# MAGNESIUM COMPOUNDS[1]

[Data in thousand metric tons of contained magnesium oxide (MgO) unless otherwise noted][2]

**Domestic Production and Use:** Seawater and natural brines accounted for about 67% of U.S. magnesium compound production in 2022. The value of shipments of all types of magnesium compounds was estimated to be $460 million, a 5% increase from the revised value in 2021. Magnesium 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.

In the United States, about 75% of magnesium compounds were consumed in the form of caustic-calcined magnesia, magnesium chloride, magnesium hydroxide, and magnesium sulfates across the following industries and uses, in descending order of quantity, environmental, chemical, agricultural, and deicing. The remaining magnesium compounds were consumed for refractories in the form of dead-burned magnesia, fused magnesia, and olivine. Across all industries, the leading magnesium compounds consumed, in descending order of quantity, were magnesium oxide (caustic-calcined magnesia, dead burned magnesia, and fused magnesia), magnesium hydroxide, magnesium chloride, and magnesium sulfate.

| Salient Statistics—United States: | 2018 | 2019 | 2020 | 2021 | 2022[e] |
|---|---|---|---|---|---|
| Production | 405 | 376 | 363 | 432 | 450 |
| Shipments (gross weight) | 610 | 563 | 547 | 634 | 660 |
| Imports for consumption | 551 | 564 | 480 | 655 | 640 |
| Exports | 116 | 88 | 66 | 86 | 140 |
| Consumption, apparent[3] | 840 | 852 | 777 | 1,001 | 950 |
| Employment, plant, number[e] | 270 | 270 | 260 | 270 | 280 |
| Net import reliance[4] as a percentage of apparent consumption | 52 | 56 | 53 | 57 | 53 |

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

**Import Sources (2018–21):** Caustic-calcined magnesia: China,[5] 74%; Canada, 20%; Israel, 3%; and other, 3%. Crude magnesite: China,[5] 87%; Singapore, 10%; and other, 3%. Dead-burned and fused magnesia: China,[5] 68%; Brazil, 16%; Turkey, 5%; Mexico, 3%; and other, 8%. Magnesium chloride: Israel, 60%; Netherlands, 26%; China,[5] 5%; and other, 9%. Magnesium hydroxide: Mexico, 57%; Netherlands, 15%; Israel, 11%; Austria, 7%; and other, 10%. Magnesium sulfates: China,[5] 58%; India, 15%; Germany, 10%; Vietnam, 4%; and other, 13%. Total imports: China,[5] 61%; Israel, 10%; Canada, 7%; Brazil, 6%; and other, 16%.

| Tariff: Item | Number | Normal Trade Relations 12–31–22 |
|---|---|---|
| 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 valorem. |
| Magnesium chloride | 2827.31.0000 | 1.5% ad valorem. |
| Magnesium sulfate (synthetic) | 2833.21.0000 | 3.7% ad valorem. |

**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:** In 2022, consumption of dead-burned and fused magnesia is expected to decrease in the United States and globally by an estimated 4% and 5%, respectively, compared with that in 2021 based on steel production data through August. Coronavirus disease 2019 (COVID-19) pandemic-related shutdowns in China, especially in manufacturing dominated Provinces and port cities, contributed to the decrease in consumption of magnesium compounds. Domestic consumption for all magnesium compounds has somewhat followed the general trend of the performance of the U.S. manufacturing industry. Globally, China is the leading producer of magnesia and magnesite and remains the principal exporter of magnesia to the United States and much of the world.

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In August 2022, a China-based magnesia and refractories producer commenced operations in Mayfield, KY. The new plant was designed to produce between 50,000 and 60,000 tons per year of refractory products. Feed material for the plant was sourced from company-owned mines located overseas. Products produced by the plant included resin bonded magnesia-carbon and magnesia-alumina-carbon refractory bricks for use in furnaces servicing the steel industry.

In the third quarter of 2022, North America's largest producer of epsom salts opened a bulk production facility in Hazelwood, NC. In spring 2023, an Austria-based magnesia and refractories producer plans to open its North American corporate headquarters in Tampa, FL.

**World Magnesite Mine Production and Reserves:**[6] In addition to magnesite reserves, vast reserves of magnesium exist in well and lake brines and seawater from which magnesium compounds can be recovered. Reserves for China were revised based on company and Government reports.

| | Mine production[e] | | Reserves[7] |
|---|---|---|---|
| | 2021 | 2022 | |
| United States | W | W | 35,000 |
| Australia | 2,700 | 2,600 | [8]290,000 |
| Austria | 800 | 800 | 49,000 |
| Brazil | 1,600 | 1,500 | 200,000 |
| Canada | 190 | 180 | NA |
| China | 18,000 | 17,000 | 580,000 |
| Greece | 540 | 510 | 280,000 |
| India | 99 | 100 | 82,000 |
| Iran | 200 | 190 | 12,000 |
| Russia | 1,000 | 950 | 2,300,000 |
| Slovakia | 500 | 480 | 370,000 |
| Spain | 650 | 620 | 35,000 |
| Turkey | 1,900 | 1,800 | 110,000 |
| Other countries | 400 | 400 | 2,500,000 |
| World total (rounded) | [9]29,000 | [9]27,000 | 6,800,000 |

**World Resources:**[7] 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 13 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.

[e]Estimated. W Withheld to avoid disclosing company proprietary data.

[1]See also the Magnesium Metal chapter.

[2]Reported as magnesium content through Mineral Commodity Summaries 2016. Based on input from consumers, producers, and others involved in the industry, reporting magnesium compound data in terms of contained magnesium oxide was determined to be 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%.

[3]Defined as production + imports – exports.

[4]Defined as imports – exports.

[5]Includes Hong Kong.

[6]Gross weight of magnesite (magnesium carbonate) in thousand tons.

[7]See Appendix C for resource and reserve definitions and information concerning data sources.

[8]For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 37 million tons.

[9]Excludes U.S. production.