affect magnesium consumption (Alcoa Corp., 2019). Magnesium consumption in the United States by secondary aluminum smelters is expected to decline in response the COVID-19 pandemic. Magnesium consumption by the aluminum industry in other countries is expected to continue to follow the trend of aluminum production as world economic growth contracts and then recovers.

The use of aluminum sheet alloyed with magnesium in automobiles has increased domestic consumption of magnesium, but further growth in this market is expected to be limited. Because of its higher cost, the use of aluminum sheet alloyed with magnesium in automobiles has been limited to vehicle types with high customer brand loyalty such as light trucks, luxury sedans, and sports cars, but some manufacturers have indicated that they are planning to expand its use to other vehicle types (Maltais, 2016).

Increased magnesium consumption by the aerospace industry is expected in the coming years as magnesium may substitute for aluminum in seat frames on commercial aircraft. Although approval was given by the Federal Aviation Administration for use of magnesium in the interior of commercial aircraft in 2013, widespread use of magnesium-framed seats for commercial aircraft are not expected until at least a few more years. Decreased air travel may further delay the adoption of magnesium-framed seats as airlines decrease capital expenditures and delay aircraft deliveries after the COVID-19 pandemic, especially if jet fuel prices remain depressed. The development of additive manufacturing with magnesium may further increase the use of magnesium in aerospace applications (Magnesium Elektron Ltd., 2014; Danon, 2017). Consumption of magnesium by the iron and steel industry in other countries is expected to decrease slightly in 2020, based on steel production (World Steel Association AISBL, 2021).

Magnesium production in China is expected to decrease in response to strict lockdown orders by the Government in places most affected by the COVID-19 pandemic, especially in the first half of 2020. Although some expansion projects are being constructed in China, additional capacity expansions are expected to be limited, as production has been only about one-half of capacity in recent years. Stricter enforcement of environmental policies in China is expected to limit production from older smelters that use the Pidgeon process. The China Nonferrous Metals Industry Association forecast that magnesium consumption by the automotive industry will be 1.5 Mt/yr by 2025 and 2 Mt/yr by 2030. China's Ministry of Industry and Information Technology forecast that magnesium content per automobile in automobiles manufactured in China would reach 15 kilograms (kg) in 2020, 25 kg by 2025, and 45 kg by 2030, from less than 1 kg in 2016. Electric vehicles are expected to account for most of the increase in magnesium consumption in China's automotive industry, with production forecast to reach 2.1 million units in 2020, 5 million units by 2025, and 15 million units in 2030. Consumption for trains would reach 500,000 t/yr and 1 Mt/yr for construction by 2030 (Leung, 2019c, d).

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

		2015	2016	2017	2018	2019
United States:						
Production:						
Primary		W	W	W	W	W
Secondary		88,500	101,000 r	112,000 r	109,000	101,000
Exports		15,200	19,300	13,700	12,300 r	9,770
Imports for consumption		49,200	45,500	41,900	46,500 r	58,800
Consumption, reported		63,800	69,000	65,500 r	50,700 r	51,700
Yearend stocks, producer		W	W	W	W	W
Yearend price[2]	dollars per pound	2.10–2.20	2.10–2.20	2.10–2.20	2.20–2.30	2.70–2.90
World, primary production[3]		970,000	993,000 r	1,050,000 r	1,000,000 r	1,120,000

rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through September 17, 2020. Data are rounded to no more than three significant digits.
[2]Source: S&P Global Platts Metals Week.
[3]Does not include U.S. production.

TABLE 2
MAGNESIUM RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY KIND OF SCRAP AND FORM OF RECOVERY[1]

(Metric tons)

	2018	2019
KIND OF SCRAP		
New scrap:		
Magnesium-base	39,800 r	39,600
Aluminum-base	40,600	34,900
Total	80,400 r	74,500
Old scrap:		
Magnesium-base	6,640 r	6,640
Aluminum-base	22,000	19,400
Total	28,700 r	26,100
Grand total	109,000	101,000
FORM OF RECOVERY		
Magnesium alloy ingot[2]	W	W
Magnesium alloy castings	33,300	33,300
Aluminum alloys	74,900 r	66,400
Other[3]	890 r	890
Total	109,000	101,000

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Table includes data available through September 17, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes secondary magnesium content of both secondary and primary alloy ingot.
[3]Includes chemical and other dissipative uses, cathodic protection, and data indicated by symbol W.

TABLE 3
U.S. CONSUMPTION OF PRIMARY MAGNESIUM, BY USE[1]

(Metric tons)

Use	2018	2019
For structural products:		
Castings:		
Die	23,100	23,000
Permanent mold	563 r	540
Sand	1,430	1,450
Wrought products[2]	W	W
Other	206	206
Total	25,300 r	25,200
For distributive or sacrificial purposes:		
Aluminum alloys	15,100 r	16,400
Cathodic protection (anodes)	W	W
Iron and steel desulfurization	7,170	7,170
Nodular iron	518	474
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	1,500 r	1,500
Other[3]	1,130	984
Total	25,500 r	26,500
Grand total	50,700 r	51,700

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Table includes data available through September 17, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes sheet and plate and forgings.
[3]Includes chemicals and scavenger, deoxidizer, powder, and any data indicated by W.

TABLE 4
YEAREND MAGNESIUM PRICES

		2018	2019
U.S. spot dealer import	dollars per pound	1.85–1.95	2.45–2.65
U.S. spot Western	do.	2.20–2.30	2.70–2.90
China	dollars per metric ton	2,670–2,700	NA
European free market	do.	2,575–2,700	2,100–2,175

do. Ditto. NA Not available.

Source: S&P Global Platts Metals Week.

TABLE 5
U.S. EXPORTS OF MAGNESIUM, BY COUNTRY OR LOCALITY[1]

	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
Country or locality	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
2018:								
Brazil	148	$286 r	--	--	1,910	$5,710	112 r	$541 r
Canada	85	183	1,400	$4,620	1,670	5,550	567 r	16,800 r
China	--	--	2	79	--	--	31 r	2,170 r
France	--	--	8	2,540	--	--	34 r	5,710 r
Japan	--	--	--	--	--	--	40 r	992 r
Korea, Republic of	--	--	5	164	87	288	174 r	687 r
Mexico	90	140	(2) r	8 r	4,310	13,900	36 r	1,870 r
Singapore	--	--	44	12,400	--	--	13 r	2,040 r
United Kingdom	117	182	(2)	95	3	9	366 r	9,310 r
Other	343	659	6 r	293 r	80 r	296 r	577 r	21,500 r
Total	784	1,450	1,460	20,200	8,060	25,800	1,950 r	61,700 r
2019:								
Brazil	6	15	--	--	1,060	3,220	42	161
Canada	190	355	1,350	5,020	2,170	7,180	440	9,470
China	--	--	1	65	--	--	36	2,140
France	--	--	11	3,950	--	--	35	5,080
Japan	--	--	2	23	2	20	27	1,050
Korea, Republic of	58	75	2	99	(2)	6	85	295
Mexico	28	91	21	93	1,120	3,620	1,400	12,400
Singapore	--	--	48	12,400	--	--	5	706
United Kingdom	--	--	(2)	180	8	37	116	3,350
Other	651	947	7	80	104	364	754	6,380
Total	933	1,480	1,440	21,900	4,460	14,400	2,940	41,000

rRevised. -- Zero.
[1]Table includes data available through August 31, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM, BY COUNTRY OR LOCALITY[1]

	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
Country or locality	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, Mg content)	Value (thousands)	Quantity (metric tons, Mg content)	Value (thousands)
2018:								
Canada	8,210	$16,500	1,110	$1,580	153 r	$363	766 r	$3,450 r
China	2,180	4,010	20 r	48	180 r	812 r	921 r	8,460 r
Germany	1,040	956 r	(2)	3	1,650 r	5,630	25 r	125 r
Israel	--	--	7,240	27,100	3,260 r	11,800	--	--
Japan	--	--	--	--	--	--	8 r	104
Kazakhstan	--	--	355	1,040	--	--	--	--
Mexico	4,920	7,470	--	--	-- r	-- r	528 r	2,860
Russia	--	--	3,270	8,930	--	--	--	--
Taiwan	1,430	2,660	--	--	857 r	2,640	(2)	138
United Kingdom	1,380	3,190	--	--	862 r	13,300	170 r	24,800
Other	3,000	5,950 r	1,960	6,490 r	243 r	492	780 r	4,670
Total	22,200	40,700	14,000	45,200 r	7,210 r	35,000 r	3,200 r	44,600 r
2019:								
Canada	11,600	30,300	929	1,370	30	107	736	3,640
China	4,890	10,800	149	442	44	174	478	6,800
Germany	1,290	1,480	--	--	1,580	6,410	68	181
Israel	18	11	5,700	23,100	237	1,070	--	--
Japan	--	--	--	--	90	296	8	158
Kazakhstan	--	--	503	1,670	--	--	--	--
Mexico	5,530	7,680	20	32	--	--	772	3,800
Russia	--	--	4,210	12,900	--	--	1	24
Taiwan	1,650	3,290	--	--	3,660	12,200	270	1,030
Turkey	199	254	3,150	10,200	--	--	143	414
United Kingdom	156	139	--	--	886	14,600	76	9,310
Other	6,790	13,700	561	2,220	1,690	5,560	663	4,230
Total	32,100	67,500	15,200	51,800	8,210	40,300	3,220	29,600

rRevised. -- Zero.
[1]Table includes data available through August 31, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2019[1, 2]

(Metric tons)

Country or locality	Capacity
Brazil	20,000 e
China	1,800,000 e
Iran	6,000 e
Israel	34,000
Kazakhstan	30,000 e
Korea, Republic of	10,000
Malaysia	15,000
Russia	81,000 e
Serbia	5,000 e
Turkey	15,000
Ukraine	22,000 e
United States	63,500
Total	2,100,000

eEstimated.
[1]Table includes capacity at operating plants as well as at plants on standby basis. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]In addition to the countries and (or) localities listed, trial production from a pilot plant in Canada was reported starting in 2017. Magnesium was produced to determine the economic viability of an experimental process and to provide samples for certification by potential consumers, but available information was inadequate to make a reliable estimate of output.

TABLE 8
MAGNESIUM: PRIMARY WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality	2015	2016	2017	2018	2019
Brazil[e]	15,000	16,000 r	20,000 r	21,000 r	22,000
China	859,000	872,800 r	904,600 r	863,000 r	970,000 e
Iran[e]	1,000	2,000	3,000	1,000	--
Israel	19,307	22,548	23,000	21,000	21,000
Kazakhstan[3]	8,100	10,000 e	12,000 r, e	17,000 e	25,000 e
Russia[3]	60,000	58,900 r	65,000	67,000 r	67,000
Turkey	200	3,750 e	14,000 e	4,000 e	7,000 e
Ukraine[e, 3]	7,700	6,770	7,300 r	7,000 r	8,000
United States	W	W	W	W	W
Total	970,000	993,000 r	1,050,000 r	1,000,000 r	1,120,000

eEstimated. rRevised. W Withheld to avoid disclosing proprietary data, not included in total. -- Zero.
[1]Table includes data available through July 7, 2020. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]In addition to the countries and (or) localities listed, trial production from a pilot plant in Canada was reported starting in 2017. Magnesium was produced to determine the economic viability of an experimental process and to provide samples for certification by potential consumers, but available information was inadequate to make a reliable estimate of output.
[3]Includes magnesium consumed for titanium sponge production.