

## 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 57% of U.S. magnesium compound production in 2018. The value of production of all types of magnesium compounds was estimated to be \$257 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 60% of the magnesium compounds consumed in the United States were used in agricultural, chemical, construction, environmental, and industrial applications in the form of caustic-calcined magnesia, magnesium chloride, magnesium hydroxide, and magnesium sulfates. The remaining 40% was used for refractories in the form of dead-burned magnesia, fused magnesia, and olivine.

<b>Salient Statistics—United States:</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018<sup>e</sup></b>
Production (shipments)	395	394	408	438	460
Shipments (gross weight)	560	561	579	616	640
Imports for consumption	471	602	370	436	530
Exports	65	71	88	103	110
Consumption, apparent <sup>3</sup>	801	925	690	771	880
Employment, plant, number <sup>e</sup>	250	260	260	260	270
Net import reliance <sup>4</sup> as a percentage of apparent consumption	51	57	41	43	48

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

**Import Sources (2014–17):** Caustic-calcined magnesia: China, 57%; Canada, 22%; Australia, 9%; Brazil, 4%; and other, 8%. Dead-burned and fused magnesia: China, 60%; Brazil, 19%; Ukraine, 6%; Turkey, 6%; and other, 9%. Magnesium chloride: Israel, 63%; Netherlands, 27%; China, 4%; India, 3%; and other, 3%. Magnesium hydroxide: Mexico, 42%; Israel, 18%; Netherlands, 14%; Austria, 13%; and other, 13%. Magnesium sulfates: Germany, 42%; China, 41%; Canada, 6%; Mexico, 5%; and other, 6%.

<b>Tariff:<sup>5</sup> Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–18</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	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 increased by 6% in the United States in the first 8 months of 2018 compared with that of the same period in 2017 and was expected to continue to increase at a similar rate in the foreseeable future. Global consumption of dead-burned and fused magnesia increased by about 7% during the first 8 months of 2018 compared with that in the same period of 2017, as world steel production increased in 2018. Prices for dead-burned magnesia and caustic-calcined magnesia remained high after increasing in the second half of 2017 as demand was strong and supplies from China were constrained.

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.

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Because China was the leading producing country for magnesite and magnesia, policy changes in China affected prices and availability of all grades of magnesia in the world market. Prices for all types of magnesia surged during 2017 and prices generally remained at these higher levels in 2018. Magnesite plant shutdowns in 2017 and 2018, ordered by the Government of China for environmental concerns, resulted in limited supplies and price increases. The Government of China also restricted the use of explosives and certain equipment in magnesite mines in some areas, resulting in shortages of raw material for some magnesia producers. The prices for high-grade dead-burned magnesia (97.5% MgO) produced in China increased as demand was strong, but supplies were limited. Prices in China for lower grade dead-burned magnesia (94%–95% MgO) declined as demand for lower grade material decreased. Prices for caustic-calcined magnesia from China remained stable but were generally higher than those in other countries, and many consumers switched to suppliers from other countries. Environmental concerns in China were expected to continue to affect production and prices. In the main magnesia-producing regions of China, Provincial government-owned companies previously announced plans to consolidate small producers; however, the consolidation was not completed as of mid-2018.

Magnesia exports from North Korea to China and other countries were restricted in 2017. Exports to China resumed in 2018 but not to other countries, accounting for a significant decline of magnesite production in North Korea in 2018 compared with that of 2017. A fused magnesia producer in Norway, which had shut down production in August 2016 citing low prices, restarted production in December 2017 and ramped up production in the first half of the year.

**World Magnesite Mine Production and Reserves:**<sup>6</sup> In addition to magnesite, vast reserves exist in well and lake brines and seawater from which magnesium compounds can be recovered. Reserves for India and North Korea were revised based on Government reports and other sources.

	Mine production		Reserves <sup>7</sup>
	2017	2018 <sup>e</sup>	
United States	W	W	35,000
Australia	470	500	<sup>8</sup> 320,000
Austria	600	600	50,000
Brazil	1,800	1,900	390,000
China	19,000	19,000	1,000,000
Greece	400	400	280,000
India	188	200	82,000
Korea, North	380	270	2,300,000
Russia	1,500	1,500	2,300,000
Slovakia	450	470	120,000
Spain	300	330	35,000
Turkey	3,300	3,400	230,000
Other countries	700	830	1,400,000
World total (rounded)	<sup>9</sup> 29,100	<sup>9</sup> 29,000	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 believed 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>Tariffs are based on gross weight.

<sup>6</sup>Gross weight of magnesite (magnesium carbonate) in thousand tons.

<sup>7</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>8</sup>For Australia, Joint Ore Reserves Committee-compliant reserves were about 38 million tons.

<sup>9</sup>Excludes U.S. production.