



2021 Minerals Yearbook

MAGNESIUM [ADVANCE RELEASE]

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MAGNESIUM

By E. Lee Bray

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During 2021, U.S. reported consumption of primary magnesium decreased by 5% from that in 2020 (tables 1, 3). Magnesium exports were about one-half of those in 2020, and magnesium imports for consumption decreased by 18% compared with those in 2020 (table 1). Production of secondary magnesium increased by 9% in 2021 from that in 2020 (tables 1, 2). 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. The U.S. share of the world's primary magnesium capacity decreased to 3% in 2021 from the high of 30% in 1998. During that time period, two of three domestic producers closed, and China had more than a fifteenfold increase in capacity and production. Excluding production in the United States, worldwide primary magnesium production was 1.07 million metric tons (Mt) in 2021, 7% more than 1.00 Mt in 2020 (table 8). Production increased by an estimated 5% in China [44,000 metric tons (t)], and production was estimated to have increased in Russia by 21% (10,000 t), accounting for most of the increase in global production compared with that in 2020. China, with 86% of global capacity, accounted for 87% of global production (excluding the United States) (tables 7, 8).

Prices for magnesium generally increased throughout 2021 in the United States. At yearend 2021, the U.S. spot dealer import price range was \$6.25 to \$6.90 per pound compared with the price range at yearend 2020 of \$2.00 to \$2.15 per pound (table 4). The annual average U.S. spot dealer import price was \$3.53 per pound, 57% more than the annual average price in 2020. The U.S. spot Western magnesium price range increased to \$6.25 to \$6.90 per pound at yearend 2021 from \$2.30 to \$2.35 per pound at yearend 2020. The S&P Global Platts Metals Week annual average U.S. spot Western magnesium price of \$3.73 per pound in 2021 was 51% more than the 2020 annual average price (S&P Global Platts Metals Daily, 2022b).

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

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 cover gas for melt protection are primary production; secondary production; die, permanent mold, and sand casting; and wrought products production. 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 carbon dioxide (CO₂)] 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 SF₆ emissions reduction partnership. According to the EPA, SF₆ emissions by the magnesium industry in 2021 were equivalent to 1.1 teragrams of CO₂, greater than the 0.9 teragrams emitted in 2020 and in 2019, but the same as the amount emitted in 2018. The industry continued its efforts to use SF₆ alternatives, which have lower global warming potential than SF₆ 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 HFC-134a decreased to 0.040 teragrams of CO₂ equivalent in 2021 from the 0.052 teragrams used in 2020. This continued the downward trend of use of HFC-134a from 0.098 teragrams in 2017, 0.079 teragrams in 2018, and 0.066 teragrams in 2019 (U.S. Environmental Protection Agency, 2019, p. 4–86 to 4–90; 2020, p. 4–96 to 4–101; 2021, p. 4–99 to 4–104; 2022, p. 4–104 to 4–110; 2023, p. 4–105 to 4–110).

In November, the U.S. International Trade Commission completed a 5-year review of antidumping duties on magnesium alloy imports from China. In 2005, antidumping duties were imposed on magnesium alloy imports from China at rates ranging from 49.66% to 141.49%. The duties are to be reviewed every 5 years. The latest review, completed in November 2021, concluded that revocation of the duties would likely lead to material injury to domestic magnesium producers; therefore, the antidumping duties were retained (Coyne, 2021; U.S. International Trade Commission, 2021).

Production

Because there was only one primary magnesium producer operating in the United States, production data were withheld by the 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. On September 29, US Magnesium declared force majeure on contracted deliveries, 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 nor did it give a schedule for completion of repairs of affected equipment. Several customers stated that the force majeure notice was still in effect at the end of the year (McBeth, 2021f, g).

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 9% compared with that in 2020. About 53% of the secondary magnesium recovered was contained in aluminum alloys, and about 47% was contained in magnesium alloy castings, ingot, and other forms (table 2).

Secondary magnesium recovered from aluminum-base scrap increased by 11% (5,460 t) compared with that in 2020. Secondary magnesium recovery from new aluminum-base scrap increased by 12% (3,840 t) compared with that in 2020. Secondary magnesium recovery from old aluminum-base scrap increased by 9% (1,620 t) compared with that in 2020. Increased secondary recovery from aluminum-base scrap was attributed to an 8% increase of secondary aluminum production compared with that in 2020. Increased manufacturing in 2021, especially in the aerospace and automobile sectors, was cited for increased new aluminum scrap generated by manufacturers after the easing of the coronavirus disease 2019 (COVID-19) pandemic-related restrictions implemented in 2020. Recovery of secondary magnesium from new scrap in 2021 increased by 13% (5,220 t). Consumption of secondary magnesium in castings increased by 9% compared with that in 2020 (table 2).

Western Magnesium Inc. started construction of a pilot plant in Cadiz, OH, to test magnesium production from dolomite by a process it developed. Construction was expected to be completed by yearend 2022. If the pilot plant proved the process to be economically competitive, a commercial-scale 100,000-t/yr magnesium smelter was planned (Western Magnesium Inc., 2020a, b, 2021a, b).

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 industry indicators.

Reported primary magnesium consumption in 2021 decreased by 5% to 51,400 t in 2021 from 54,000 t (revised) in 2020. This decrease was attributed to decreased consumption for aluminum alloys, which decreased by 32%, but was partially offset by increased consumption for diecastings and other structural products, which increased by 5% (table 3). The principal applications for primary magnesium in the United States in

2021 were diecasting (53%); alloying aluminum (20%); and desulfurization of iron and steel (14%). The decrease of primary magnesium consumption in aluminum alloys corresponded to decreased primary aluminum production, which was 12% less than that in 2020 (Merrill, 2023). Primary aluminum producers generally preferred to use primary magnesium instead of secondary magnesium for alloys.

Increased consumption of primary and secondary magnesium in castings was attributed to increased automobile production compared with that in 2020. Total light-vehicle sales in the United States in 2021 were 15.41 million units, 4% more than the 14.88 million units in 2020 (Bureau of Economic Analysis, 2022).

Shortages of magnesium caused by production issues at the US Magnesium plant in Utah were cited for many magnesium consumers seeking other suppliers. Some aluminum rolling mills and magnesium diecasters warned their customers of potential shortages of aluminum alloy products and diecastings (Lazzaro, 2021b).

Prices

The S&P Global Platts Metals Week U.S. spot Western magnesium price range was \$2.30 to \$2.35 per pound at the beginning of the year and decreased to \$2.10 to \$2.30 per pound by the end of June. At the end of September, it was \$4.50 to \$6.50 per pound on news of production problems at the US Magnesium plant in Utah. By the end of October, the price range was \$6.75 to \$8.50 per pound. At the end of November, the price range was \$6.75 to \$7.00 per pound, and at the end of December it was \$6.25 to \$6.90 per pound. The annual average U.S. spot Western price of \$3.73 per pound in 2021 was 51% more than the annual average price in 2020. 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; S&P Global Platts Metals Daily, 2022b).

Contracts for delivery in 2022 signed in the fourth quarter of 2021 were reported in a wide price range, attributed to the uncertainty of deliveries from US Magnesium after it declared force majeure on deliveries in September. Prices between \$5.25 per pound to \$6.45 per pound were reported for full loads of primary magnesium to be delivered in 2022 (McBeth, 2021d).

The U.S. spot dealer prices for imported magnesium ranged from \$2.00 to \$2.10 per pound at the beginning of January to \$2.10 to \$2.25 per pound at the end of August. At the end of September, the spot imported price range was \$4.50 to \$6.50 per pound, then increased to \$6.75 to \$8.50 per pound at the end of October before decreasing to \$6.25 to \$6.90 per pound at the end of December. The annual average spot dealer import magnesium price was \$3.38 per pound, 50% more than that in 2020 (S&P Global Platts Metals Daily, 2022b).

The annual average magnesium price in Europe was \$5,011 per metric ton, 133% more than that in 2020. The month end average magnesium price in Europe in January was \$2,600 per metric ton and gradually increased through the end of July to \$3,700 per metric ton. In August, the price increased to \$4,300 per metric ton and then to \$10,750 per

metric ton at the end of September as temporary production cuts were enforced by environmental regulators in China. As producers in China restarted, the average price in Europe decreased to \$8,300 per metric ton at the end of October and was at \$7,750 per metric ton at the end of December (S&P Platts Metals Daily, 2021b, d, e).

Foreign Trade

Total U.S. magnesium exports in 2021 were about one-half of those in 2020 (table 1). Canada (63%) and Mexico (10%) were the leading destinations (table 5). In 2021, exports of magnesium metal, scrap, alloys, and semifabricated products decreased by 77%, 34%, 18%, and 18%, respectively, from those in 2020. Total magnesium imports for consumption in 2021 were 18% less than those in 2020 (table 1). Scrap accounted for 38% of total magnesium imports; alloys, 28%; magnesium metal, 27%; and semifabricated products, 7%. Turkey was the leading source of imported magnesium metal (40%). Russia was the second-ranked supplier of magnesium metal imports (35%), and Israel was the third-ranked supplier (13%). Mexico, Austria, China, and Taiwan supplied 23%, 21%, 20%, and 17%, respectively, of semifabricated magnesium product imports in 2021. 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, but China has often been an important source of semifabricated magnesium products. Czechia was the leading supplier of magnesium alloys (28%), followed by Israel (18%), Taiwan (14%), and the Republic of Korea (9%). Scrap accounted for 38% of total magnesium imports; Canada (43%), Mexico (21%), and China (9%) were the leading sources of scrap imports (table 6).

World Review

Global production of primary magnesium (excluding the United States) was 1.07 Mt, 7% more than the amount produced in 2020 (table 8).

Australia.—Latrobe Magnesium Ltd. continued preparations to construct a pilot plant to produce magnesium 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 initial planned pilot plant capacity was 3,000 t/yr, but the plan was revised to increase capacity to 10,000 t/yr. Construction was expected to begin in 2022, and initial production would start about 18 months later. Future expansion to 40,000 t/yr was being considered (Latrobe Magnesium Ltd., 2020, p. 22; 2021a, p. 6, 7; 2021b).

Canada.—Alliance Magnesium Inc. started production of secondary magnesium in Asbestos, Quebec Province. At yearend, secondary production was at a rate of between 250 and 300 metric tons per month (t/mo) but would be 1,000 t/mo once the plant was fully ramped up. Alliance also continued construction of the first phase of a plant at the same location to produce primary magnesium from asbestos mine tailings. Primary magnesium production was expected in 2022. Both plants would have a combined capacity of 18,000 t/yr. Expansion of the plants to 50,000 t/yr was planned (Alliance

Magnesium Inc., 2020; Lazzaro, 2020; McBeth, 2020; Belda and others, 2022).

China.—China's magnesium production was an estimated 930,000 t in 2021, 5% more than the amount in 2020 (table 8). Magnesium consumption in China was 423,000 t in 2021, compared with 541,000 t in 2020. Magnesium exports increased to 480,000 t from 394,000 t in 2020 (S&P Global Platts Metals Daily, 2022a). Although exports for the full year increased by 21% compared with exports in 2020, production cuts in the third quarter resulted in exports during the third quarter being 11% less than those in the second quarter of the year (S&P Global Platts Metals Daily, 2021a, e).

On March 1, the Government of China removed a 15% tax on magnesium produced in western Provinces and locations. Removal of the tax was part of a policy to encourage the westward movement of the magnesium industry where power was more abundant and to encourage foreign investment. The locations to which the policy applied were Chongqing Municipality, Gansu Province, Guizhou Province, Ningxia Autonomous Region, Qinghai Province, and Shaanxi Province (Leung, 2021a).

In August and September, the Government of China mandated the magnesium industry to cut power consumption, resulting in increased prices and decreased supplies of magnesium. Five smelters in Fugu, Shaanxi Province, with a combined capacity of 70,000 t/yr were reported to have temporarily shut down in August to comply with local government emissions and energy consumption limits. The city government of Yulin, Shaanxi Province, also required three smelters to shut down and another to decrease production to one-half of its 50,000-t/yr capacity in September until they complied with environmental regulations. Some of the capacity affected by environmental inspections required by the environmental regulations was restarted within about a month, and most capacity was restarted by yearend. These regulatory actions were intended to encourage the industry to modernize equipment to decrease energy consumption and pollution (Lazzaro, 2021a; Leung, 2021b; McBeth, 2021a, b, e; S&P Global Platts Metals Daily, 2021c).

At the beginning of December, the Ministry of Ecology and Environment increased safety inspections at magnesium producers in Shaanxi Province. Many producers were reported to have decreased production, which was cited as the reason for prices increasing after they had decreased in November (S&P Global Platts Metals Daily, 2021d).

Work to correct production problems was being conducted at the Qinghai Salt Lake Magnesium Co. Ltd. (QSLM) smelter in Golmud, Qinghai Province, that was designed to produce magnesium from lake brines. Although some tasks were completed by yearend, completion of all repairs was not expected until midyear 2022. 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 repair work on the plant to correct the issues was delayed because of financial issues.

Production was not restarted by yearend 2021 (Magontec Ltd., 2020a, p. 2–3; 2020b; 2021, p. 2, 5).

Russia.—VSMPO-Avisma Corp. resumed exports of magnesium ingot to the United States. VSMPO-Avisma produced magnesium and titanium sponge in a closed-loop process. For more than 10 years it had not produced magnesium ingot for export to the United States, instead focusing on using its magnesium production for use in titanium sponge production with some sales to aluminum smelters in Russia and a limited amount for export. Decreased titanium sales to the aerospace industry in 2020 were cited for the shift to producing more magnesium for export markets from consuming magnesium in its titanium production (McBeth, 2021h).

Outlook

World consumption of magnesium in 2022 is expected to increase with increased economic activity. Consumption of magnesium for primary aluminum alloys in the United States is expected to decrease in 2022 if electricity prices increase at a higher rate than aluminum prices. Magnesium consumption by the aluminum industry in other countries is expected to continue to follow the trend of aluminum production.

Automobile production is expected to decrease in 2022 if supply chain disruptions experienced in 2021 continue and if increasing interest rates deter customers from purchasing automobiles. These trends would be expected to have negative effects on magnesium shipments to the transportation sector. Magnesium consumption per vehicle by the domestic automobile industry is expected to continue to increase as automobile manufacturers have plans to substitute magnesium castings for aluminum and steel castings in more models. Many automobile manufacturers plan to continue increasing fuel efficiency; substitution of aluminum alloyed with magnesium for steel is expected to be important in achieving this objective (McBeth, 2021c).

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TABLE 1
SALIENT MAGNESIUM STATISTICS¹

(Metric tons unless otherwise specified)

	2017	2018	2019	2020	2021
United States:					
Production:					
Primary	W	W	W	W	W
Secondary	114,000 ^r	109,000	103,000 ^r	94,800	103,000
Exports	13,700	12,300	9,770	14,900	7,590
Imports for consumption	41,900	46,500	58,800	61,200	49,900
Consumption, primary, reported	70,600 ^r	55,900 ^r	56,800 ^r	54,000 ^r	51,400
Yearend stocks, producer	W	W	W	W	W
Yearend U.S. spot price range ² dollars per pound	2.10–2.20	2.20–2.30	2.70–2.90	2.30–2.35	6.25–6.90
Annual average spot import price ² do.	1.45	1.57	2.32	2.26	3.53
World, primary production ^{3,4}	1,050,000	1,000,000	1,060,000	1,000,000	1,070,000

^rRevised. do. Ditto. W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through November 16, 2022. Data are rounded to no more than three significant digits.

²Source: S&P Global Platts Metals Week.

³Does not include U.S. production.

⁴May include estimated data.

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

(Metric tons)

	2020	2021
TYPE OF SCRAP		
New scrap:		
Magnesium-base	39,200	44,400
Aluminum-base	31,100	34,900
Total	70,300	79,300
Old scrap:		
Magnesium-base	6,360	4,080
Aluminum-base	18,200	19,800
Total	24,500	23,900
Grand total	94,800	103,000
FORM OF RECOVERY		
Magnesium alloy ingot ²	W	W
Magnesium alloy castings	32,900	35,800
Aluminum alloys	61,300	67,000
Other ³	589 ^r	360
Total	94,800	103,000

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

¹Table includes data available through October 5, 2022. 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 "W."

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

(Metric tons)

Use	2020	2021
For structural products:		
Castings:		
Die	27,100 ^r	27,200
Permanent mold	540	915
Sand	1,410	1,670
Wrought products ²	W	W
Other ³	206	1,070
Total	29,300 ^r	30,800
For distributive or sacrificial purposes:		
Aluminum alloys	15,200	10,300
Cathodic protection (anodes)	W	W
Iron and steel desulfurization	7,170	7,440
Nodular iron	321	262
Reducing agent for titanium and other metals	1,090	W
Other ³	996	2,560
Total	24,800	20,500
Grand total	54,000 ^r	51,400

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

¹Table includes data available through October 5, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes forgings and sheet and plate.

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

TABLE 4
YEAREND MAGNESIUM PRICES

Price	2020	2021
U.S. spot dealer import dollars per pound	2.00–2.15	6.25–6.90
U.S. spot Western do.	2.30–2.35	6.25–6.90
European free market dollars per metric ton	2,550–2,700	7,500–8,000
do. Ditto.		

Source: S&P Global Platts Metals Week.

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

(Metric tons, gross weight, and thousand dollars)

Country or locality	Metal ²		Alloys ³		Powder, sheets, tubing, ribbons, wire, other forms ⁴		Scrap ⁵	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
2020:								
Australia	--	--	--	--	204	902	--	--
Brazil	--	--	193	592	27	98	19	41
Canada	7,200	18,400	2,090	6,840	353	6,050	29	69
China	2	88	13	45	37	3,140	19	37
Czechia	--	--	--	--	6	237	864 ^r	1,190
France	4	1,440	3	9	9	1,110	--	--
Israel	2	55	1	4	251	1,150	--	--
Japan	--	--	3	15	54	738	--	--
Korea, Republic of	9	91	21	74	254	1,480	77	155
Mexico	6	184	590	1,610	739	17,200	66	153
Netherlands	--	--	--	--	8	286	12	12
Romania	--	--	--	--	207	793	--	--
Singapore	16	4,030	--	--	1	28	--	--
Taiwan	--	--	--	--	1	27	85	138
United Kingdom	(6)	10	--	--	79	2,390	--	--
Other	9	49	41	217	137 ^r	5,320 ^r	1,130 ^r	1,490 ^r
Total	7,250	24,400	2,950	9,410	2,370	40,900	2,300	3,280
2021:								
Australia	--	--	--	--	132	446	--	--
Brazil	--	--	1	4	47	165	--	--
Canada	1,360	5,320	2,370	8,400	334	13,600	707	1,720
China	(6)	8	2	8	28	1,840	--	--
Czechia	--	--	--	--	10	553	271	300
France	2	827	--	--	18	2,770	--	--
Israel	--	--	--	--	148	639	--	--
Japan	--	--	--	--	16	230	--	--
Korea, Republic of	15	123	25	85	214	860	19	30
Mexico	5	43	18	44	686	11,000	14	27
Netherlands	--	--	--	--	5	446	101	175
Romania	--	--	--	--	68	225	--	--
Singapore	17	5,080	1	3	1	99	--	--
Taiwan	1	16	--	--	1	12	4	11
United Kingdom	38	257	2	7	99	2,190	--	--
Other	249	1,710	13	46	146	5,720	395	608
Total	1,690	13,400	2,430	8,600	1,950	40,800	1,510	2,870

^rRevised. -- Zero.

¹Table includes data available through June 6, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

²Data are for Harmonized Tariff Schedule of the United States (HTS) code and Schedule B number 8104.11.0000.

³Data are for HTS code and Schedule B number 8104.19.0000.

⁴Data are for HTS code and Schedule B numbers 8104.30.0000 and 8104.90.0000.

⁵Data are for HTS code and Schedule B number 8104.20.0000.

⁶Less than ½ unit.

Source: U.S. Census Bureau.

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

Country or locality	Metal ²		Alloys ³		Powder, sheets, tubing, ribbons, wire, other forms ⁴		Scrap ⁵	
	Gross weight (metric tons)	Value (thousands)	Magnesium content (metric tons)	Value (thousands)	Magnesium content (metric tons)	Value (thousands)	Gross weight (metric tons)	Value (thousands)
2020:								
Austria	--	--	738	\$2,320	915	\$3,990	--	--
Canada	763	\$1,070	15	57	532	3,200	9,100	\$22,100
China	25	81	50	157	542	4,550	4,940	10,200
Czechia	18	56	2,110	6,650	--	--	273	687
France	--	--	--	--	--	--	112	247
Germany	--	--	1,650	8,220	72	311	577	416
Hungary	--	--	2,280	8,190	--	--	--	--
Israel	3,380 ^e	23,400	704 ^e	7,980	--	--	--	--
Japan	(6)	6	--	--	4	62	14	14
Kazakhstan	686	2,900	--	--	--	--	--	--
Korea, Republic of	--	--	1,060	3,450	63	834	295	164
Mexico	--	--	--	--	600	3,370	4,180	10,400
Russia	4,780	17,900	--	--	(6)	3	--	--
Taiwan	--	--	5,550	17,200	452	1,760	1,590	3,640
Turkey	8,600 ^e	37,500	--	--	--	--	--	--
United Kingdom	2	39	661	10,000	94	8,080	35	33
Other	332	1,560	582	1,820	117	1,040	2,680	4,820
Total	18,600	84,500	15,400	66,100	3,390	27,200	23,800	52,800
2021:								
Austria	--	--	711	2,660	707	3,400	--	--
Canada	845	1,130	446	4,040	172	1,310	8,250	19,000
China	12	122	78	374	685	6,130	1,700	5,050
Czechia	--	--	3,900	14,000	--	--	75	164
France	--	--	--	--	--	--	234	515
Germany	--	--	1,150	5,980	137	815	534	1,080
Hungary	--	--	1,070	4,260	--	--	--	--
Israel	1,750 ^e	14,100	2,570 ^e	12,600	--	68	--	--
Japan	--	--	--	--	6	98	--	--
Kazakhstan	56	235	--	--	--	--	--	--
Korea, Republic of	(6)	4	1,240	5,480	76	776	216	162
Mexico	--	--	--	--	794	4,010	4,080	9,060
Russia	4,720	15,800	--	--	--	--	--	--
Taiwan	--	--	2,040	6,600	586	2,630	1,120	2,870
Turkey	5,330 ^e	19,400	--	--	--	--	--	--
United Kingdom	23	57	623	10,300	131	10,500	55	44
Other	648	2,820	252	882	92	815	2,780	5,190
Total	13,400	53,700	14,100	67,100	3,390	30,500	19,000	43,200

^eEstimated. -- Zero.

¹Table includes data available through June 6, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

²Data are for Harmonized Tariff Schedule of the United States (HTS) code and Schedule B number 8104.11.0000.

³Data are for HTS code and Schedule B number 8104.19.0000.

⁴Data are for HTS code and Schedule B numbers 8104.30.0000 and 8104.90.0000.

⁵Data are for HTS code and Schedule B number 8104.20.0000.

⁶Less than ½ unit.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey. Adjustment made to estimate volume of metal and alloys imported from Israel and Turkey, which only report value of imports.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2021¹

(Metric tons)

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

^cEstimated.

¹Includes capacity at operating plants and at plants on standby basis. Data are rounded to no more than three significant digits; may not add to totals shown.

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

(Metric tons)

Country or locality	2017	2018	2019	2020	2021
Brazil ^c	20,000	20,000	20,000	18,000	20,000
China	904,600	863,000	910,000	886,000	930,000 ^c
Iran ^c	3,000	1,000	--	--	5,000
Israel	23,000	21,000	21,350	18,500	18,200
Kazakhstan ^{c, 2}	12,000	17,000	25,000	16,000	16,000
Russia ²	65,000	67,000	67,000	48,000	58,000 ^c
Turkey ^c	14,000	4,000	7,000	12,000	13,000
Ukraine ^{c, 2}	7,300	7,000	8,000	6,000	10,000
United States	W	W	W	W	W
Total	1,050,000	1,000,000	1,060,000	1,000,000	1,070,000

^cEstimated. W Withheld to avoid disclosing proprietary data; not included in total. -- Zero.

¹Table includes data available through November 16, 2022. 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.

²Includes magnesium consumed for titanium sponge production.