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Magnesium

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During 2017, U.S. total magnesium imports and primary magnesium consumption decreased by 8% and 22%, respectively, compared with those in 2016. Imports continued to provide a significant share of the U.S. supply of primary magnesium as 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 more than a thirteenfold increase in capacity and production. Excluding production in the United States, worldwide primary magnesium production was 1.04 million metric tons (Mt) in 2017, 5% more than the revised 989,000 metric tons (t) in 2016 (table 8). Estimated production in China increased by 7% (59,000 t) and Turkey more than tripled production to 14,000 t compared with that in 2016, accounting for most of the increase in global production. These increases were partially offset by decreased production in Russia by an estimated 30% (18,000 t). China, with 85% of global capacity, accounted for 89% of global production (excluding the United States) (tables 7, 8).

Import prices for magnesium generally decreased throughout 2017 in the United States. The U.S. spot dealer import price for magnesium at yearend 2017 was 7% less than that at yearend 2016. The Platts Metals Week annual average U.S. spot magnesium price of $2.15 per pound in 2017 was unchanged from the 2016 annual average price. The Platts Metals Week spot magnesium price at yearend in China was $1.06 per pound and in Europe was $1.07 per pound. The prices in China and Europe dropped at the beginning of the year but generally increased throughout the year, spiking to the highs for the year in August, then decreasing until November and then increasing in December. The prices at yearend 2017 compared with those at yearend 2016 were the same in Europe and slightly higher in China.

U.S. consumption of primary magnesium decreased by 22% to 53,600 t in 2017 from the revised 69,000 t in 2016. Decreased magnesium consumption for reducing titanium and other metals and for diecastings was partially offset by increased consumption for aluminum alloys. Production of secondary magnesium increased by 12% in 2017 compared with that in 2016 (tables 1, 2).

Magnesium is the eighth most abundant element in the Earth's crust and the third most plentiful 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 pure metal. Magnesium's chemical properties also make it useful to remove sulfur from iron and steel.

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 SF_6 for melt protection are primary production; secondary production; die, permanent mold, and sand casting; wrought products production; and anode production. According to the U.S. Environmental Protection Agency (EPA), SF_6 emissions by the magnesium industry in 2016 increased by 11% compared with emissions in 2015 and were equivalent to 1.0 teragram of carbon dioxide (CO_2). Increased production at diecasting facilities was cited as the principal reason for the increased emissions. The industry also continued its 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 and EPA's partnership, but their use did not increase during 2016 from that in 2015. The SF_6 alternatives have lower global warming potential than SF_6 and tend to decompose quickly during their exposure to the molten metal. 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 CO_2) resulted in a call for voluntary reductions in emissions. In 1999, the U.S. magnesium industry, the International Magnesium Association, and the EPA began a voluntary SF_6 emissions reduction partnership (U.S. Environmental Protection Agency, 2018b, p. 4–85 to 4–89).

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 further investigate the site to determine whether 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, but a report of the results was still pending, and cleanup activities had not started by yearend 2017 (Fahys, 2011; U.S. Environmental Protection Agency, 2018a).

In February, the U.S. International Trade Commission (USITC) issued the final results of the 5-year review of antidumping duties on pure magnesium imports from China which was initiated in October 2016. The USITC concluded that the removal of the antidumping duty would likely lead to renewed dumping. The antidumping duty imposed was 108.26% ad valorem. In 1995, antidumping duties were imposed on pure magnesium imports from China, with the duties to be reviewed after 5 years. Three previous reviews

have concluded that revocation of the duties would likely lead to material injury to domestic magnesium producers; therefore, the antidumping duties were retained (U.S. International Trade Commission, 2016, 2017).

In March, the U.S. Department of Commerce, International Trade Administration (ITA) issued the final determination of an administrative review of the antidumping order on magnesium exported from China by Tianjin Magnesium International Co. Ltd. (TMI) and Tianjin Magnesium Metal Co. Ltd. (TMM) between April 1, 2015, and March 31, 2016. The review determined that TMI and TMM did not ship 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 by TMI and TMM. Magnesium from all other producers in China that did not have an individual rate would have a duty rate of 141.49% ad valorem (U.S. Department of Commerce, International Trade Administration, 2017).

In June, the ITA initiated an administrative review of the antidumping order on magnesium imported from China by TMI and TMM between April 1, 2016, and March 31, 2017. The preliminary review determined that TMI and TMM did not ship magnesium to the United States during the review period. Antidumping duty rates would be determined once the final results were issued (U.S. Department of Commerce, International Trade Administration, 2018).

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.

Domestic secondary magnesium metal recovery from magnesium and aluminum scrap increased by 12% compared with that in 2016. About 64% of the secondary magnesium recovered was contained in aluminum alloys, and 36% was contained in magnesium alloy castings, ingot, and other forms (table 2).

In 2016, Nevada Clean Magnesium Inc. (Canada) successfully tested its bench-scale pilot plant to recover magnesium from dolomite samples from the Tami-Mosi deposit near Ely, NV. The company planned to construct a 30,000-t/yr magnesium smelter adjacent to its dolomite deposit that graded an average of 12.3% magnesium (Nevada Clean Magnesium Inc., 2016, 2017).

Consumption

Data for magnesium metal consumption were collected from two voluntary surveys of U.S. operations by the USGS. Of the 43 companies canvassed for magnesium consumption data, 42% 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 25 nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Primary magnesium consumption in 2017 decreased by 22% compared with that in 2016, which was attributed to decreases in consumption for diecastings, titanium reduction, and other uses of 5%, 98%, and 45%, respectively. These decreases were partially offset by an 18% increase in consumption for aluminum alloys (table 3). Decreased consumption for reducing titanium was attributed to the shutdown of a titanium sponge producer in 2016, which cited the availability of imported titanium sponge at lower prices for the shutdown. Allegheny Technologies Inc. (ATI) (Pittsburgh, PA) ceased titanium sponge production at its plant in Rowley, UT, during the second half of 2016. Titanium sponge imports were estimated to have increased by 42% in 2017 compared with imports in 2016. ATI consumed 1 t of molten magnesium from US Magnesium's plant per 1 t of titanium sponge produced. ATI used titanium sponge to produce ingot used for aerospace and medical applications (Haflich, 2015; Maltais, 2016b).

Substitution by magnesium for iron and steel in diecastings for automobiles increased total consumption of magnesium in automobiles, even though production of automobiles decreased. Consumption of secondary magnesium in diecastings increased by 21% (6,420 t) compared with that of 2016. This was partially offset by decreased consumption of primary magnesium for diecastings of 5% (1,270 t) compared with that in 2016 (tables 2, 3). Total light-vehicle production in North America in 2017 decreased by 4.3% compared with that of 2016. Passenger car production decreased by 15.3%, but light-truck production increased by 2.5% compared with production in 2016. Light-vehicle production in the United States decreased by 8.6% compared with that of 2016. Total light-vehicle sales in 2017 were 17.55 million units, 1.8% less than the record-high 17.87 million units in 2016. It was the first year that light-vehicle sales had decreased since 2009 (Ward's Automotive Group, 2017; Petit, 2018a, b).

The increase of primary magnesium consumption in aluminum alloys corresponded to increased magnesium content in aluminum alloys produced during the year, even though total aluminum production decreased slightly. The principal applications for magnesium in the United States in 2017 were diecasting (50%), alloying aluminum (29%); and desulfurization of iron and steel (13%) (table 3). Consumption of secondary magnesium scrap for castings in 2017 increased by 21% to 36,500 t from the revised total of 30,100 t in 2016 (table 2). Secondary magnesium recovery increased by 12% compared with that in 2016, attributable to increased magnesium recovery from magnesium-base new scrap (table 2).

Research and Development

Researchers at the U.S. Department of Energy, Joint Center for Energy Storage Research, were developing a battery that would use a solid magnesium-based electrolyte. The magnesium-scandium-selenide-spinel electrolyte was tested for its ability to move magnesium ions rapidly. Magnesium theoretically has twice the energy density of lithium and would be more stable in batteries than lithium. However, without an electrolyte that is compatible with magnesium, magnesium batteries are not practical. Further research would need to be

conducted before commercial application of the new technology became feasible (Maloney, 2017).

Prices

The Platts Metals Week U.S. spot Western magnesium price range was $2.10 to $2.20 per pound throughout the entire year for an annual average price of $2.15 per pound in 2017, unchanged from the average price since the beginning of 2014 (tables 1, 4). 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 the fall of 2016 for delivery in 2017 ranged from about $1.50 to $1.70 per pound, with most contracts reported to be in the range of $1.60 to $1.70 per pound (McBeth, 2016). Prices for material contracted in the fall of 2017 for delivery in 2018 ranged from $1.40 to $1.50 per pound (McBeth, 2017).

Although the U.S. spot Western price range for magnesium was unchanged, U.S. spot dealer prices for imported magnesium generally decreased throughout the year from an average range of $1.47 to $1.55 per pound at the beginning of January, reaching a low of $1.39 to $1.43 per pound in August before increasing slightly to $1.42 to $1.46 per pound in December (table 4). The annual average spot dealer import magnesium price was $1.45 per pound, 7% lower than that in 2016. Abundant supplies were cited for declining domestic prices. Decreased consumption by diecasters and for titanium reduction also contributed to magnesium price declines in the United States (McBeth, 2016, 2017).

The January average magnesium price in China was $2,125 per metric ton, and the price generally increased through July to $2,245 per metric ton. The average price in August spiked to $2,800 per metric ton but then declined to $2,280 per metric ton in September. The price then increased again to $2,345 per metric ton in December. The annual average magnesium price in China was $2,270 per metric ton, slightly more than that in 2016. The January average magnesium price in Europe was $2,163 per metric ton, and the price generally followed the same upward trend as the price in China, peaking at $2,550 per metric ton in August and averaging $2,350 per metric ton in December. The annual average magnesium price in Europe was $2,266 per metric ton, 4% more than that in 2016 (table 4). While magnesium consumption was stable, the increased cost of production, attributed to higher prices for dolomite and ferrosilicon in China, was cited for price increases in China and Europe in the summer and again in December (Yee, 2017b–e).

Foreign Trade

Total U.S. magnesium exports in 2017 were 29% less than those in 2016 (table 5). Mexico (45%), Canada (27%), and Brazil (15%) were the principal destinations. In 2017, exports of magnesium metal, alloys, and semifabricated products decreased by 65%, 17%, and 20%, respectively, from those in 2016, whereas exports of scrap increased by 20% compared with those in 2016 (table 5). Total magnesium imports for consumption in 2017 were 8% less than those in 2016 (table 6). Israel was the leading source of imported magnesium metal (54%) and alloys (42%). 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 was the leading supplier of semifabricated magnesium products (39%) to the United States in 2017. Taiwan was the second-ranked supplier of magnesium alloy imports (22%). Scrap accounted for 40% of total magnesium imports, with Canada (36%), Mexico (30%), and the United Kingdom (19%) as the leading sources of the scrap imports (table 6).

World Review

Global production of primary magnesium (excluding the United States) was 1.04 Mt, 5% more than the revised amount produced in 2016 (table 8). Global consumption of magnesium was estimated to be 972,000 t (McBeth, 2018).

Australia.—Latrobe Magnesium Ltd. completed the preliminary feasibility study for a primary magnesium plant in the Latrobe Valley, Victoria, which would use fly ash having a high magnesium content as the feed material. The study determined that the optimal plant size would be 3,000 t/yr instead of 5,000 t/yr as previously proposed. A bankable feasibility study was being conducted and expected to be completed in early 2018. Construction was expected to take about 1 year to complete once started. Future expansion to 40,000 t/yr was being considered (Latrobe Magnesium Ltd., 2017, 2018).

Canada.—In May, Alliance Magnesium Inc. started production of magnesium from its 25-kilogram-per-day pilot plant that was completed earlier in the year. Alliance planned to construct a 50,000-t/yr smelter to produce magnesium from asbestos mine tailings in Asbestos, Quebec. Construction of the first phase of the smelter with 5,000 t/yr of capacity would start once financing and permits were obtained, and expansion to 50,000 t/yr of capacity was to be constructed on a modular basis (Alliance Magnesium Inc., 2017a–c).

Mag One Products Inc. continued planning a smelter to produce magnesium from asbestos mine tailings near Danville, Quebec. The plant would have an initial capacity of 5,000 t/yr; total production capacity would be scaled to market demand. The plant would also have the capability to produce high-purity magnesium compounds with ferronickel and high-purity silica as byproducts (Mag One Products Inc., 2017).

West High Yield Resources Inc. continued an environmental study required for a mine permit application for its proposed Record Ridge project in British Columbia. The company proposed building a mine and smelter to produce magnesium from a serpentine deposit. The assessment indicated an 80% recovery rate for the magnesium. However, in June 2017, West High Yield presented the results of a micro-plant test prepared by Drinkard Metalox, Inc. (Charlotte, NC). Drinkard Metalox developed a nitric acid leach extraction process that would increase the magnesium recovery rate to 98% and allow the production of multiple salable products such as magnesium nitrate, nickel hydroxide, and high-grade magnesium oxide (West High Yield Resources Inc., 2013, 2017).

China.—China produced 930,000 t of magnesium in 2017, 7% more than that in 2016 (table 8). Magnesium consumption in China was estimated to be 480,000 t, 22% more than the 393,000 t consumed in 2016. The Ministry of Industry and Information Technology forecasted magnesium consumption to be 750,000 t in 2020, 40% more than that consumed in 2015. Increasing use of magnesium in automobiles was cited as the main reason for the consumption growth forecasted. In 2017, total magnesium exports from China were 460,200 t, 29% more than exports in 2016. China exported 250,500 t of magnesium ingot and 118,200 t of magnesium alloys, 29% more and slightly more, respectively, than exports in 2016. Combined exports of wrought magnesium, powder, and magnesium articles were 91,500 t (Leung, 2017c, 2018a, b; Yee, 2018a, b).

Raw material availability and prices were affected by regulatory actions. In April, environmental inspectors ordered several dolomite mines in Shanxi Province to shut down for inspections. The mines were reportedly still closed in mid-June. The mines were able to supply customers with stockpiled dolomite during the shutdowns, although dolomite prices were reported to have increased for some smelters. In May, environmental regulators ordered several facilities at the Port of Tianjin that acid wash magnesium ingot to shut down; these shutdowns were reported to be permanent. It was estimated that one-half of the magnesium producers in China do not have acid-washing capacity at their own plants and rely on servicers at the Tianjin Port. Following the shutdowns, these producers lowered their prices in order to sell to customers that do not need their magnesium acid washed (Yee, 2017a–e).

The monthly average export price from January through July was stable, ranging between $2,125 per metric ton and $2,245 per metric ton, as supplies were sufficient for demand. Prices for acid-washed magnesium increased slightly as some customers that prefer the acid-washed magnesium were willing to pay more for the limited supplies, but the monthly average export price remained stable during that time. The monthly average export price increased from $2,245 per metric ton in July to $2,800 per metric ton in August. Increased ferrosilicon prices, attributed to shortages after several silica mines and ferrosilicon plants were shut down by regulators for environmental reasons, were cited for the increased magnesium price. Magnesium prices decreased after ferrosilicon production increased in September. The monthly average price was $2,280 per metric ton in September and dropped to $2,215 per metric ton in November. The monthly average price in December increased to $2,570 per metric ton, attributed to increased demand ahead of planned shutdowns for holidays in January (Yee, 2017a, b, e).

Commercial production started from Qinghai Salt Lake Magnesium Co. Ltd.'s 100,000-t/yr smelter in Golmud, Qinghai Province. The smelter produced magnesium from lake brines. Construction was completed and trial runs were conducted in mid-2016. In August 2016, Magontec Ltd. (Australia) commissioned its 56,000-t/yr casthouse in Golmud and started production in October. The casthouse consumed molten magnesium from the Qinghai Salt Lake smelter to produce magnesium alloys (Lee, 2017; Magontec Ltd., 2017, 2018).

Century Sunshine Group Holdings Ltd. (Hong Kong) was increasing the capacity of its smelter in Hami, Xinjiang Uygur Autonomous Region, to 45,000 t/yr from 15,000 t/yr. The first phase of the expansion was expected to be completed in early 2018. In March, Century Sunshine completed an expansion of its smelter in Baishan, Jilin Province, to 75,000 t/yr from 25,000 t/yr. However, commissioning of the new capacity was delayed because of unfavorable market conditions (Century Sunshine Group Holdings Ltd., 2017, 2018; Leung, 2017a, b).

Outlook

Consumption of magnesium for primary aluminum alloys in the United States is expected to increase owing to the expected restart of approximately 300,000 t/yr of capacity at three primary aluminum smelters in 2018. Magnesium consumption in the United States by secondary aluminum smelters is expected to remain in the range of recent years. Magnesium consumption by the aluminum industry in other countries is expected to continue to increase as more primary aluminum is produced in countries such as China.

Automobile manufacturers are expected to continue substituting lightweight materials, including magnesium and aluminum, for iron and steel in castings to decrease vehicle weight and meet emission targets. The choice between aluminum and magnesium by casting foundries is expected to be determined in part by the relative prices of the two metals. The use of aluminum sheet alloyed with magnesium in automobiles has increased domestic consumption of magnesium. 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 as manufacturers gain more experience with aluminum sheet, they are expected to introduce it in other models. Although some automobile manufacturers have adopted aluminum sheet alloyed with magnesium, others have signaled that they favor high-strength steel sheet. Some magnesium sheet has been introduced into luxury and high-end sports cars, and although further penetration into these automobile types is being considered, significant use of magnesium in auto sheet applications is not expected for several years (Maltais, 2016a).

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, magnesium-framed seats for commercial aircraft are not expected for at least a few more years. 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 increase by 5% in 2018, based on steel production growth (World Steel Association, 2018).

Although some expansion projects are being constructed in China, additional capacity expansions in China are expected

to be limited, as production has been only about one-half of capacity in recent years. The Magnesium Industry Association of Shaanxi forecast that production in China would increase by 10% per year to 1.3 Mt/yr by 2020 (Leung, 2015a, b). However, stronger enforcement of environmental policies in China is expected to limit production from older smelters that use the Pidgeon process. Global consumption of magnesium is expected to increase by a compound annual growth rate of about 5% per year from 2017 through 2027 (McBeth, 2018). Consumption growth by the aluminum industry and by diecasters is expected to increase by about 4% per year each during this period (Roskill Information Services Ltd., 2016).

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

		2013	2014	2015	2016	2017
United States:						
Production:						
Primary		W	W	W	W	W
Secondary		79,200	81,100	88,500	102,000 r	114,000
Exports		16,100	17,000	15,200	19,300 r	13,700
Imports for consumption		45,900	51,900	49,200	45,500	41,900
Consumption, reported		66,400	63,700	63,800	69,000 r	53,600
Yearend stocks, producer		W	W	W	W	W
Yearend price[2]	dollars per pound	2.10–2.15	2.10–2.20	2.10–2.20	2.10–2.20	2.10–2.20
World, primary production[3]		910,000	995,000 r	970,000 r	989,000 r	1,040,000

rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through September 12, 2018. Data are rounded to no more than three significant digits.
[2]Source: 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)

	2016	2017
KIND OF SCRAP		
New scrap:		
Magnesium-base	35,500 r	46,700
Aluminum-base	37,200	38,600
Total	72,700 r	85,400
Old scrap:		
Magnesium-base	7,270 r	6,810
Aluminum-base	22,100 r	22,200
Total	29,400 r	29,000
Grand total	102,000 r	114,000
FORM OF RECOVERY		
Magnesium alloy ingot[2]	W	W
Magnesium alloy castings	30,100 r	36,500
Aluminum alloys	68,800 r	73,500
Other[3]	3,180	4,450
Total	102,000 r	114,000

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Table includes data available through September 12, 2018. 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	2016	2017
For structural products:		
Castings:		
Die	28,000 r	26,700
Permanent mold	419	424
Sand	1,320	1,370
Wrought products[2]	W	W
Other	1,870	769
Total	31,600 r	29,300
For distributive or sacrificial purposes:		
Aluminum alloys	13,000 r	15,300
Cathodic protection (anodes)	W	W
Iron and steel desulfurization	7,270	7,120
Nodular iron	305	439
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	15,300	300
Other[3]	1,620	1,150
Total	37,400 r	24,300
Grand total	69,000 r	53,600

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Table includes data available through September 12, 2018. 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

		2016	2017
U.S. spot dealer import	dollars per pound	1.47–1.55	1.42–1.46
U.S. spot Western	do.	2.10–2.20	2.10–2.20
China	dollars per metric ton	2,250–2,300 [r]	2,320–2,370
European free market	do.	2,300–2,400	2,300–2,400

[r]Revised. do. Ditto.

Source: 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)
2016:								
Brazil	--	--	(2)	$4	1,010	$3,130	50	$252
Canada	336	$700	4,540	11,200	4,380	14,800	661	12,100
China	--	--	2	30	9	109	177	4,270
France	--	--	--	--	--	--	51	7,660
Japan	--	--	(2)	9	14	138	32	1,030
Mexico	304	538	22	80	5,200	16,700	38	1,630
Singapore	--	--	30	8,460	--	--	14	2,960
United Kingdom	87	240	(2)	66	--	--	168	7,900
Venezuela	--	--	--	--	--	--	4	85
Other	269	559	866 [r]	3,160	145	2,130	883	10,900
Total	996	2,040	5,460 [r]	23,000	10,700	37,000	2,080	48,800
2017:								
Brazil	313	581	--	--	1,650	4,740	45	228
Canada	361	750	1,830	5,590	830	3,070	694	16,900
China	--	--	2	74	8	78	103	3,620
France	--	--	1	400	--	--	43	5,730
Japan	--	--	(2)	18	2	32	29	623
Mexico	9	7	4	41	6,160	19,700	35	2,770
Singapore	--	--	41	11,900	1	3	13	2,140
United Kingdom	226	388	3	15	(2)	12	157	6,310
Venezuela	--	--	--	--	20	106	1	55
Other	287	539	9	508	232	967	544	8,830
Total	1,200	2,270	1,890	18,500	8,900	28,700	1,660	47,200

[r]Revised. -- Zero.
[1]Table includes data available through September 12, 2018. 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)
2016:								
Canada	9,640	$23,100	1,240	$1,340	532	$1,760	766	$3,620
China	15	43	(2)	13	8	31	1,290	5,450
Germany	348	357	--	--	941	3,320	48	144
Israel	--	--	8,840	34,300	2,100	12,100	34	69
Japan	--	--	--	--	287	958	3	35
Kazakhstan	--	--	338	1,070	--	--	--	--
Mexico	2,620	3,980	--	--	56	135	599	4,100
Russia	--	--	1,860	4,910	--	--	13	67
Taiwan	249	476	7	17	2,070	5,660	(2)	15
United Kingdom	5,850	16,600	(2)	27	607	12,500	23	3,520
Other	3,180	5,800	1,060	4,300	436	1,560	485	3,820
Total	21,900	50,300	13,300	46,000	7,040	38,100	3,260	20,800
2017:								
Canada	6,050	13,100	1,210	1,200	162	438	823	4,070
China	327	602	1	7	--	--	1,270	6,480
Germany	864	814	--	--	412	1,570	15	33
Israel	--	--	8,900	33,000	2,210	10,500	15	11
Japan	--	--	--	--	36	122	7	232
Kazakhstan	--	--	55	153	--	--	--	--
Mexico	5,090	7,960	--	--	100	265	584	3,810
Russia	--	--	5,400	14,100	--	--	--	--
Taiwan	521	914	--	--	1,170	3,320	(2)	36
United Kingdom	3,160	8,200	9	23	622	10,900	43	6,560
Other	854	1,380	881	2,860	579	1,620	516	3,410
Total	16,900	32,900	16,500	51,400	5,290	28,800	3,270	24,600

-- Zero.
[1]Table includes data available through September 12, 2018. 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, 2017[1]

(Metric tons)

Country or locality	Capacity
Brazil	22,000
Canada	5
China	1,700,000
Iran	6,000
Israel	34,000
Kazakhstan	30,000
Korea, Republic of	10,000
Malaysia	15,000
Russia	80,000
Serbia	6,000
Turkey	15,000
Ukraine	22,000
United States	63,500
Total	2,000,000

[1]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 total shown.

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

(Metric tons)

Country or locality[2]	2013	2014	2015	2016	2017
Brazil[e]	16,000	16,000	15,000	15,000 [r]	15,000
China	770,000	874,000	859,000	871,000	930,000 [e]
Iran	--	500 [e]	1,000 [e]	2,000 [e]	3,000 [e]
Israel	27,399	25,993	19,307	22,548 [r]	23,000
Kazakhstan[3]	13,000	9,500	8,100	10,000 [e]	9,000 [e]
Korea, Republic of	7,500	-- [r]	-- [r]	-- [r]	--
Malaysia	150 [e]	-- [e]	-- [e]	--	--
Russia[e, 3]	66,000	62,000	60,000	58,000	40,000
Turkey	--	--	200	3,750 [r, e]	14,000 [e]
Ukraine[e, 3]	10,300	7,200	7,700	6,770 [r]	8,000
United States	W	W	W	W	W
Total	910,000	995,000 [r]	970,000 [r]	989,000 [r]	1,040,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing proprietary data; not included in total.
-- Zero.
[1]Table includes data available through July 11, 2018. 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 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.