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Magnesium

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U.S. reported consumption of primary magnesium in 2022 increased by 4% from that in 2021 (tables 1, 3). Production of secondary magnesium increased by 11% in 2022 from that in 2021 (tables 1, 2). Magnesium exports decreased by 17% from those in 2021, and total magnesium imports for consumption increased by 63% from those in 2021. 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 the 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 1.05 million metric tons (Mt) in 2022, slightly more than the 1.03 Mt (revised) in 2021 (table 8). Production increased by 5% (45,000 metric tons [t]) in China, accounting for most of the increase in global production compared with that in 2021. The increased production in China was largely offset by the 37,000-t decrease in production in Russia. China, with 86% of global capacity, accounted for 89% of global production (excluding the United States) (tables 7, 8).

Import prices for magnesium in the United States generally increased through May 2022, then generally decreased for the remainder of the year. The average U.S. spot dealer import price for magnesium at yearend 2022 was 9% less than that at yearend 2021. The S&P Global Platts Metals Week annual average U.S. spot Western magnesium price of $7.59 per pound in 2022 was 115% more than the 2021 annual average price.

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 metal. Magnesium's chemical properties also make it useful to remove sulfur from iron and steel.

This chapter 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 (USGS) Minerals Yearbook, volume I, Metals and Minerals.

Government Actions and Legislation

In response to military action in Ukraine by Russia, the Suspending Normal Trade Relations with Russia and Belarus Act was passed by Congress and signed by the President of the United States in April. As a result, tariffs on pure magnesium imported from Russia increased to 100% ad valorem from 8% ad valorem. For magnesium alloys imported from Russia, the tariff increased to 60.5% ad valorem from 6.5% ad valorem (Lazzaro, 2022a, c; McBeth, 2022b).

In June, the U.S. Department of Commerce, International Trade Administration (ITA) completed a 5-year review of antidumping duties on pure magnesium imports from China. In 1997, antidumping duties were imposed on pure magnesium imports from China at a weighted-average rate of 108.26%. The duties were to be reviewed every 5 years. The ITA review concluded that revocation of the duties would likely lead to continuation or recurrence of dumping; therefore, the antidumping duties were retained (International Trade Administration, 2022; Lazzaro, 2022b).

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 1,000 years) of SF_6 and its high potential as a greenhouse gas [23,500 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 2022 were equivalent to 1.1 teragrams of CO_2, less than the 1.2 teragrams emitted in 2021 but more than the 0.9 teragrams emitted in 2020. The U.S. magnesium industry continued its efforts to use SF_6 alternatives that have lower global warming potential than SF_6 and tend to decompose quickly during their exposure to the molten metal, such as dodecafluoro-2-methyl-3-pentanone, HFC-134a, and sulfur dioxide. However, the use of these alternatives decreased during 2022 from the amount used in 2017. Emissions of HFC-134a in 2022 and 2021 were equivalent to 0.040 teragram of CO_2, less than the 0.1 teragram in each year from 2015 to 2020. This continued the downward trend of use of HFC-134a from 0.098 teragram in 2017, 0.079 teragram in 2018, 0.066 teragram in 2019, and 0.052 teragram in 2020 (U.S. Environmental Protection Agency, 2019, p. 4–86 to 4–90; 2023, p. 4–100 to 4–106; 2024, p. ES–3, 1–4 to 1–5, 4–127 to 4–128).

Production

Because there was only one primary magnesium producer operating in the United States (US Magnesium LLC), production data were withheld by the USGS to avoid disclosing company proprietary data. US Magnesium 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. US Magnesium continued to have production issues throughout 2022 since it declared force majeure on contracted deliveries in September 2021, citing equipment failures for decreased production at its plant in Utah. The company did not disclose details of the production issues including the amount of capacity affected or give a schedule for completion of repairs of affected equipment. In early January 2022, industry sources reported that US Magnesium had received the equipment necessary to repair the smelter but a completion schedule for the repairs was not available. On March 5, 2022, a construction worker died in an accident while working on repairs to the smelter (McBeth, 2022a, c). The production problems at US Magnesium led to production problems at some of its contracted customers. On July 7, 2022, Kaiser Aluminum Corp. declared force majeure at its Warrick rolling mill in Indiana owing to the limited availability of magnesium after deliveries from US Magnesium stopped. The action lasted until September 7, 2022, when Kaiser announced that it had found other sources of magnesium, an essential component of its aluminum packaging products (Kaiser Aluminum Corp., 2022a, b).

Secondary magnesium ingot was produced from scrap by three companies in the United States—Advanced Magnesium Alloys Corp. (Anderson, IN), MagPro LLC (Camden, TN), and Magretech LLC (Bellevue, OH). 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 increased by 11% from that in 2021 (table 2). 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. Secondary magnesium recovered from aluminum-base scrap in 2022 was 55,500 t compared with 54,700 t in 2021. Secondary magnesium recovery from new aluminum-base scrap increased by 281 t from that in 2021. Secondary magnesium recovery from old aluminum-base scrap increased by 495 t from that in 2021. Secondary aluminum production increased slightly from that in 2021, which accounted for the increased recovery of secondary magnesium contained in aluminum alloys. Increased manufacturing in 2022, especially in the automobile sector, was cited for increased new aluminum scrap generated by manufacturers in 2022. Recovery of secondary magnesium from new scrap in 2022 increased by 11% to 87,900 t. Consumption of secondary magnesium in castings and other magnesium-base products decreased slightly from that in 2021. The increased consumption of secondary magnesium was attributed partly to consumers switching from primary magnesium owing to continued shortages after US Magnesium declared force majeure in September 2021 and did not return to producing at prior levels in 2022 (Jonson, 2022d).

Western Magnesium Inc. completed construction of a pilot plant in Cadiz, OH, to test magnesium production from dolomite by a process it developed. Construction of the pilot plant started in 2021 and in June, magnesium was produced from the pilot plant. If the pilot plant proves the company's process to be economically competitive, a commercial-scale smelter was planned (Western Magnesium Inc., 2020, 2021, 2022).

Real Alloy LLC sold its European magnesium and aluminum recycling business to Speira GmbH (Germany). Seven facilities in France, Germany, Norway, and the United Kingdom were involved in the transaction. Real Alloy said it would focus its business on secondary aluminum production in North America and Speira planned to expand its aluminum and magnesium recycling business in Europe (Poole, 2022).

Consumption

Data for magnesium metal consumption were collected from two voluntary surveys of U.S. operations by the USGS. 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 related to magnesium consumption.

Reported primary magnesium consumption in 2022 increased by 4% from that in 2021, which was attributed to increased consumption for diecastings and other structural products, which increased by 9%. The principal applications for primary magnesium in the United States in 2022 were diecasting (59%); alloying aluminum (21%); and desulfurization of iron and steel (7%) (table 3).

Increased consumption of primary and secondary magnesium in castings was attributed to increased automobile production compared with that in 2021. Total domestic automobile production in the United States in 2022 was 17.0 million units, 9% more than the 15.6 million units in 2021 (Bureau of Economic Analysis, 2024).

Prices

In 2022, the S&P Global Platts Metals Week U.S. spot dealer import price and the U.S. spot Western average price for magnesium followed the same trajectory. Both prices increased by 20% in the first quarter of 2022; at the end of March 2022, both prices were $7.88 per pound compared with $6.58 per pound at the end of December 2021. The average prices for magnesium each decreased slightly in the second quarter of 2022; at the end of June 2022, both prices were $8.75 per pound compared with $7.88 per pound at the end of March 2022. The prices decreased by 21% in the third quarter of 2022, and the prices decreased by 13% in the fourth quarter of 2022. The increases of the U.S. spot dealer import and U.S. spot Western prices in the first quarter of the year were partly attributed to the continued shutdown of an undisclosed amount of capacity at US Magnesium's smelter in Utah. Speculation about the effect of sanctions on Russia that included increasing the tariff on magnesium to 100% ad valorum from 8% ad valorum also contributed to price increases in the first quarter (McBeth, 2022c). By the second quarter of the year, prices decreased significantly and were stable the rest of the year as suppliers were found to replace shipments expected from US Magnesium (Baltic, 2022).

According to traders and producers, however, U.S. spot dealer import and 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). Contracts for delivery in 2022 signed in the fourth quarter of 2021 were reported in a wide range, attributed to the uncertainty of deliveries from US Magnesium after it declared force majeure on deliveries in September 2021. Prices between $5.25 per pound and $6.45 per pound were reported for full loads of primary magnesium delivered in 2022 (McBeth, 2021, 2022a).

Many magnesium consumers delayed signing contracts for delivery in 2023 citing the possibility of deliveries from US Magnesium resuming to previous levels in early 2023. Several market participants reported that consumers had ample supplies that would last into 2023, and other consumers preferred to make purchases on the spot market until there was more information about the return of US Magnesium to the market. Some contracts were reported with prices of $6.50 per pound or more for full loads of primary magnesium delivered in 2023 (Jonson, 2022a).

The U.S. spot dealer prices for imported magnesium ranged from $6.00 to $7.25 per pound in January and increased to $8.50 to $10.50 per pound in April. The price range decreased to $6.50 to $7.50 per pound in August. By October, the price range was $6.00 to $7.00 per pound, and in December, the price range decreased to $5.50 to $6.50 per pound. The annual average spot dealer import magnesium price was $7.59 per pound, more than twice that in 2021.

The annual average magnesium price in Europe was $5,210 per metric ton, 4% more than that in 2021. The average magnesium price in Europe at the beginning of the year was $9,250 per metric ton and decreased through the end of the year. At the end of the March, the average price in Europe was $7,150 per metric ton, decreased to $4,100 per metric ton by the end of June, and continued to decline, ending the year at $3,350 per metric ton. Prices in China and Europe during the fourth quarter of 2021 hit record highs after production decreases in September 2021 in China to comply with emission targets imposed by the Government of China. While production increased in the first quarter of 2022, magnesium consumption in some parts of China decreased in response to lockdowns imposed after outbreaks of the global coronavirus disease 2019 (COVID-19) pandemic were reported in the first 3 months of the year, leading to increased supply and decreased price in Europe (S&P Global Platts Metals Daily, 2021, 2022a, d).

Foreign Trade

Total U.S. magnesium exports in 2022 were 17% less than those in 2021, but the value of total magnesium exports increased by 14% (table 1). Canada (51%) and Mexico (9%) were the leading destinations for total magnesium exports by quantity (table 5). In 2022, exports of magnesium metal were 85% less than those in 2021. Exports of magnesium alloys, scrap, and semifabricated products increased by 28%, 27%, and 13%, respectively, from those in 2021. Total magnesium imports for consumption in 2022 were 63% more than those in 2021, and the value of total magnesium imports increased by nearly 300%. Imports of magnesium scrap, alloys, metal, scrap, and semifabricated products increased by 67%, 65%, 60%, and 41%, respectively, from those in 2021 (table 6). Continued shortages of magnesium caused by production issues at the US Magnesium plant in Utah were cited for increased imports, including from China, despite antidumping and countervailing duties on magnesium imported from China (Jonson, 2022b, c).

Magnesium scrap accounted for 36% of total magnesium imports in 2022; alloys, 35%; metal, 24%; and semifabricated products, 6%. Canada was the leading source of scrap imports in 2022 (27%), followed by China (14%) and Mexico (12%). Czechia was the leading supplier of magnesium alloys (29%), followed by Hungary and Taiwan (14% each) and the Republic of Korea (11%). Israel was the leading source of imported magnesium metal (23%). Turkey was the second-ranked supplier of magnesium metal imports (20%), and China and Russia each supplied 19% of magnesium metal imports. Austria, Mexico, China, and Taiwan supplied 32%, 23%, 16%, and 15%, respectively, of semifabricated magnesium product imports in 2022 (table 6).

World Review

Global production of primary magnesium (excluding the United States) was 1.05 Mt, slightly more than the revised amount produced in 2021 (table 8).

Australia.—Latrobe Magnesium Ltd. modified its plans to construct a pilot plant to test magnesium production from coal fly ash in the Latrobe Valley in the State of Victoria. In September 2020, Latrobe received approval from the Victorian Environmental Protection Authority to construct the pilot plant. The pilot plant capacity previously was planned to be 3,000 t/yr, but during 2022, the plan was revised to decrease capacity to 1,000 t/yr. Construction was expected to be completed by June 2023. If the pilot plant proved successful, Latrobe planned to build a 10,000-t/yr plant by the end of 2024. Future expansion to 100,000 t/yr by the end of 2027 was being considered (Latrobe Magnesium Ltd., 2020, p. 22; 2022, p. 3, 14).

Canada.—Alliance Magnesium Inc. continued construction of the first phase of a plant to produce primary magnesium from asbestos mine tailings in Asbestos, Quebec Province. When completed, Alliance planned to have 18,000 t/yr of production capacity (Alliance Magnesium Inc., 2020; Decarie, 2022).

China.—China's magnesium production was 933,000 t in 2022, 5% more than the revised amount in 2021, and accounted for 89% of world production (excluding production in the United States) (table 8). Magnesium consumption in China was 436,000 t in 2022 compared with 401,000 t in 2021 (China Metal Market—Magnesium, 2023). Exports from China were 460,000 t during the first 11 months of the year, 9% more than those in the same period of 2021 (S&P Global Platts Metals Daily, 2023). Increased consumption was attributed to increased demand from diecasters and aluminum smelters after easing of the shutdowns which were ordered in 2021 to contain COVID-19 outbreaks. But consumption and production decreased in April in response to an outbreak of COVID-19 in Yulin, Shaanxi Province. Production decreased again in June and July in Shaanxi and Shanxi Provinces as prices decreased in response to lower demand and to comply with emission restrictions. In August, decreased end-use demand led to lower prices, which in turn led to some smelters decreasing production (S&P Global Platts Metals Daily, 2022b, g, j).

At the end of October, several semicoke producers in Yulin, Shaanxi Province, were shutdown to comply with environmental regulations, resulting in magnesium production capacity being closed. Other shutdowns of semicoke producers and magnesium smelters were reported during the year. Many magnesium smelters in China used waste gas from semicoke producers as a fuel source. Magnesium prices were reported to have increased on news of the semicoke producers shutting down. The amount of magnesium production capacity affected by the shutdown of semicoke producers was not available. Production in October also was slowed in some locations as outbreaks of COVID-19 were reported in places that produced raw materials including dolomite and ferrosilicon (S&P Global Platts Metals Daily, 2022e, f, i).

Production at the Qinghai Salt Lake Magnesium Co. Ltd. (QSLM) smelter in Golmud, Qinghai Province, continued to be delayed after first being commissioned in 2017. Work to correct production problems was being conducted at the QSLM smelter that was designed to produce magnesium from lake brines. Production was halted in April 2019 at the 100,000-t/yr smelter after technical issues resulted in low volumes of magnesium produced 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 2020 because of financial issues. Work on the plant to correct the issues was delayed until 2021 because of the financial situation. Magontec Ltd. (Australia), which owned 29% of QSLM, reported that no magnesium was produced by the smelter in the first half of 2022 (Magontec Ltd., 2020, p. 2–3, 6–7; 2021, p. 2, 5; S&P Global Platts Metals Daily, 2022k).

Russia.—In May, a court upheld a ruling that declared the privatization of the Solikamsk Magnesium Plant (SMZ) in 1992–93 was not authorized by the Government. The ruling stripped four individuals of their share of ownership of the company, which combined was 89.5% of the total shares of SMZ. SMZ held about 60% of Russia's magnesium production capacity and also produced niobium, rare-earth elements, tantalum, and titanium sponge (Bouckley, 2022).

Turkey.—In September, Kar Mineral Madencilik acquired the 15,000-t/yr magnesium smelter in Eskisehir from ESAN Eczacıbaşı Industrial Raw Materials Co. Kar planned to add a new casting line, upgrade its furnace, and expand its solar energy capacity. A construction schedule for the upgrades was not available (McBeth, 2022d).

Outlook

Magnesium consumers in the United States were expected to continue to rely on imported primary magnesium and secondary magnesium as alternatives owing to decreased deliveries from the sole domestic producer. Magnesium consumption by the aluminum industry is expected to continue to follow the trend of aluminum production, with China expected to be a major consumer of magnesium for aluminum alloys. Consumption of magnesium by the iron and steel industry is expected to be essentially unchanged in 2023 compared with that in 2022, based on projected steel production (World Steel Association AISBL, 2023).

In China, consumption of magnesium for electric vehicles is expected to reach 230,000 t in 2025 as sales of electric vehicles are expected to reach 6.4 million units by that year, double the number sold in 2021. Use of magnesium sheet and extrusions is expected to help minimize the weight of electric vehicles (S&P Global Platts Daily, 2022c, h). Production in China is expected be constrained at times to comply with environmental regulations and energy use restrictions, causing periods of price volatility in the world market. This risk will decrease if the QSLM smelter starts production and the industry shifts production to locations in the west, where pollution concerns are lower and power supplies are more abundant.

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

		2018	2019	2020	2021	2022
United States:						
Production:						
Primary		W	W	W	W	W
Secondary		109,000	103,000	94,800	103,000	115,000
Exports		12,300	9,770	14,900	10,500 r	8,690
Imports for consumption		46,500	58,800	61,200	54,800 r	89,100
Consumption, primary, reported		55,300 r	56,500 r	54,200 r	48,100 r	50,200
Yearend stocks, producer		W	W	W	W	W
Yearend price range[2]	dollars per pound	2.20–2.30	2.70–2.90	2.30–2.35	6.25–6.90	5.50–6.50
Annual average price[2]	do.	1.55 r	2.32	2.26	3.38 r	7.59
World, primary production[3, 4]		985,000 r	1,080,000 r	1,080,000 r	1,030,000 r	1,050,000

[r]Revised. do. Ditto. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through November 20, 2023. 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.
[4]May include estimated data.

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

(Metric tons)

	2021	2022
Type of scrap:		
New scrap:		
Magnesium-base	44,400	52,800
Aluminum-base	34,900	35,200
Total	79,300	87,900
Old scrap:		
Magnesium-base	4,080	6,420
Aluminum-base	19,800	20,300
Total	23,900	26,700
Grand total	103,000	115,000
Form of recovery:		
Magnesium alloy ingot[2]	W	W
Magnesium alloy castings	35,800	35,200
Aluminum alloys	67,000	76,000
Other[3]	357 r	3,460
Total	103,000	115,000

[r]Revised. W Withheld to avoid disclosing company proprietary data; included in “Other.”
[1]Table includes data available through June 16, 2023. 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 “W.”

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

(Metric tons)

Use	2021	2022
For structural products:		
Castings:		
Die	27,400 r	29,800
Permanent mold	915	567
Sand	1,710 r	1,620
Wrought products[2]	W	W
Other	1,070	886
Total	31,100 r	32,800
For distributive or sacrificial purposes:		
Aluminum alloys	10,300	10,400
Cathodic protection (anodes)	W	W
Iron and steel desulfurization	3,400 r	3,400
Nodular iron	217 r	240
Reducing agent for titanium and other metals	W	W
Other[3]	3,200 r	3,340
Total	17,100 r	17,400
Grand total	48,100 r	50,200

[r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Table includes data available through June 16, 2023. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes forgings and sheet and plate.
[3]Includes chemicals and scavenger, deoxidizer, powder, and any data indicated by "W."

TABLE 4
YEAREND MAGNESIUM PRICES

		2021	2022
U.S. spot dealer import	dollars per pound	6.25–6.90	5.50–6.50
U.S. spot Western	do.	6.25–6.90	5.50–6.50
European free market	dollars per metric ton	7,500–8,000	3,300–3,400

do. Ditto.

Source: S&P Global Platts Metals Week.

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

(Metric tons, gross weight, and thousand dollars)

	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
Country or locality	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
2021:								
Australia	--	--	1 r	$327 r	--	--	132	$446
Brazil	--	--	--	--	1	$4	47	187 r
Canada	739 r	$1,810 r	3,560 r	14,100 r	2,850 r	10,600 r	421 r	15,300 r
China	--	--	(2)	8	2	8	28	1,840
Czechia	271	300	--	--	--	--	10	553
France	--	--	2	827	--	--	18	2,770
Israel	--	--	--	--	--	--	148	639
Japan	--	--	--	--	1 r	14 r	16	239 r
Korea, Republic of	19	30	15	151 r	25	85	215 r	1,090 r
Mexico	14	27	7 r	50 r	65 r	270 r	723 r	11,800 r
Montenegro	19	25	--	--	--	--	--	--
Netherlands	101	175	--	--	--	--	5	454 r
Romania	--	--	--	--	--	--	68	226 r
Serbia	307	413	--	--	--	--	--	--
Singapore	--	--	17	5,080	1	3	1	99
Taiwan	4	11	1	16	--	--	1	41 r
United Kingdom	--	--	38	257	3 r	10 r	99	2,200 r
Other	68 r	170 r	249	1,710	13	46	152 r	5,980 r
Total	1,540 r	2,960 r	3,890 r	22,500 r	2,970 r	11,100 r	2,080 r	43,800 r
2022:								
Australia	--	--	--	--	--	--	140	497
Brazil	--	--	(2)	10	17	84	64	276
Canada	345	982	492	2,950	3,290	24,900	339	17,200
China	44	91	--	--	1	4	186	5,730
Czechia	--	--	--	--	5	16	11	647
France	--	--	1	294	--	--	23	3,870
Israel	--	--	1	15	--	--	235	1,120
Japan	--	--	1	76	1	15	26	307
Korea, Republic of	--	--	7	250	6	26	406	1,440
Mexico	82	211	12	163	411	1,870	251	6,140
Montenegro	304	563	--	--	--	--	20	160
Netherlands	453	884	--	--	--	--	23	240
Romania	--	--	--	--	(2)	7	37	197
Serbia	422	549	--	--	--	--	--	--
Singapore	--	--	30	8,790	(2)	4	1	66
Taiwan	68	121	--	--	--	--	11	88
United Kingdom	--	--	37	738	9	46	38	1,890
Other	237	505	6	237	49	298	554	7,510
Total	1,950	3,900	586	13,500	3,790	27,200	2,370	47,300

[r]Revised. -- Zero.
[1]Table includes data available through June 16, 2023. 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	Gross weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Value (thousands)	Magnesium content (metric tons)	Value (thousands)	Magnesium content (metric tons)	Value (thousands)
2021:								
Austria	--	--	--	--	711	$2,660	1,070 r	$5,380 r
Canada	8,250	$19,000	846 r	$1,130	446	4,040	172	1,310
China	1,700	5,050	212 r	847 r	2,200 r	6,180 r	685	6,110 r
Czechia	75	164	--	--	5,670 r	18,500 r	--	--
France	234	515	--	--	--	--	--	--
Germany	534	1,080	--	--	1,150	5,980	137	815
Hungary	--	--	--	--	1,070	4,260	--	--
Israel	--	--	1,750	13,900 r	2,750 r	12,600	--	68
Japan	--	--	--	--	--	--	6	98
Kazakhstan	--	--	56	235	--	--	--	--
Korea, Republic of	216	162	(2)	4	1,290 r	5,660 r	76	776
Mexico	4,080	9,060	--	--	--	--	794	4,010
Russia	--	--	4,350 r	15,900 r	--	--	--	--
Taiwan	1,120	2,870	--	--	2,000 r	6,470 r	586	2,630
Turkey	--	--	5,330	19,400	--	--	--	--
United Kingdom	55	44	23	57	623	10,300	131	10,500
Other	2,780	5,190	648	2,820	886 r	2,510 r	92	815
Total	19,000	43,200	13,200 r	54,300 r	18,800 r	79,100 r	3,750 r	32,500 r
2022:								
Austria	324	526	(2)	2	418	3,670	1,680	15,000
Canada	8,650	51,100	2,320	13,700	2,300	28,900	11	1,490
China	4,360	23,100	3,950	22,500	417	2,810	853	8,660
Czechia	3,490	24,300	--	--	8,890	74,000	--	--
France	--	--	--	--	--	--	(2)	13
Germany	2,280	7,830	100	425	1,970	24,300	70	431
Hungary	--	--	--	--	4,390	51,800	--	--
Israel	886	2,250	4,770	112,000	2,180	39,400	--	1,620
Japan	31	96	47	410	(2)	3	8	149
Kazakhstan	--	--	200	2,090	--	--	--	--
Korea, Republic of	717	2,270	19	104	3,360	27,200	37	1,090
Mexico	3,930	11,800	--	--	191	957	1,200	6,240
Russia	--	--	4,110	25,200	--	--	--	--
Taiwan	1,900	9,270	--	--	4,270	42,600	810	9,040
Turkey	--	--	4,320	105,000	57	377	184	1,920
United Kingdom	--	--	67	521	638	10,200	150	15,900
Other	5,170	17,600	1,170	9,140	1,870	10,300	292	3,340
Total	31,700	150,000	21,100	291,000	31,000	316,000	5,290	64,900

r Revised. -- Zero.
[1] Table includes data available through June 16, 2023. 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; data adjusted by the U.S. Geological Survey.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2022[1]

(Metric tons)

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

[e]Estimated.
[1]Includes capacity at operating plants and 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	2018	2019	2020	2021	2022
Brazil[e]	20,000	20,000	18,000	20,000	22,000
China	848,100 r	930,600 r	961,000 r	888,700 r	933,300
Iran[e]	1,000	--	--	5,000	5,000
Israel	21,000	21,350	18,500	18,211 r	21,500
Kazakhstan[e, 2]	17,000	25,000	16,000	17,000 r	27,000
Russia[2]	67,000	67,000	48,000	58,000 e	21,000 e
Turkey[e]	4,000	7,000	12,000	13,000	14,000
Ukraine[e, 2]	7,000	8,000	6,000	10,000	2,000
United States	W	W	W	W	W
Total	985,000 r	1,080,000 r	1,080,000 r	1,030,000 r	1,050,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing proprietary data; not included in total. -- Zero.
[1]Table includes data available through November 20, 2023. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes magnesium consumed for titanium sponge production.