

## MAGNESIUM METAL<sup>1</sup>

(Data in thousand metric tons unless otherwise noted)

**Domestic Production and Use:** In 2014, primary magnesium was produced by one company in Utah at an electrolytic process plant that recovered magnesium from brines from the Great Salt Lake. The leading use for primary magnesium metal was aluminum-base alloys that were used for packaging, transportation, and other applications, which accounted for 35% of apparent consumption. Use as a reducing agent for the production of titanium and other metals accounted for 30% of primary magnesium consumption. Structural uses of magnesium (castings and wrought products) accounted for 15% of primary metal consumption, desulfurization of iron and steel, 10%, and other uses, 10%.

<b>Salient Statistics—United States:</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014<sup>e</sup></b>
Production:					
Primary	W	W	W	W	W
Secondary (new and old scrap)	72	67	77	79	82
Imports for consumption	53	48	51	46	55
Exports	15	12	18	16	18
Consumption:					
Reported, primary	57	81	72	69	80
Apparent <sup>2</sup>	100	110	110	120	120
Price, yearend:					
U.S. spot Western, dollars per pound, average	2.43	2.13	2.20	2.13	2.15
China free market, dollars per metric ton, average	2,925	3,025	3,170	2,590	2,500
Stocks, producer and consumer, yearend	W	W	W	W	W
Employment, number <sup>e</sup>	400	400	420	420	420
Net import reliance <sup>3</sup> as a percentage of apparent consumption	38	33	29	27	30

**Recycling:** In 2014, about 25,000 tons of secondary magnesium was recovered from old scrap and 57,000 tons were recovered from new scrap. Aluminum-base alloys accounted for 75% of the secondary magnesium recovered. Magnesium chloride produced as a waste product of titanium sponge production at a plant in Utah is returned to the primary magnesium supplier where it is reduced to produce metallic magnesium; however, this metal is not included in the secondary magnesium statistics.

**Import Sources (2010–13):** Israel, 33%; Canada, 23%; China, 8%; United Kingdom, 7%; and others, 29%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations</b>
			<b>12–31–14</b>
	Unwrought metal	8104.11.0000	8.0% ad val.
	Unwrought alloys	8104.19.0000	6.5% ad val.
	Wrought metal	8104.90.0000	14.8¢/kg on Mg content + 3.5% ad val.

**Depletion Allowance:** Dolomite, 14% (Domestic and foreign); magnesium chloride (from brine wells), 5% (Domestic and foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** Several projects under development could significantly increase primary magnesium metal capacity in North America. In February 2014, the sole U.S. primary magnesium producer announced plans to expand capacity to 76,500 tons per year from 63,500 tons per year by yearend 2015. Engineering studies were completed for a proposal to expand the plant capacity to 90,000 tons per year, although a proposed construction schedule for that expansion was not released. Net import reliance as a percentage of apparent magnesium consumption has gone down to 30% in 2014 from 61% in 2004, even though apparent consumption has gone down by about 15% during the same time owing to recent expansions by this producer. The company and the union which represents its workers signed a 5-year labor contract that took effect at the end of August. In Nevada, a company was proposing to build a plant to produce magnesium from dolomite. A preliminary economic assessment of the dolomite deposit was completed in 2012, but permits have not been issued for the project. In Quebec, Canada, a company was building a pilot plant to test production of magnesium from tailings from asbestos mining. If the pilot plant proves the company's process to be economically feasible, the company planned to build a 50,000-ton-per-year plant.

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The use of magnesium in automobile parts was expected to continue to increase as automobile manufactures seek to decrease vehicle weight to comply with fuel efficiency standards. In September, an expansion project started at a plant in Mexico, MO, which manufactures die-cast magnesium parts for the automotive industry. The capacity of the plant and the expansion project were not released, but employment at the plant was expected to increase by about 30% when completed in September 2015. Consumption of magnesium in the production of titanium metal by the Kroll process was expected to increase as the use of titanium increases in aerospace applications.

In China, expansion of capacity to produce magnesium metal continued in areas adjacent to sources of dolomite or lake brines and coking operations. Although much of the newer capacity is in locations with lower costs, such as Shaanxi Province, older capacity was still producing at reduced rates and could increase output if prices supported it. A company in Norway was building a 15,000-ton-per-year plant to produce magnesium from olivine. The plant was expected to be completed at mid-year 2015. It would also include secondary magnesium capacity.

The U.S. Department of Energy's (DOE) Advanced Research Projects Agency-Energy was funding a project to develop a method of recovering magnesium from seawater using less energy than current production methods. The 3-year project conducted at DOE's Pacific Northwest National Laboratory in Richland, WA, was started in January 2014, and funded for \$2.7 million. Two corporate partners were also participating in the research project.

### World Primary Production and Reserves:

	Primary production		Reserves <sup>4</sup>
	2013	2014 <sup>e</sup>	
United States	W	W	Magnesium metal is derived from seawater, natural brines, dolomite, and other minerals. The reserves for this metal are sufficient to supply current and future requirements. To a limited degree, natural brines may be considered to be a renewable resource wherein any magnesium removed by humans may be renewed by nature in a short span of time.
Brazil	16	16	
China	770	800	
Israel	28	30	
Kazakhstan	23	21	
Korea, Republic of	8	10	
Malaysia	1	0	
Russia	<u>32</u>	<u>28</u>	
World total <sup>5</sup> (rounded)	878	907	

**World Resources:** Resources from which magnesium may be recovered range from large to virtually unlimited and are globally widespread. Resources of dolomite and magnesium-bearing evaporite minerals are enormous. Magnesium-bearing brines are estimated to constitute a resource in the billions of tons, and magnesium could be recovered from seawater along world coastlines.

**Substitutes:** Aluminum and zinc may substitute for magnesium in castings and wrought products. For iron and steel desulfurization, calcium carbide may be used instead of magnesium. Magnesium's light weight is an advantage over aluminum and zinc in castings and wrought products; however, its high cost is a disadvantage relative to these substitutes. Magnesium is preferred to calcium carbide for desulfurization of iron and steel because calcium carbide produces acetylene in the presence of water.

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

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

<sup>2</sup>Rounded to two significant digits to protect proprietary data.

<sup>3</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>4</sup>See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

<sup>5</sup>Excludes U.S. production.