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Magnesium

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Primary magnesium was produced by one company in the United States, and much of the U.S. demand was met by imports. Israel was the principal source of imported magnesium metal and alloys, and Canada accounted for most of the scrap imports, which have become an important source of supply. Aluminum alloying, diecasting, and iron and steel desulfurization were the principal applications for magnesium in the United States in 2011. Consumption of primary magnesium in the United States in 2011 was about 7% higher than that in 2010, mostly as a result of an increase in magnesium used for automotive diecastings as U.S. vehicle production increased. China continued to dominate world production of primary magnesium, accounting for 86% of the total (excluding the United States). Because of the continued imposition of antidumping duties, the quantity of pure and alloy magnesium imported from China to the United States was minimal.

Legislation and Government Programs

During 2011, Government agencies made numerous determinations about dumping duties on magnesium imports from China and Russia. In February, following a full sunset review of duties on magnesium alloy imports from China and Russia that were established in 2005, the U.S. International Trade Commission (ITC) voted to retain antidumping duties on magnesium alloy from China and revoke antidumping duties on pure and alloy magnesium imports from Russia (U.S. International Trade Commission, 2011b). In April, U.S. Magnesium LLC filed a formal complaint with the U.S. Court of International Trade (CIT) appealing the ITC's decision to revoke antidumping duties on imports of magnesium from Russia. The complaint alleged that the ITC should have cumulated imports of Russian and Chinese magnesium before making a ruling instead of looking at each country's imports separately. U.S. Magnesium also contended that the ITC's determination that revocation of the duties would not lead to increases in imports was erroneous (Riley, 2011c). No decision was made by yearend.

After conducting an expedited third 5-year review of the antidumping duty order for pure magnesium imports from China into the United States, the ITC upheld the original order, determining that revocation of the duty would lead to continuation or recurrence of injury (U.S. International Trade Commission, 2011a).

The CIT upheld the U.S. Department of Commerce, International Trade Administration's (ITA) remand decision regarding imposition of a 111.73% ad valorem antidumping duty on Tianjin Magnesium International Co. Ltd. (TMI) for May 1, 2007, to April 31, 2008. The court determined that TMI had not cooperated with the ITA during the investigation (U.S. Court of International Trade, 2011).

The ITA published the final results of the antidumping duty review on imports of pure magnesium from China for TMI for May 1, 2009, through April 30, 2010. The ITA determined that TMI did not sell magnesium in the United States at prices below normal value, so it set the antidumping duty at 0% ad valorem. The ITA also rescinded a review of TMI's antidumping duties for pure magnesium for May 1, 2010, through April 30, 2011, because the company did not ship magnesium to the United States during this period (U.S. Department of Commerce, International Trade Administration, 2011b, c).

Two requests for scope rulings for granular magnesium imports from China that were subject to antidumping duties were completed in 2011. (After a duty order is published, scope rulings may be necessary when interested parties need clarification of the status of their products under the order.) In response to a request from ESM Group Inc., the ITA issued a final scope determination that magnesium atomized in China from pure magnesium ingots produced in the United States and imported by ESM was not within the scope of the antidumping duty order on pure magnesium in granular form from China. ITA determined that the process of atomizing magnesium does not substantially transform the magnesium ingot, so the country of origin of the atomized magnesium (the United States) remained the country of origin of the original magnesium ingot. For essentially the same reason, in response to a request from U.S. Magnesium, the ITA issued a final scope determination that granular magnesium ground in Mexico from pure magnesium ingots produced in China is within the scope of the antidumping duty order on pure magnesium in granular form (U.S. Customs and Border Protection, 2011a, b).

On September 13, the ITA published final results of the antidumping duty review of pure and alloy magnesium imports from Russia for April 1, 2009, through March 31, 2010. For VSMPO-Avisma Corp., the duty was set at 2.24% ad valorem. For Solikamsk Magnesium Works, which did not ship magnesium to the United States during the period of review, the rate that was in effect the last time the company had U.S. sales was retained. On October 4, however, because it had used incorrect cost data to calculate VSMPO-Avisma's rate, the ITA revised its rate for VSMPO-Avisma to 22.38% ad valorem for the period of review (U.S. Department of Commerce, International Trade Administration, 2011a).

On July 5, the World Trade Organization (WTO) issued its report concerning allegations by the European Union, Mexico, and the United States that export restraints maintained by China on various metals and minerals including magnesium were a violation of WTO rules. A panel had been convened by the WTO in 2009 in response to the allegations. The panel found that the export duties and export quotas that China maintained on various forms of magnesium constituted a breach

of WTO rules and that China failed to justify those measures as legitimate conservation measures, environmental protection measures, or short supply measures. The panel also found that China's imposition of minimum export price, export licensing, and export quota administration requirements on these materials, as well as China's failure to publish certain measures related to these requirements, was inconsistent with WTO rules (Office of the U.S. Trade Representative, 2011). In January 2012, after China appealed the WTO decision, the Appellate Body of the WTO determined that China's export restraints on several raw materials including magnesium were inconsistent with China's WTO obligations (World Trade Organization, 2012).

Production

U.S. Magnesium was the sole producer of primary magnesium in the United States. The company recovered magnesium electrolytically from brines from the Great Salt Lake in Utah at its 63,500-metric-ton-per-year (t/yr) plant in Rowley, UT. By yearend, U.S. Magnesium completed an 11,500-t/yr expansion, increasing the plant's capacity to 63,500 t/yr. The expansion was originally scheduled to be completed by yearend 2012, but the company cited an increase in orders for accelerating the startup (McBeth, 2011c). A substantial portion of U.S. Magnesium's output from the expansion was scheduled to be supplied to Allegheny Technologies Inc.'s (ATI) nearby titanium sponge plant. Magnesium chloride produced at the titanium sponge plant (from recovering titanium from titanium tetrachloride) was converted into magnesium metal and chlorine at U.S. Magnesium's plant, and the magnesium was provided to ATI. ATI was increasing sponge production at the plant to 10,000 to 12,000 metric tons (t) (Waite, 2011).

Molycor Gold Corp. completed a resource analysis for its Tami-Mosi magnesium property in Nevada that, using a cutoff grade of 12% magnesium, estimated the inferred resource to be 412 million metric tons (Mt) of dolomite at an average grade of 12.3% magnesium. The contained metal content would be 50.3 Mt of magnesium. Molycor also completed an economic assessment for a 30,000-t/yr silicothermic plant to produce primary magnesium from dolomite, with a capital cost of $424 million and operating costs of $1.28 per pound of recovered magnesium. Molycor planned to complete a prefeasibility study by early 2014 (Molycor Gold Corp., 2011). Molycor had been evaluating the Tami-Mosi property since at least 2007. In 2012, Molycor changed its name to Nevada Clean Magnesium Inc.

Environmental

The cover gas sulfur hexafluoride (SF_6) that is used to protect molten magnesium from oxidation has been identified as a potential factor in global warming. Although studies on the effect of the gas continued, its long atmospheric life (about 3,000 years) and high potential as a greenhouse gas (GHG) (23,900 times the global warming potential of carbon dioxide) resulted in a call for voluntary reductions in emissions. In 1999, the U.S. magnesium industry, the International Magnesium Association, and the U.S. Environmental Protection Agency (EPA) began a voluntary partnership to reduce emissions of SF_6. The major molten magnesium processes that require SF_6 melt protection are primary production; secondary production; die, permanent mold, and sand casting; wrought products production; and anode production. According to the EPA, the magnesium industry emitted 1.3 teragrams CO_2 equivalent of SF_6 in 2010, representing an increase of approximately 21% from 2009 emissions. Increased steel production, which uses magnesium for desulfurization, and increased production of automobiles, which use diecast magnesium components, were the principal reasons for increased magnesium-processing-generated SF_6 emissions. The increase was mitigated in part by continuing industry efforts to utilize SF_6 alternatives, such as Novec™612 (dodecafluoro-2-methyl-3-pentanone), and sulfur dioxide, as part of the EPA's SF_6 Emission Reduction Partnership for the Magnesium Industry. These alternatives have lower global warming potential than SF_6 and tend to quickly decompose during their exposure to the molten metal (U.S. Environmental Protection Agency, 2012, p. 4–59—4–62).

In January 2011, the U.S. Circuit Court of Appeals for the District of Columbia denied U.S. Magnesium's appeal of the EPA's decision to include the company's Rowley magnesium production facility as a Superfund site. U.S. Magnesium had challenged the agency's 2008 listing decision and argued that the agency had overestimated the risk of pollutants from the facility entering the air and soil. Designation of the facility as a Superfund site gave the EPA the authority to investigate the site further to determine if a cleanup is necessary. The designated site encompasses 1,830 hectares (4,530 acres) on the southwest edge of the Great Salt Lake. Contaminants at the site included acidic wastewater, dioxins, furans, heavy metals, hexachlorobenzene, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons (Fahys, 2011).

Consumption

Data for magnesium metal are collected from two voluntary surveys of U.S. operations by the U.S. Geological Survey. Of the 59 companies canvassed for magnesium consumption data, 46% responded, representing 54% of the magnesium-base scrap consumption listed in table 2 and the primary magnesium consumption listed in table 3. Data for the 32 nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Primary magnesium consumption in 2011 was about 7% higher than that in 2010 (table 3), which coincided with an increase in the U.S. economy. Aluminum alloying and diecasting each consumed about 38% of the total followed by iron and steel desulfurization with 11%. Consumption of magnesium for diecasting increased by about 15% from that in 2010 mainly because of an 11.5% increase in U.S. vehicle production compared with that in 2010 (International Organization of Motor Vehicle Manufacturers, 2012). A 7% increase in steel production from 2010 to 2011 was responsible for an 8% increase in the use of magnesium for desulfurization (World Steel Association, 2012).

Phoenix Global Enterprises LLC (PGE) opened a magnesium scrap recycling plant in Anderson, IN, to process magnesium turnings. The new plant is adjacent to Advanced Magnesium Alloys Corp.'s (Amacor) magnesium recycling facility, which is majority owned by the same individual as PGE. The new

plant was expected to be able to take machining turnings, which are considered hazardous materials because of their size, and convert them into 3-pound cylinders containing 90% to 94% magnesium to be sold to the secondary aluminum industry. Normally diecasting companies pay to have the magnesium metal slivers removed because they are difficult to recycle, but Amacor developed a proprietary process that enabled the turnings to be economically recycled (McBeth, 2011a).

In March, ESM Group Inc. (a subsidiary of SKW Stahl-Metallurgie Holding AG) opened a new atomized magnesium metal powder facility at its plant in Saxonburg, PA. The expanded plant produced fine and ultrafine spherical magnesium powder, used for military flares that are used as countermeasures to protect aircraft from missiles (Metal Powder Report.net, 2011). At the beginning of 2011, SKW consolidated its specialty magnesium powder business in a new company, ESM Special Metals & Technology, Inc. In September, Hart Metals Inc. (a subsidiary of United Kingdom-based Luxfer Group) completed the installation of a new atomizer to produce magnesium alloy powders for military applications at its plant in Tamaqua, PA.

Massachusetts-based Metal-Oxygen Separation Technologies Inc. received a $6 million grant from the U.S. Department of Energy (DOE) to scale up its new technology to produce magnesium from magnesium oxide. The company planned to use the funds to support a 3-year pilot-plant project to produce 30 to 50 t/yr of magnesium. The funding was from the DOE's Vehicle Technologies Program; magnesium's light weight was expected to be important in achieving new Federal corporate average fuel economy requirements of 35.5 miles per gallon in 2016. Metal-Oxygen Separation Technologies was founded in 2008 and has received funding from the DOE, the National Science Foundation (NSF), and private investors (Alspach, 2011).

nanoMAG, LLC was awarded funding from the NSF and the U.S Department of the Army to develop new applications for its magnesium sheet. A $730,000 contract extension with the Army was expected to focus on development of lightweight composite armor for vehicle and ballistics applications, and a $100,000 NSF grant was to support research on resorbable biomedical implants for orthopedic applications. nanoMAG claimed that magnesium sheet produced by its patent-pending process provides 200% higher strength and improved toughness over conventional magnesium sheet, while also providing the strength of carbon steel sheet at one-fourth the weight (nanoMAG, LLC, 2011).

French company McPhy Energy, which was created in 2008 to industrialize and commercialize solid hydrogen storage technology using magnesium hydride, signed a contract with Enel Group, Italy's leading and Europe's second leading power company, by installed capacity, to supply a 2-kilogram (kg) solid hydrogen storage system. The company also signed a contract with Iwatani Corp., Japan's leading supplier of hydrogen in terms of market share, to supply a 4-kg solid hydrogen storage solution. Historically, hydrogen storage methods have been based on compression and liquefaction (direct storage), which involve safety problems and costs for compression and cooling. McPhy's systems, initially marketed to the merchant hydrogen market, were also being used for the renewable energy industry (McPhy Energy, 2011a, b).

The potential of magnesium batteries to increase efficiency compared with existing battery technology spurred several research projects. Researchers from Toyota Corp. demonstrated the first rechargeable battery system using a magnesium anode and sulfur cathode. A magnesium-sulfur battery could be substantially more efficient than existing lithium-ion rechargeable battery technologies, but this research was in the early stages of development and had a number of hurdles to overcome before it could be commercialized. Pellion Technologies, a Massachusetts-based startup company, also was investigating magnesium-based battery technology by trying to find a suitable cathode material (Cohen, 2011; Hadlington, 2011).

Stocks

Producers' yearend 2011 stocks of primary magnesium were slightly lower than those at yearend 2010; producer stock data were withheld to avoid disclosing company proprietary data. Consumer stocks of primary and alloy magnesium were 4,860 t at yearend 2011, 15% more than the yearend 2010 level of 4,230 t.

Prices

At the beginning of 2011, the Platts Metals Week U.S. spot Western magnesium price range was $2.35 to $2.50 per pound. This range reached its high for the year of $2.40 to $2.50 per pound in mid-February and remained at that level until the beginning of May. The price range decreased steadily to a low of $2.05 to $2.20 per pound in late December. The average Platts Metals Week U.S. spot Western magnesium price in 2011 was $2.40 per pound, about 7% less than the 2010 average of $2.57 per pound.

Spot prices fell during the fourth quarter as a result of lower negotiated prices for 2012 contracts. Press reports indicated that aluminum producers had contracted for most of their magnesium requirements for 2012 at $2.00 to $2.05 per pound (McBeth, 2011b). Consumers of diecasting alloy reportedly settled their 2012 contracts at $2.00 to $2.20 per pound for AM50 or AZ91 alloy. Contract prices in 2012 for secondary 90/10 alloy were reported to be in the low $1.80s per pound (McBeth and Poole, 2011).

Foreign Trade

Total magnesium exports for 2011 were about 17% less than those in 2010 (table 5). Canada (29%), Singapore (28%), and Mexico (22%) were the principal destinations.

Magnesium imports for consumption in 2011 were about 8% lower than those in 2010 (table 6). Israel (30%) was the principal source of magnesium imports, mostly metal, and Canada (26%) was the second ranked source of magnesium imports, mostly waste and scrap.

China's reported exports of magnesium to the United States under Harmonized Tariff Schedule (HTS) number 8104.30.0000 were significantly higher than U.S. trade statistics for imports from China under that HTS number. According to United

Nations (2012) trade statistics, China reported exports of more than 19,600 t of material under this HTS number; the United States reported imports of 1,250 t from China. The unreported U.S. imports were thought to be desulfurization reagents that were not subject to antidumping duties and were included in a different HTS number in U.S. import statistics. These data have not been included in apparent consumption calculations.

World Review

Armenia.—The Armenian Development Agency announced that a primary magnesium plant would be constructed at the Yeghvard branch of Yerevan Scientific Research Institute of Mathematical Machines (more commonly known as Mergelyan Institute) if enough investors were found. Initial plans called for a $1 million investment to produce 300 t/yr of magnesium, with an additional $6 million to increase production to 10,000 t/yr (PanARMENIAN.net, 2011).

Australia.—Latrobe Magnesium Ltd. completed a prefeasibility study for a plant to recover 10,000 t/yr of magnesium from coal fly ash produced at the Hazelwood powerplant in Victoria. The company planned to conduct further test work to confirm some design and feedstock assumptions used in the study and refine capital cost estimates. The bankable prefeasibility was scheduled to be completed by March 2013. The 10,000-t/yr demonstration plant was expected to be commissioned in March 2014, and a 40,000-t/yr plant built in early 2015. Latrobe planned to raise about $100 million to build the demonstration plant. Magnesium recovery from Hazelwood coal fly ash has been under investigation since 2001 (Latrobe Magnesium Ltd., 2011).

In July, Advanced Magnesium Ltd. (AML) purchased all the shares of Varomet Holdings Ltd. (the holding company for the Magontec Group businesses) from Straits Mine Management Pty. Ltd. for approximately $6 million. Magontec businesses included magnesium alloy and anode manufacturing plants in Xi'an and Suzhou, China, recycling operations at Bottrop, Germany, and a recycling facility at Santana, Romania, which was scheduled to be completed in 2012. Through its subsidiaries, AML's total magnesium manufacturing and recycling capacity would be 60,000 t/yr. In addition to the manufacture of magnesium alloy in Xi'an and at HNKWE (AML's 53%-owned Chinese joint-venture), the company has installed recycling capacity of 19,000 t/yr, which would rise to 25,000 t/yr in 2012 when the new Romanian recycling plant comes onstream. The Romanian facility was expected to produce magnesium alloys and 2,000 t/yr of magnesium anodes (Advanced Magnesium Ltd., 2011). The plants in Bottrop and Xi'an were originally owned by Norsk Hydro ASA.

China.—According to data from China Non-ferrous Metals Industry Association, China produced 661,000 t of magnesium in 2011. This was slightly more than the quantity produced in 2010. Forty-four percent of the country's primary magnesium was produced in Shanxi Province, and 38% was produced in Shaanxi Province (Hao, 2012).

Several firms continued to expand their primary magnesium metal production capacities. Australia-based China Magnesium Corp. Ltd. began producing magnesium from a refurbished 5,000-t/yr plant at Pingyao, Shanxi Province in April, which had been idle since 2008, and was on schedule to complete expansion to 20,000 t/yr by December 2011 (Platts Metals Week, 2011). Xinjiang Hongxing Kejian Magnesium Co., Ltd. brought a 20,000-t/yr magnesium plant onstream in early 2011 in the Xinjiang Uygur Autonomous Region and planned to increase production capacity to 100,000 t/yr within 3 years (Metal-Pages, 2011b).

Israel.—Dead Sea Magnesium Ltd. (Beer Sheva, Israel) announced that it would increase production at its magnesium plant in Sdom by as much as 10% through debottlenecking. The plant had the capacity to produce 34,000 t/yr of magnesium, and the company said that the increased production level would be reached in the first quarter of 2011. Most of the additional output was expected to be shipped to the United States, with some to Europe and Brazil (Riley, 2011a).

Korea, Republic of.—Steel producer POSCO Co. Ltd. announced that it would begin construction of a 10,000-t/yr primary magnesium plant in Gangneung City, Gangwon Province, in May. Construction of the modified Pidgeon process plant was expected to be completed by June 2012, with further expansion to 20,000 t/yr by 2016 and 100,000 t/yr by 2018. POSCO has been producing magnesium strip from magnesium imported from China. By constructing a primary metal plant that would use dolomite byproduct from cement production, POSCO would not be dependent upon China for its raw material (Metal-Pages, 2011a).

POSCO was constructing a new 10,000-t/yr line to produce 2,000-millimeter magnesium plate at its existing plant in Suncheon, Jeollanam Province, which was expected to be in commercial production by August 2013. This plate, the widest in the world, was expected to be used for components by South Korean automobile manufacturers. POSCO completed the development of a magnesium automobile front seat frame and was marketing the frame to South Korean auto manufacturers. Also in November, POSCO signed an agreement with a trading unit of Japan's Toyota Corp. to supply magnesium ingot to the company. POSCO planned to develop a magnesium rear seat frame by March 2013 (Japan Metal Bulletin, 2011; 2012).

Russia.—Despite the removal of the antidumping duties, Solikamsk Magnesium Works reportedly did not plan to sell magnesium into the United States in 2011. Based on information available in early 2011, the company planned to produce 13,500 t of magnesium in 2011 for its customers in Belarus, Kazakhstan, and Russia (Riley, 2011b).

Outlook

U.S. magnesium consumption was expected to continue to be directly correlated to the global economy. A recovering economy could result in magnesium consumption returning to its previous levels. A significant portion of U.S. demand for magnesium will depend on its use in aluminum alloys. Primary aluminum production through May 2012 was 12% higher than that in the same period of 2011 and is likely to result in increased magnesium use in aluminum alloying.

Analysts at CM Group projected that global primary magnesium consumption would increase by 6.6% annually from 2012 through 2016 and by 7.1% from 2017 through 2026. Annual consumption in China was forecast to increase by 12%

in the 5-year period. About 190,000 t/yr of primary magnesium capacity was under construction in China, and additional capacity may come onstream in Australia, Canada, the Republic of Korea, and the Middle East (McBeth, 2012).

According to Ward's Automotive Group (2012), U.S. light vehicle production for the first half of 2012 was 26% higher than that in 2011, which is likely to lead to increased magnesium diecasting production and use in 2012. The Original Equipment Suppliers Association (2012, p. 2), projected that production planning volumes were trending upward for 2012 and 2013. The 2012 median volume projection in July was 14.0 million units, up 500,000 units from the January 2012 indicated level. The 2013 median volume was projected to be 14.8 million units, up 700,000 units from the January 2012 projection.

Most of the growth in magnesium use in the past two decades resulted from its increased use in automotive applications because of its light weight, and any increase in automobile manufacturing would be expected to result in an increase in the use of magnesium. However, because of the limited availability from multiple producers, automotive manufacturers outside China may be less likely to choose magnesium than other lightweight materials, such as plastic. Because of antidumping duties assessed on magnesium imported from China, the leading producer, U.S. automobile manufacturers are limited to sourcing primary magnesium from one company in Brazil, one in Israel, two in Russia, and one in the United States. A new plant in Malaysia could serve as an additional supplier as production stabilizes. The limited number of suppliers was one of the reasons that the U.S. automotive industry was reluctant to use magnesium for many years. As a result of the downturn in the U.S. economy and the limited number of suppliers of magnesium, the U.S. diecasting industry has lost at least six large diecasting facilities since 2008. Uncertainty about the European economic slowdown, however, is causing suppliers to remain cautious.

Because of its light weight, companies continued to develop new applications for magnesium that could increase consumption in the future. Magnesium-base batteries for electric vehicles may prove to be feasible, but substantial research and development needs to be done before this happens. Magnesium-base fuel cells also could be a potential new use for magnesium if the technology is commercially proven. Companies are developing new high-strength corrosion-resistant alloys for use in aerospace and defense applications and new alloys for bioabsorbable implants.

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

	2007	2008	2009	2010	2011
United States:					
Production:					
Primary magnesium	W	W	W	W	W
Secondary magnesium	89,300	88,400	68,600	71,800 r	74,900
Exports	14,800	14,400	19,600	14,800	12,300
Imports for consumption	71,800	83,300	47,300	52,700	48,400
Consumption, primary	72,200	64,500	50,900	55,700	59,300
Yearend stocks, producer	W	W	W	W	W
Price[2] dollars per pound	2.00–2.50	3.05–3.25	2.20–2.40	2.35–2.50	2.05–2.20
World, primary production e	751,000	670,000	598,000	755,000 r	771,000

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Data are rounded to no more than three significant digits.
[2]Source: Platts Metals Week.

TABLE 2
MAGNESIUM RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY KIND OF SCRAP AND FORM OF RECOVERY[1]

(Metric tons)

	2010	2011
KIND OF SCRAP		
New scrap:		
Magnesium-base	21,100	17,700
Aluminum-base	30,300 r	33,100
Total	51,300 r	50,900
Old scrap:		
Magnesium-base	1,210	1,210
Aluminum-base	19,300	22,800
Total	20,500	24,100
Grand total	71,800 r	74,900
FORM OF RECOVERY		
Magnesium alloy ingot[2]	W	W
Magnesium alloy castings	6,520	130
Aluminum alloys	54,400 r	64,100
Other[3]	10,900	10,700
Total	71,800 r	74,900

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes secondary magnesium content of both secondary and primary alloy ingot.
[3]Includes chemical and other dissipative uses, cathodic protection, and data indicated by symbol W.

TABLE 3
U.S. CONSUMPTION OF PRIMARY MAGNESIUM, BY USE[1]

(Metric tons)

Use	2010	2011
For structural products:		
Castings:		
Die	19,600	22,500
Permanent mold	163	336
Sand	424	498
Wrought products[2]	2,120	3,580
Total	22,300	26,900
For distributive or sacrificial purposes:		
Aluminum alloys	23,800	22,500
Cathodic protection (anodes)	709	876
Iron and steel desulfurization	5,960	6,430
Nodular iron	412	457
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	882	399
Other[3]	1,630	1,720
Total	33,400	32,400
Grand total	55,700	59,300

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes sheet and plate and forgings.
[3]Includes chemicals and scavenger, deoxidizer, and powder.

TABLE 4
YEAREND MAGNESIUM PRICES

		2010	2011
U.S. spot dealer import	dollars per pound	2.25–2.40	2.05–2.15
U.S. spot Western	do.	2.35–2.50	2.05–2.20
China	dollars per metric ton	2,900–2,950	3,000–3,050
European free market	do.	2,950–3,050	3,125–3,200

do. Ditto.

Source: Platts Metals Week.

TABLE 5
U.S. EXPORTS OF MAGNESIUM, BY COUNTRY[1]

	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
Country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2010:								
Brazil	--	--	60	$220	396	$2,350	15	$856
Canada	85	$219	1,730	8,400	4,270	18,100	272	4,090
Mexico	112	205	937	2,730	1,500	6,380	648	4,130
Singapore	--	--	2,110	7,070	61	386	37	743
United Kingdom	4	11	--	--	29	292	461	15,000
Other	280	367	465	1,340	676	3,400	638	11,800
Total	481	802	5,300	19,800	6,940	30,900	2,070	36,600
2011:								
Brazil	--	--	--	--	148	553	8	300
Canada	233	747	1,590	4,800	1,540	6,140	260	4,530
Mexico	1,160	2,780	70	239	1,310	5,220	154	1,740
Singapore	--	--	3,440	8,620	20	67	44	879
United Kingdom	35	35	11	22	100	380	470	15,000
Other	255	400	411	926	382	2,180	684	13,200
Total	1,680	3,960	5,520	14,600	3,500	14,500	1,620	35,600

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM, BY COUNTRY[1]

	Waste and scrap		Metal		Alloys, magnesium content		Powder, sheets, tubing, ribbons, wire, other forms, magnesium content	
Country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2010:								
Canada	10,100	$25,300	30	$117	835	$2,840	306	$1,530
China	196	292	93	560	1,270	3,370	335	2,740
Israel	--	--	15,800	73,200	2,510	13,200	--	--
Kazakhstan	--	--	875	3,520	--	--	--	--
Mexico	687	1,650	--	--	1,130	4,830	63	1,250
Russia	--	--	618	1,820	--	--	--	--
United Kingdom	3,280	7,370	--	--	807	11,400	40	1,920
Other	7,850	22,000	807	4,310	5,080	18,800	44	1,730
Total	22,100	56,500	18,200	83,500	11,600	54,400	788	9,160
2011:								
Canada	11,400	21,200	9	50	975	4,220	74	3,100
China	1	5	65	449	2,960	8,440	400	3,150
Israel	--	--	12,100	58,400	2,560	13,700	--	--
Kazakhstan	--	--	409	1,740	--	--	--	--
Mexico	1,680	3,160	--	--	3	16	444	3,690
Russia	--	--	470	1,720	--	--	(2)	10
United Kingdom	1,640	4,440	--	--	888	13,200	15	1,040
Other	7,240	20,000	1,250	6,560	3,790	14,900	41	1,840
Total	22,000	48,700	14,300	68,900	11,200	54,600	974	12,800

-- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2011[1]

(Metric tons)

Country	Capacity
Brazil	22,000
China	1,120,000
India	900
Israel	34,000
Kazakhstan	30,000
Malaysia	15,000
Russia	80,000
Serbia	5,000
Ukraine	15,000
United States	63,500
Total	1,380,000

[1]Includes capacity at operating plants as well as at plants on standby basis.

TABLE 8
MAGNESIUM: ESTIMATED PRIMARY WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	2007	2008	2009	2010	2011
Brazil	18,000	15,000	16,000	16,000	16,000
Canada	16,300 [3]	2,000 [3]	--	--	--
China	625,000	559,000	501,000	654,000	661,000
Israel	29,618 [4]	32,051 [4]	19,405 [4]	23,309 [r, 4]	30,000
Kazakhstan	21,000	21,000	21,000	21,000	21,000
Malaysia	--	--	--	--	2,000
Russia[3]	37,000	37,000	37,000	37,000	37,000
Serbia	2,000	1,500	1,500	1,500	1,500
Ukraine	2,500	2,000	2,000	2,000	2,000
United States	W	W	W	W	W
Total	751,000	670,000	598,000	755,000 [r]	771,000

[r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.
[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through June 8, 2012.
[3]Includes secondary.
[4]Reported figure.