

## MAGNESIUM COMPOUNDS<sup>1</sup>

[Data in thousand metric tons of magnesium oxide (MgO) content unless otherwise noted]<sup>2</sup>

**Domestic Production and Use:** Seawater and natural brines accounted for about 73% of U.S. magnesium compound production in 2019. The value of production of all types of magnesium compounds was estimated to be \$276 million. Magnesium oxide and other compounds were recovered from seawater by one company in California and another company in Delaware, from well brines by one company in Michigan, and from lake brines by two companies in Utah. Magnesite was mined by one company in Nevada. One company in Washington processed olivine that was mined previously for use as foundry sand. About 72% of the magnesium compounds consumed in the United States were used in agricultural, chemical, construction, deicing, environmental, and industrial applications in the form of caustic-calcined magnesia, magnesium chloride, magnesium hydroxide, and magnesium sulfates. The remaining 28% was used for refractories in the form of dead-burned magnesia, fused magnesia, and olivine.

<b>Salient Statistics—United States:</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019<sup>e</sup></b>
Production (shipments)	394	408	438	405	410
Shipments (gross weight)	561	579	616	610	620
Imports for consumption	602	370	436	551	570
Exports	71	88	103	116	120
Consumption, apparent <sup>3</sup>	925	690	771	840	860
Employment, plant, number <sup>e</sup>	260	260	260	270	270
Net import reliance <sup>4</sup> as a percentage of apparent consumption	57	41	43	52	52

**Recycling:** Some magnesia-based refractories are recycled, either for reuse as refractory material or for use as construction aggregate.

**Import Sources (2015–18):** Caustic-calcined magnesia: China, 60%; Canada, 20%; Australia, 8%; Hong Kong, 4%; and other, 8%. Dead-burned and fused magnesia: China, 60%; Brazil, 15%; Turkey, 6%; Ukraine, 6%; and other, 13%. Magnesium chloride: Israel, 60%; Netherlands, 28%; China, 4%; India, 4%; and other, 4%. Magnesium hydroxide: Mexico, 50%; Netherlands, 15%; Israel, 14%; Austria, 10%; and other, 11%. Magnesium sulfates: China, 53%; Germany, 27%; Canada, 6%; Mexico, 4%; and other, 10%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–19</b>
Crude magnesite	2519.10.0000	Free.
Dead-burned and fused magnesia	2519.90.1000	Free.
Caustic-calcined magnesia	2519.90.2000	Free.
Kieserite	2530.20.1000	Free.
Epsom salts	2530.20.2000	Free.
Magnesium hydroxide and peroxide	2816.10.0000	3.1% ad val.
Magnesium chloride	2827.31.0000	1.5% ad val.
Magnesium sulfate (synthetic)	2833.21.0000	3.7% ad val.

**Depletion Allowance:** Brucite, 10% (Domestic and foreign); dolomite, magnesite, and magnesium carbonate, 14% (Domestic and foreign); magnesium chloride (from brine wells), 5% (Domestic and foreign); and olivine, 22% (Domestic) and 14% (Foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** Consumption of dead-burned and fused magnesia in the United States increased slightly in 2019 compared with that in 2018. Global consumption of dead-burned and fused magnesia increased by about 4% during the first 8 months of 2019 compared with that in the same period of 2018, as world steel production increased in 2019. However, sales of magnesia-based refractory products by major producers lagged as many consumers in the steel industry started the year with high stock levels and destocked during the first half of the year, especially in Europe. Consumption by nonferrous metal producers and other consumers of magnesia refractory products offset some of the decreased consumption by the steel industry. Although world prices for dead-burned and fused magnesia started the year high, by March import prices were declining and by August, prices were about 50% lower than at the start of the year as producers in China sought to sell surplus supplies. Import prices for caustic-calcined magnesia were more stable during the year and the average price of imports through August was 14% higher than that for the same period in 2018.

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Consumption of caustic-calcined magnesia continued to increase for animal feed supplements and fertilizer as the importance of magnesium as a nutrient gained recognition. Environmental applications, such as wastewater treatment, also accounted for increasing consumption of magnesium compounds, including caustic-calcined magnesia and magnesium hydroxide.

Because China was the leading producing country for magnesia and magnesite, policy changes in China affected prices and availability of all grades of magnesia in the world market. Stricter enforcement of environmental regulations in Henan and Shandong Provinces that forced some refractory producers to decrease production was cited for decreased consumption of fused magnesia. Decreased demand in China resulted in lower prices as producers in China increased exports. Lower prices for fused magnesia caused prices for dead-burned magnesia to also decrease; the export price range for dead-burned magnesia from China decreased by about 33% from the start of the year to the end of June. Magnesite mines in Liaoning Province were shut down from August 1 to October 31 owing to high stocks, low prices, and environmental regulations. The temporary closure of mines in China did not cause magnesia prices to increase significantly as stocks were high before the announcement. The Government of China announced mandatory shutdowns of capacity in several industries, including steelmaking, in certain areas during the winter months, which would likely decrease demand for fused and dead-burned magnesia.

**World Magnesite Mine Production and Reserves:**<sup>5</sup> In addition to magnesite, vast reserves exist in well and lake brines and seawater from which magnesium compounds can be recovered.

	Mine production		Reserves <sup>6</sup>
	2018	2019 <sup>e</sup>	
United States	W	W	35,000
Australia	265	300	<sup>7</sup> 320,000
Austria	750	740	50,000
Brazil	1,700	1,700	390,000
China	18,500	19,000	1,000,000
Greece	450	470	280,000
India	175	140	82,000
Korea, North	70	50	2,300,000
Russia	1,500	1,500	2,300,000
Slovakia	475	500	120,000
Spain	550	580	35,000
Turkey	1,800	2,000	230,000
Other countries	865	600	1,400,000
World total (rounded)	<sup>8</sup> 27,100	<sup>8</sup> 28,000	8,500,000

**World Resources:** Resources from which magnesium compounds can be recovered range from large to virtually unlimited and are globally widespread. Identified world magnesite and brucite resources total 12 billion tons and several million tons, respectively. Resources of dolomite, forsterite, magnesium-bearing evaporite minerals, and magnesia-bearing brines are estimated to constitute a resource of billions of tons. Magnesium hydroxide can be recovered from seawater. Serpentine could be used as a source of magnesia but global resources, including in tailings of asbestos mines, have not been quantified but are thought to be very large.

**Substitutes:** Alumina, chromite, and silica substitute for magnesia in some refractory applications.

<sup>e</sup>Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>See also Magnesium Metal.

<sup>2</sup>Previously reported as magnesium content. Based on input from consumers, producers, and others involved in the industry, it was determined that reporting magnesium compound data in terms of contained magnesia was more useful than reporting in terms of magnesium content. Conversion factors used: magnesite, 47.8% MgO; magnesium chloride, 42.3% MgO; magnesium hydroxide, 69.1% MgO; and magnesium sulfate, 33.5% MgO.

<sup>3</sup>Defined as shipments + imports – exports.

<sup>4</sup>Defined as imports – exports.

<sup>5</sup>Gross weight of magnesite (magnesium carbonate) in thousand tons.

<sup>6</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>7</sup>For Australia, Joint Ore Reserves Committee-compliant reserves were 37 million tons.

<sup>8</sup>Excludes U.S. production.