

# 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 70% of U.S. magnesium compound production in 2020. The value of shipments of all types of magnesium compounds was estimated to be \$360 million, essentially unchanged from the revised value in 2019. 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 67% of the magnesium compounds consumed in the United States was 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 33% was used for refractories in the form of dead-burned magnesia, fused magnesia, and olivine.

| <b>Salient Statistics—United States:</b>                                 | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020<sup>e</sup></b> |
|--|-------------|-------------|-------------|-------------|-------------------------|
| Production (shipments)   | 408         | 438         | 405         | 376         | 350                     |
| Shipments (gross weight)   | 579         | 616         | 610         | 563         | 530                     |
| Imports for consumption  | 370         | 436         | 551         | 564         | 480                     |
| Exports  | 88          | 103         | 116         | 88          | 70                      |
| Consumption, apparent <sup>3</sup>                                       | 690         | 771         | 840         | 852         | 760                     |
| Employment, plant, number <sup>e</sup>                                   | 260         | 260         | 270         | 270         | 270                     |
| Net import reliance <sup>4</sup> as a percentage of apparent consumption | 41          | 43          | 52          | 56          | 54                      |

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

**Import Sources (2016–19):** Caustic-calcined magnesia: China, 69%; Canada, 21%; Australia, 5%; Israel, 3%; and other, 2%. Crude magnesite: China, 84%; Singapore, 12%; and other 4%. Dead-burned and fused magnesia: China, 66%; Brazil, 10%; Turkey, 6%; Mexico, 4%; and other, 14%. Magnesium chloride: Israel, 63%; the Netherlands, 24%; China, 5%; India, 3%; and other, 5%. Magnesium hydroxide: Mexico, 53%; the Netherlands, 15%; Israel, 12%; Austria, 10%; and other, 10%. Magnesium sulfates: China, 55%; Germany, 13%; India, 11%; Canada, 8%; and other, 13%. Total imports: China, 44%; Israel, 15%; Brazil, 14%; the Netherlands, 7%; and other, 20%.

| <b>Tariff:</b> | <b>Item</b>                      | <b>Number</b> | <b>Normal Trade Relations<br/>12–31–20</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 decreased by 11% in 2020 compared with that in 2019. Global consumption of dead-burned and fused magnesia decreased by about 3% during the first 9 months of 2020 compared with that in the same period of 2019. Top domestic consumption of magnesium compounds, in descending order, were water treatment, deicing, chemical, and agriculture. The leading magnesium compounds consumed, in descending order, were magnesium oxide (caustic-calcined magnesia, dead burned magnesia, and fused magnesia), magnesium hydroxide, and magnesium chloride.

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The global COVID-19 pandemic and efforts to mitigate the spread of the disease caused disruptions in many of the mining and manufacturing industries across the United States and around the world. Overall demand for magnesium compounds was lower in the first half of the year, rebounding to January levels by the third quarter as global lockdowns were eased.

China remains the leading producer of magnesite and magnesite. Policy changes, coupled with the impacts of the global COVID-19 pandemic, have resulted in inconsistent supplies and restricted availability of all grades of magnesite in the world market. Pandemic-related closures of mining and manufacturing activities and reduced demand from downstream industries in early 2020 caused decreased steel production, a major consumer of refractory-grade magnesite. Air pollution controls scheduled to be imposed in major steel-producing Provinces during the autumn and winter months will further reduce consumption of refractory grade magnesite. Liaoning Province, a major source of Chinese magnesite, implemented a 6-month ban on the use of explosives that began on July 1. New open pit mines were banned as well. Export prices for dead-burned and fused magnesite from China decreased by about 13% from the start of the year to the end of September, which was likely caused by a decrease in demand owing to the impact of the global pandemic.

**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. Reserves for Austria, Brazil, Slovakia, and Turkey were revised based on new information from Government and industry sources.

|                       | Mine production     |                         | Reserves <sup>6</sup> |
|-----------------------|---------------------|-------------------------|-----------------------|
|                       | <u>2019</u>         | <u>2020<sup>e</sup></u> |                       |
| United States         | W                   | W                       | 35,000                |
| Australia             | 320                 | 310                     | <sup>7</sup> 320,000  |
| Austria               | 780                 | 760                     | 49,000                |
| Brazil                | 1,500               | 1,500                   | 200,000               |
| China                 | 19,000              | 18,000                  | 1,000,000             |
| Greece                | 530                 | 500                     | 280,000               |
| India                 | 150                 | 150                     | 82,000                |
| Russia                | 1,500               | 1,500                   | 2,300,000             |
| Slovakia              | 475                 | 460                     | 370,000               |
| Spain                 | 570                 | 600                     | 35,000                |
| Turkey                | 1,500               | 1,100                   | 205,000               |
| Other countries       | <u>700</u>          | <u>680</u>              | <u>2,700,000</u>      |
| World total (rounded) | <sup>8</sup> 27,100 | <sup>8</sup> 26,000     | 7,600,000             |

**World Resources:**<sup>6</sup> 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 magnesite-bearing brines are estimated to constitute a resource of billions of tons. Magnesite-bearing brines can be recovered from seawater. Serpentine could be used as a source of magnesite 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 magnesite 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 magnesium oxide was more useful than reporting in terms of magnesium content. Calculations were made using the following magnesium oxide (MgO) contents: magnesite, 47.8%; magnesium chloride, 42.3%; magnesium hydroxide, 69.1%; and magnesium sulfate, 33.5%.

<sup>3</sup>Defined as production + 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.