



2016 Minerals Yearbook

MAGNESIUM [ADVANCE RELEASE]

MAGNESIUM

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During 2016, U.S. total magnesium imports and consumption decreased by 8% and 26%, respectively, compared with those in 2015. 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 twelvefold increase in production. Excluding production in the United States, worldwide primary magnesium production was 998,000 metric tons (t) in 2016, slightly more than the revised 979,000 t in 2015 (table 8). Production increased in China slightly (12,000 t), in Israel by 19% (3,700 t), and Turkey produced an estimated 5,000 t compared with only about 200 t in 2015, accounting for most of the increase in global production. These increases were partially offset by declines in Russia (by 3%) and Ukraine (by 35%). China, with 85% of global capacity, accounted for 87% of global production (excluding the United States) (tables 7, 8).

Import prices for magnesium generally decreased throughout 2016 in the United States, but prices in China and Europe generally increased. The U.S. spot dealer import price for magnesium at yearend 2016 was 11% less than that at yearend 2015. The prices at yearend 2016 in China and Europe were 31% and 21% more, respectively, than those at yearend 2015. However, the Platts Metals Week annual average magnesium price of \$2.15 per pound in 2016 was unchanged from the 2015 annual average price.

U.S. consumption of primary magnesium decreased by 26% to 46,900 t in 2016 from the revised 63,800 t in 2015. Decreased magnesium consumption for aluminum alloys and for reducing titanium and other metals was partially offset by increased consumption for castings and wrought products. Production of secondary magnesium increased by 9% in 2016 compared with that in 2015 (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, lake brines, and seawater. 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 (SF₆), 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 SF₆ 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), SF₆ emissions by the magnesium industry decreased by 7% compared with emissions in 2014 and were equivalent to 0.9 teragram of carbon dioxide (CO₂). Decreased production at facilities was cited as the principal reason for the decreased emissions. The decrease was also partly attributed to continuing industry efforts to use SF₆ alternatives, such as Novec™ 612 (dodecafluoro-2-methyl-3-pentanone) and sulfur dioxide, as part of the industry and EPA's partnership. These alternatives have lower global warming potential than SF₆ and tend to decompose quickly during their exposure to the molten metal. The long atmospheric life (about 3,000 years) of SF₆ and its high potential as a greenhouse gas (23,900 times the global warming potential of CO₂) resulted in a call for voluntary reductions in emissions. In 1999, the U.S. magnesium industry, the International Magnesium Association, and EPA began a voluntary SF₆ emissions reduction partnership (U.S. Environmental Protection Agency, 2017b, p. 4–80 to 4–85).

In January 2011, the U.S. Circuit Court of Appeals for the District of Columbia denied the appeal by US Magnesium LLC (US Magnesium; Salt Lake City, UT) of EPA's decision to include the company's Rowley, UT, magnesium production facility as a Superfund site. US Magnesium had challenged EPA's 2008 listing decision and argued that EPA had overestimated the risk of pollutants from the facility entering the air and soil. Designation of the facility as a Superfund site gave EPA the authority to further 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 EPA as part of a site study, but a report of the results was still pending, and cleanup activities had not started by yearend 2016 (Fahys, 2011; U.S. Environmental Protection Agency, 2017a).

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. In October, US Magnesium shut down an undisclosed amount of magnesium capacity at its smelter after Allegheny Technologies Inc. (ATI) (Pittsburgh, PA) shut down an adjacent titanium sponge plant in August. Consequently, US Magnesium announced that the completion of a capacity expansion at its magnesium smelter to 76,500 t/yr from

63,500 t/yr would be delayed until at least 2018 (Maltais, 2016b; US Magnesium LLC, 2016).

Domestic secondary metal recovery from magnesium and aluminum scrap increased by 9% compared with that in 2015. About 71% of the secondary magnesium recovered was contained in aluminum alloys and 29% was contained in magnesium alloy castings, ingot, and other forms (table 2). Advanced Magnesium Alloys Corp. (Anderson, IN) announced that it would expand its secondary magnesium metal production capacity to 50,000 t/yr from 25,000 t/yr. A production line was restarted in October and was ramped up at yearend. The plant in Anderson, IN, produced magnesium ingot from scrap for use by aluminum smelters and diecasters (Advanced Magnesium Alloys Corp., 2016; McBeth, 2016f).

In 2016, Nevada Clean Magnesium Inc. (Canada) began constructing a bench-scale pilot plant to test recovery of magnesium from dolomite. Test runs using dolomite samples from the Tami-Mosi deposit near Ely, NV, were expected to start in 2017. If the pilot-plant testing was successful, 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).

Consumption

Data for magnesium metal consumption were collected from two voluntary surveys of U.S. operations by the USGS. Of the 52 companies canvassed for magnesium consumption data, 52% 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 2016 decreased by 26% compared with that in 2015, which was attributed to decreases of 48% and 32%, respectively, in consumption for aluminum alloys and titanium reduction, partially offset by a 9% increase in consumption for castings and wrought products (table 3). The decrease of primary magnesium consumption in aluminum alloys corresponded to primary aluminum production decreasing 47%. The principal applications for magnesium in the United States in 2016 were reduction of titanium and other metals (32%); alloying aluminum (24%); diecasting (16%); and desulfurization of iron and steel (15%). Consumption of secondary magnesium scrap for castings in 2016 increased by 7% to 25,000 t from the revised total of 23,300 t in 2015 (table 2). Secondary magnesium recovery increased by 9% compared with that in 2015, attributable to increased magnesium recovery from magnesium-base scrap (table 2).

ATI ceased titanium sponge production at its plant in Rowley, UT, during the last half of 2016. ATI consumed 1 t of molten magnesium from US Magnesium's plant per 1 t of titanium sponge produced. ATI started production at the Rowley plant in 2009 and was in the process of ramping up to its full capacity of 10,900 t/yr when the decision to stop production was made in August. ATI cited the availability of imported titanium sponge at lower prices for the shutdown. ATI used titanium sponge to produce ingot used for aerospace and medical applications (Haflich, 2015; Maltais, 2016b).

Research and Development

Toyota Motor Corp. announced that researchers at the Toyota Research Institute of North America identified an electrolyte that is compatible with magnesium in batteries. Magnesium theoretically has a higher energy density potential for batteries than lithium and is more stable in the presence of oxygen 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 is feasible (Toyota Motor Corp., 2016).

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 2016, unchanged from the average price in 2015. 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, 2016c). Prices for material contracted in the fall of 2015 for delivery in 2016 ranged from \$1.67 to \$1.80 per pound (McBeth, 2015).

Although the U.S. spot Western price range for magnesium was unchanged, U.S. spot dealer prices for imported magnesium decreased throughout the year from an average range of \$1.65 to \$1.70 per pound in January to \$1.47 to \$1.55 per pound in December. The annual average spot dealer import magnesium price was \$1.56 per pound, 12% lower than that in 2015. Abundant supplies, including imports from Russia and Turkey, were cited for declining domestic prices. Decreased consumption by primary aluminum producers and for titanium reduction also contributed to magnesium price declines in the United States. Availability of scrap aluminum with high magnesium content was cited for demand from the secondary aluminum industry being similar to that in 2015, also a contributing factor in declining U.S. magnesium prices (McBeth, 2016b, d, e, g).

The January average magnesium price in China was \$1,940 per metric ton, and the price generally increased through April to \$2,275 per metric ton. The average price started to decline in May and reached \$2,095 per metric ton at the end of June. Lower domestic prices and currency valuations were cited for this decline (Yee, 2016c). In July, the price resumed the upward trend and reached \$2,525 per metric ton at the end of October before declining to \$2,275 per metric ton at yearend. The price increase in the second half of the year was attributed to increased production costs, increasing demand, and tight supplies (Leung, 2016g; Yee, 2016a). The annual average magnesium price in China was \$2,210 per metric ton, 4% higher than that in 2015. The January average magnesium price in Europe was \$1,885 per metric ton, and the price generally followed the same upward trend as the price in China, peaking at \$2,500 per metric ton in November and averaging \$2,350 per

metric ton in December. The annual average magnesium price in Europe was \$2,189 per metric ton, slightly higher than that in 2015. While demand was stable, higher production costs and some shutdowns in China were cited for price increases in China and Europe.

Foreign Trade

Total U.S. magnesium exports in 2016 were 26% more than those in 2015 (table 5). Canada (52%) and Mexico (29%) were the principal destinations. In 2016, exports of magnesium metal and semifabricated products were essentially unchanged from those in 2015, whereas exports of alloys and scrap were 43% and 131% higher, respectively, than those in 2015. Total magnesium imports for consumption in 2016 were 8% less than those in 2015 (table 6). Israel was the leading source of imported magnesium metal (66%) and alloys (31%). 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 (41%) to the United States in 2016. Taiwan was the second-ranked supplier of magnesium alloy imports (28%). Canada accounted for 44% of the scrap imports, which accounted for 21% of total magnesium imports (table 6).

The U.S. Department of Commerce, International Trade Administration (ITA) conducted an administrative review of the antidumping order on magnesium imported from China by Tianjin Magnesium International Co. Ltd. (TMI) and Tianjin Magnesium Metal Co. Ltd. (TMM) between May 1, 2014, and April 30, 2015. 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 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, 2014, 2016b, d).

In February, the U.S. International Trade Commission (USITC) instituted a 5-year sunset review of antidumping duties on magnesium metal imports from China. The review was completed in July, and the ITA and USITC determined that revocation of the antidumping duties would result in recurrence of dumping of magnesium (U.S. Department of Commerce, International Trade Administration, 2016a; U.S. International Trade Commission, 2016a).

In June, the ITA completed a 5-year sunset review of antidumping duties on magnesium alloy imports from China. The ITA ruled that the duty rate of 141.49% remain and be reviewed again in 2021 (U.S. Department of Commerce, International Trade Administration, 2016c).

In October, the USITC initiated a 5-year review of antidumping duties on pure magnesium imports from China. 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, 2016b).

World Review

Global production of primary magnesium (excluding the United States) was 998,000 t, slightly more than the revised amount produced in 2015 (table 8). Global primary capacity increased by 5% compared with that at yearend 2015 to 2 million metric tons per year (Mt/yr) (table 7).

Australia.—Latrobe Magnesium Ltd. completed the second stage of a feasibility study for a 5,000-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 take about 1 year to complete once started. Future expansion to 40,000 t/yr was being considered (Latrobe Magnesium Ltd., 2015, 2017).

Canada.—Three companies proposed magnesium projects in Canada. Alliance Magnesium Inc. continued planning a 50,000-t/yr smelter to produce magnesium from asbestos mine tailings in Asbestos, Quebec. A 25-kilogram-per-day pilot plant was under construction to test the process and would be completed in early 2017. If the pilot plant demonstrated that the process was economically viable, Alliance planned to construct the first phase of the smelter with a 5,000-t/yr capacity by yearend 2018 (Alliance Magnesium Inc., 2016a–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 and would produce ferronickel and high-purity silica as byproducts (Mag One Products Inc., 2016a, b).

West High Yield Resources Inc. started an environmental study for its proposed Record Ridge project in British Columbia. The company proposed building a mine and smelter to produce magnesium from a serpentine deposit. According to a preliminary economic assessment, measured and indicated resources totaled 10.6 Mt of serpentine grading 24.6% magnesium (West High Yield Resources Inc., 2014, 2016).

China.—China produced 871,000 t of magnesium in 2016, a slight increase compared with the revised amount in 2015. In 2016, China exported 224,000 t of unwrought magnesium, 8% more than in 2015, of which exports of magnesium alloys increased slightly to 117,000 t. Exports of wrought magnesium products decreased by 17% to 2,680 t, and exports of magnesium articles increased by 7% to 5,370 t compared with exports in 2015 (Yee, 2017a–c).

Although prices in China reached annual lows in February because of high inventories and weak demand in overseas markets, demand in China increased and prices generally increased through the remainder of the year (Yee, 2016a). Several smelters shut down capacity during the summer, citing environmental concerns and regular maintenance, causing prices to increase by about 10% in July (Leung, 2016f).

The cost of production of magnesium at Pidgeon process plants increased in 2016 owing to increased prices for ferrosilicon and coal gas. Ferrosilicon prices increased moderately in March after some domestic capacity was shut down. Prices then increased significantly in the last quarter of the year after strict weight limits for trucks were imposed on September 21. Deliveries of ferrosilicon

were also slowed owing to the load limits. Coal gas prices rose throughout the year as demand for power generation increased. The increased production costs and increased demand were cited for magnesium prices in China rising to their highest levels in 3 years during the fourth quarter. The shutdown of some producers owing to financial constraints also contributed to increased prices at the end of the year (Leung, 2016g; Yee, 2016b, d).

Century Sunshine Group Holdings Ltd. (Hong Kong) completed a 15,000-t/yr smelter in Hami, Xinjiang Uyghur Autonomous Region, in the first quarter of the year. Century Sunshine planned to increase capacity of the plant to 45,000 t/yr by yearend 2017. Century Sunshine continued expansion of its smelter in Baishan, Jilin Province, to 75,000 t/yr from 25,000 t/yr. Completion of the expansion was expected in early 2017 (Leung, 2016a, b).

Qinghai Salt Lake Magnesium Co. Ltd. completed a 100,000-t/yr smelter to produce magnesium from lake brines in Golmud, Qinghai Province. Trial runs were completed in May. Commercial production from the smelter was expected in early 2017. Magontec Ltd. (Australia) completed a 56,000-t/yr casthouse in Golmud to be supplied with molten magnesium from the Qinghai Salt Lake smelter (Herbert, 2016; Leung, 2016e, i; Lee, 2017).

In January, Jiangtai Coal Chemical Industry Co. shut down production from its 30,000-t/yr magnesium smelter in Shennu County, Shaanxi Province. A shortage of coal gas was cited for the shutdown as the gas was used for power generation, and the shutdown continued as high coal gas prices lasted throughout the year. Jiangtai planned to continue the shutdown until at least February 2017 (Leung, 2016h).

In May, Fugu Jinchuan Magnesium Co. restarted production from its 30,000-t/yr smelter in Shaanxi Province. The smelter was shut down in December 2015 on account of low magnesium prices. Increased magnesium prices were cited for the restart (Leung, 2016d).

In October, Shanyang Shenghe Magnesium Industry Co. completed a 10,000-t/yr ferrosilicon plant to supply its 10,000-t/yr magnesium smelter in Shanyang County, Shaanxi Province. An expansion of the smelter to 50,000 t/yr and a 100,000-t/yr magnesium alloy plant were expected to be completed in 2018 (Leung, 2016j).

Haicheng Haiming Mining Co. was constructing a plant that would produce magnesium and high-purity magnesia from magnesite. The plant would have a capacity of 50,000 t/yr of magnesium and 100,000 t/yr of high-purity magnesia. Completion was scheduled for July 2017 (Leung, 2016c).

Israel.—Magnesium production increased by 19% compared with that in 2015 to 23,000 t. Production in 2015 was 26% less than that in 2014, principally owing to a strike at Dead Sea Magnesium Co. Ltd. [a subsidiary of Israel Chemicals Ltd. (ICL)], Israel's only magnesium producer, that reduced production from mid-February through May 2015. On January 1, a new tax on magnesium production took effect. The new tax included a 5% royalty on the value of magnesium produced and a tax, ranging from 25% to 42%, on excess profits. Citing the new tax, ICL ceased discretionary investment in the plant and was considering shutting it down. ICL reported

an operational loss for the plant of \$22 million (Barry, 2015; Israel Chemicals Ltd., 2016a, p. 225–227; 2016b, p. 75; 2017, p. 246–247).

Turkey.—Esan Eczacıbaşı Endüstriyel Hammaddeler San. ve Tic. A.Ş. ramped up its 15,000-t/yr magnesium Pidgeon process smelter in Eskisehir, which started production in September 2015. Expansion of the smelter to 30,000 t/yr was being considered (McBeth, 2016a).

Outlook

Consumption of magnesium for primary aluminum alloys in the United States is expected to stabilize in 2017 after declining in 2016 because of the shutdown of several primary aluminum smelters at the end of 2015 and early 2016. Magnesium consumption in the United States by secondary aluminum smelters is expected to remain in the range of recent years. However, 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, for castings in order 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, 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, a trend that is expected to continue. 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 until at least a few more years (Magnesium Elektron Ltd., 2014).

Consumption of magnesium by the iron and steel industry in other countries is expected to increase by 5% in 2017 based on steel production growth (World Steel Association, 2017).

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). Global consumption of magnesium is expected to increase by an average of about 3% per year through 2020. 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 STATISTICS¹

(Metric tons unless otherwise specified)

	2012	2013	2014	2015	2016
United States:					
Production:					
Primary	W	W	W	W	W
Secondary	77,000 ^r	79,200 ^r	81,100 ^r	88,500 ^r	96,000
Exports	18,300	16,100	17,000	15,200	19,100
Imports for consumption	50,700 ^r	45,900	51,900 ^r	49,200 ^r	45,500
Consumption, primary	70,200 ^r	66,400 ^r	63,700 ^r	63,800 ^r	46,900
Yearend stocks, producer	W	W	W	W	W
Yearend price ²	dollars per pound	2.15–2.25	2.10–2.15	2.10–2.20	2.10–2.20
World, primary production ³	840,000	910,000 ^r	1,000,000	979,000 ^r	998,000 ^p

^pPreliminary. ^rRevised. W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through November 8, 2017. Data are rounded to no more than three significant digits.

²Source: Platts Metals Week.

³Does not include U.S. production.

TABLE 2
MAGNESIUM RECOVERED FROM SCRAP PROCESSED IN THE
UNITED STATES, BY KIND OF SCRAP AND FORM OF RECOVERY¹

(Metric tons)

	2015	2016
KIND OF SCRAP		
New scrap:		
Magnesium-base	28,500 ^r	35,600
Aluminum-base	37,100	37,200
Total	65,600 ^r	72,800
Old scrap:		
Magnesium-base	813 ^r	814
Aluminum-base	22,100	22,400
Total	22,900 ^r	23,200
Grand total	88,500 ^r	96,000
FORM OF RECOVERY		
Magnesium alloy ingot ²	W	W
Magnesium alloy castings	23,300 ^r	25,000
Aluminum alloys	63,500 ^r	67,900
Other ³	1,710	3,180
Total	88,500 ^r	96,000

^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."

¹Table includes data available through November 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes secondary magnesium content of both secondary and primary alloy ingot.

³Includes chemical and other dissipative uses, cathodic protection, and data indicated by symbol W.

TABLE 3
U.S. CONSUMPTION OF PRIMARY MAGNESIUM, BY USE¹

(Metric tons)

Use	2015	2016
For structural products:		
Castings:		
Die	7,830 ^r	7,740
Permanent mold	431 ^r	419
Sand	1,100 ^r	1,320
Wrought products ²	W	W
Other	1,040	1,870
Total	10,400 ^r	11,300
For distributive or sacrificial purposes:		
Aluminum alloys	21,400 ^r	11,100
Cathodic protection (anodes)	W	W
Iron and steel desulfurization	7,300	7,270
Nodular iron	432 ^r	305
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	22,300	15,300
Other ³	1,930 ^r	1,620
Total	53,400 ^r	35,600
Grand total	63,800 ^r	46,900

^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."

¹Table includes data available through November 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes sheet and plate and forgings.

³Includes chemicals and scavenger, deoxidizer, powder, and any data indicated by W.

TABLE 4
YEAREND MAGNESIUM PRICES

		2015	2016
U.S. spot dealer import	dollars per pound	1.68–1.72	1.47–1.55
U.S. spot Western	do.	2.10–2.20	2.10–2.20
China	dollars per metric ton	1,800–1,850	2,370–2,410
European free market	do.	1,900–2,000	2,300–2,400
do. Ditto.			

Source: Platts Metals Week.

TABLE 5
U.S. EXPORTS OF MAGNESIUM, BY COUNTRY OR LOCALITY¹

Country or locality	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2015:								
Brazil	--	--	--	--	482	\$1,830	67	\$225
Canada	144	\$338	2,410	\$7,310	3,420	11,200	423	20,900 ^r
China	--	--	--	--	34	243	145	4,120
France	--	--	--	--	--	--	64	9,680
Japan	--	--	68	139	31	445	88	1,130
Mexico	234	469	12	32	3,420	12,900	122	5,800
Singapore	3	8	2,500	10,300	1	5	16	3,630
United Kingdom	--	--	24	48	(2)	8	128	8,140
Venezuela	--	--	--	--	1	20	94	8,810
Other	51 ^r	80	208 ^r	469 ^r	99 ^r	563 ^r	908 ^r	9,370 ^r
Total	432^r	895	5,220	18,300	7,490	27,200	2,060	71,800^r
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	675	3,160	145	2,130	883	10,900
Total	996	2,040	5,270	23,000	10,700	37,000	2,080	48,800

^rRevised. -- Zero.

¹Table includes data available through November 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM, BY COUNTRY OR LOCALITY¹

Country or locality	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2015:								
Canada	9,960	\$19,800	1,130	\$1,280	444 ^r	\$1,290	1,180 ^r	\$4,980
China	228	520	(2)	2	(2) ^r	3 ^r	4,040 ^r	11,500
Germany	602	1,530	--	--	509 ^r	1,930	55 ^r	180
Israel	--	--	9,910	42,200	2,620 ^r	13,700	11 ^r	1,200 ^r
Japan	(2)	5	(2)	5	883 ^r	3,050	12	354
Kazakhstan	--	--	226	850	--	--	--	--
Mexico	3,550	6,740	(2)	6	52 ^r	139	584 ^r	4,300
Russia	--	--	1,910 ^r	6,160 ^r	40	132	68 ^r	442
Taiwan	462	1,030	--	--	2,200 ^r	6,720	(2)	37
United Kingdom	4,570	11,200	(2)	32	695 ^r	14,900	20 ^r	2,340
Other	1,930	3,570 ^r	630 ^r	3,420 ^r	433 ^r	1,750 ^r	303 ^r	3,430
Total	21,300	44,300 ^r	13,800 ^r	54,000 ^r	7,870 ^r	43,600 ^r	6,270 ^r	28,800
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	5,460
Germany	348	357	--	--	941	3,330	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

^rRevised. -- Zero.

¹Table includes data available through November 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2016¹

(Metric tons)

Country or locality	Capacity
Brazil	22,000
China	1,700,000
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

¹Includes capacity at operating plants as well as at plants on standby basis.

TABLE 8
MAGNESIUM: PRIMARY WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality	2012	2013	2014	2015	2016 ^P
Brazil ^c	16,000	16,000	16,000	15,000	16,000
China	698,000	770,000	874,000	859,000 ^r	871,000
Israel	27,292	27,399	25,993	19,307	23,000
Kazakhstan ^{c,2}	22,200 ^r	13,000	9,500	8,100	10,000
Korea, Republic of	2,500	7,500	10,000	10,000	10,000
Malaysia	--	150 ^e	--	--	--
Russia ^{c,2}	65,000	66,000	62,000	60,000	58,000
Turkey	--	--	--	200 ^e	5,000
Ukraine ²	9,000 ^r	10,300 ^r	7,200	7,700	5,000
United States	W	W	W	W	W
Total	840,000	910,000 ^r	1,000,000	979,000 ^r	998,000

^cEstimated. ^PPreliminary. ^rRevised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

¹Includes data available through August 8, 2017. 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.

²Includes magnesium consumed for titanium sponge production.