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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. Aluminum alloying, diecasting, and iron and steel desulfurization were, in descending order, the principal end-use applications for magnesium in the United States in 2010. Consumption of primary magnesium in the United States in 2010 was about 9% higher than that in 2009, mostly as a result of the increase in use for iron and steel desulfurization, as U.S. steel production recovered from the economic downturn. China continued to dominate world production of primary magnesium, accounting for 86% of the total (excluding the United States). The United States continued to minimize the quantity of pure and alloy magnesium imported from China through the imposition of antidumping duties.

Legislation and Government Programs

In October, the U.S. Department of Commerce, International Trade Administration (ITA), published the final results of its antidumping duty review of magnesium alloy imports from China. The ITA determined that for April 1, 2008, through March 31, 2009, for Tianjin Magnesium International Co. Ltd. (TMI) the duty was 0% ad valorem, and for other exporters from China, the rate would be 141.49% ad valorem or an individual rate that had been established for a specific company in an earlier review (U.S. Department of Commerce, International Trade Administration, 2010a). In November, the ITA issued a rescission of the antidumping duty order on magnesium alloy from TMI for April 1, 2009, through March 31, 2010, because TMI had not shipped magnesium alloy to the United States during that period (U.S. Department of Commerce, International Trade Administration, 2010b).

In December, the ITA published the final results of its antidumping duty review of pure magnesium imports from China. The ITA determined that for May 1, 2008, through April 30, 2009, for TMI, the duty was 0.73% ad valorem, and for other exporters from China, the rate would be 111.73% ad valorem (U.S. Department of Commerce, International Trade Administration, 2010e).

The ITA also completed an expedited 5-year sunset review of magnesium alloy imports from China and pure and alloy magnesium imports from Russia into the United States. Because no party in the original determination notified the ITA that it intended to participate in the reviews, the ITA determined that revocation of the antidumping orders would likely lead to a continuation of dumping. As a result, the ITA maintained the antidumping duty orders (U.S. Department of Commerce, International Trade Administration, 2010c).

Russian magnesium producer VSMPO-Avisma Corp. requested that the International Trade Commission conduct a 5-year sunset review of antidumping duties for pure magnesium imported from Russia into the United States. In August 2009, the ITA had set an antidumping duty rate of 43.58% ad valorem on magnesium metal from VSMPO-Avisma for April 1, 2007, through March 31, 2008, and a rate of 21.71% ad valorem for metal from Russian company JSC Solikamsk Magnesium Works (SMW). VSMPO-Avisma said that imports from Russia would not increase significantly if the antidumping duty order were revoked (Jennemann, 2010).

In September, the ITA published the final results of its antidumping duty review of magnesium imports from Russia for April 1, 2008, through March 31, 2009. For VSMPO-Avisma, the ITA set a duty of 0% ad valorem. Because SMW did not ship magnesium into the United States in the period of review, its duty was set at the rate that was determined the last time the company had U.S. sales or shipments (U.S. Department of Commerce, International Trade Administration, 2010d).

Federal authorities charged six people and three companies with importing substandard magnesium powder from China into the United States, where it was used to make 1.8 million countermeasure flares that were intended to be used by military aircraft to divert heat-seeking missiles. Officials said that none of the flares made it onto aircraft before being quarantined, and that all would be destroyed. The Chinese magnesium was mixed with aluminum nuggets and mislabeled when it entered the country in sealed drums, so that it would not be subject to a nearly 306% antidumping duty (Thompson, 2010).

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 at its 52,000-metric-ton-per-year (t/yr) plant in Rowley, UT. U.S. Magnesium renewed plans to increase magnesium production capacity at its Rowley plant to 63,500 t/yr by 2013. The plans to increase capacity were originally proposed in 2004, but because of the global recession, the plans were put on hold in 2009. About 11,000 t/yr of U.S. Magnesium's production was committed to Allegheny Technologies Inc. (ATI) for use in its nearby titanium sponge plant, which started operations in 2009. This magnesium, which is used in the Kroll process to produce titanium sponge from titanium tetrachloride, was committed for several years, until ATI's plant reaches full capacity (McBeth, 2010c).

Environmental Issues

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 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 1.1 teragram CO_2 equivalent of SF_6 in 2009, representing a decrease of approximately 45% from 2008 emissions. The decrease may be attributed to diecasting facilities closing in the United States and reduced demand from the American automobile industry and other industrial sectors. An issue that was expected to be addressed in future inventories is the likely adoption of alternate cover gases by U.S. magnesium producers and processors. These cover gases, which include AM-cover™ [containing hydroflurocarbon-134a (HFC–134a)] and Novec™ 612 (dodecafluoro-2-methylpentan-3-one), have lower global warming potential than SF_6 and tend to quickly decompose during their exposure to the molten metal. Magnesium producers and processors voluntarily have begun using these cover gases in a limited fashion (U.S. Environmental Protection Agency, 2011, p. 4–52—4–54).

On June 28, the EPA issued a final rule that requires annual GHG emissions reporting from four source categories—magnesium production, underground coal mines, industrial waste landfills, and industrial wastewater treatment. For magnesium, each facility must report total annual emissions for each of the following cover or carrier gases: SF_6, HFC–134a, the fluorinated ketone FK 5–1–12, carbon dioxide, and any other fluorinated GHG as defined in the rule. Collection of the data was scheduled to begin on January 1, 2011, with the first report due on March 31, 2012 (U.S. Environmental Protection Agency, 2010).

In a ruling by the 10th Circuit Court of Appeals, a 2007 decision exempting U.S. Magnesium's waste streams from regulation by the EPA under the Resource Conservation and Recovery Act (RCRA) was reversed. In the lawsuit originally begun in 2001, U.S. Magnesium argued that the EPA exempted five wastes from regulation under subtitle C of RCRA. U.S. Magnesium claimed that the EPA could not change that interpretation, at least not without first complying with the notice and comment procedures of the Administrative Procedure Act. The district court had agreed with U.S. Magnesium, but, according to the new appellate court ruling, because the EPA never previously adopted a definitive interpretation, it remained free to change its mind and issue a new interpretation of its own regulations. The appellate court remanded the decision to the district court (Leagle.com, 2010).

In November, U.S. Magnesium appealed the EPA's decision to declare its magnesium production facility in Rowley as a Superfund site. The company argued that the EPA broke its own rules by designating the plant as a Superfund site. The company also contended that although there are four sources of pollution on the site, they cannot be aggregated to show a higher waste output, and that two birds listed as affected by the plant's operation are not threatened or endangered. Because the EPA ruling that U.S. Magnesium's facility is a Superfund site is considered a Federal regulation, the appeal went directly to the Court of Appeals for the District of Columbia (Burr, 2010).

Consumption

Data for magnesium metal are collected from two voluntary surveys of U.S. operations by the U.S. Geological Survey. Of the 62 companies canvassed for magnesium consumption data, 50% responded, representing 45% of the magnesium-base scrap consumption listed in table 2 and the primary magnesium consumption listed in table 3. Data for the 31 nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Reported primary magnesium consumption in 2010 was about 9% higher than that in 2009 (table 3), which reflected a slight increase in the U.S. economy. Aluminum alloying was the principal use for primary magnesium, accounting for 43% of the total, followed by diecasting with 35% and iron and steel desulfurization with 11%. Primary magnesium use in aluminum alloying increased slightly although primary aluminum production in the United States in 2010 was about the same as that in 2009. A 36% increase in steel production from 2009 to 2010 was responsible for a 50% increase in the use of magnesium for desulfurization.

Hart Metals Inc. (a subsidiary of United Kingdom-based Magnesium Elektron Ltd.) received $1.6 million in Federal funding to design magnesium components for military vehicles. The funding was expected to be used to finance construction and installation of an atomizer by yearend 2010. Hart Metals would then start developing alloys and adjusting their properties to find the right mix to meet military specifications. Hart Metals already manufactured magnesium flares for the military (Pangonis, 2010). ESM Group Inc. announced that it would construct an atomized magnesium plant at its Saxonburg, PA, operations by the second quarter of 2011. Although the company did not specify the plant's expected production capacity, magnesium powder produced at the plant would be targeted to defense markets (Riley, 2010a).

In October, a fire at Magnesium Elektron's Madison, IL, magnesium sheet plant destroyed one of the plant's reheating furnaces, but because the plant was operating at less than its production capacity, the fire did not disrupt the company's supply to its customers. The plant produced magnesium sheet for aerospace and commercial applications (Riley, 2010b).

Metal-Oxygen Separation Technologies Inc. (Natick, MA) received a $260,000 grant from the U.S. Department of Energy (DOE) to develop an efficient one-step electrolytic process to recycle low-grade and post-consumer magnesium scrap. The company was developing an electrolytic process to recover magnesium from magnesium oxide, unlike traditional electrolytic processes that use magnesium chloride as a feed material. The National Science Foundation provided startup funding of $100,000 to the company in June 2009, and the company received $1.1 million in grants in 2010 from the DOE, including the $260,000 grant noted above (Alspach, 2010).

A new technology to produce magnesium sheet has been developed by nanoMAG, LLC (a subsidiary of Thixomat, Inc.). The process is related to the thixomolding injection molding process, which converts magnesium alloys into complex parts. nanoMAG claimed that the fine-grain sheet material forms easily, allowing fabrication of net-shape finished components currently not available. The new sheet was said to provide 200% higher strength and improved toughness compared to conventional magnesium sheet, while also providing the strength of carbon steel sheet at one-fourth the weight. The company planned to target the new sheet product to applications in military vehicle armor, resorbable biomedical implants, and structural aerospace applications (Smock, 2010).

European steelmaker Corus (a subsidiary of India's Tata Steel Group) reportedly developed improved anticorrosion steel coatings dedicated to the automotive industry. One new coating, which contains a small quantity of magnesium and aluminum and less zinc than usual, was at the commercialization phase and undergoing tests. Its claimed improved corrosion performance could enable Corus to produce steel sheet with a thinner coating layer, which could reduce the weight of individual structural car body components by up to 35% compared to conventional steels without sacrificing safety requirements (Metal-Pages, 2010c).

McPhy Energy, a French company founded in January 2008 to industrialize and commercialize a new technology for the solid storage of hydrogen in the form of magnesium hydride, raised €13.7 million ($16.9 million) in a second round of financing to scale up its hydrogen storage technology. Following a €1.6 million ($1.9 million) first round of financing in January 2009, the company established a production line and created a reservoir of magnesium hydride that was delivered to the French Laboratory of Innovation for New Energy Technologies and Nanomaterials (CEA-Liten) in March 2010 for testing on an industrial scale. In April, McPhy Energy signed a research contract with CEA-Liten to manufacture two full-size magnesium hydride storage prototypes and to test them at industrial scale. During the test campaign, they would be coupled to an electrolyzer and a fuel cell simulating a real-world renewable energy storage application (EETimes, 2010).

Stocks

Producers' yearend 2010 stocks of primary magnesium were about the same as those at yearend 2009; producer stock data were withheld to avoid disclosing company proprietary data. Consumer stocks of primary and alloy magnesium were 4,230 metric tons (t) at yearend 2010, 22% lower than the yearend 2009 level of 5,420 t (revised).

Prices

The U.S. spot Western magnesium price rose in the first quarter of the year, stabilized in the second and third quarters, and fell slightly to end the year at only about 10 cents per pound more than that at the beginning of 2010. In the first quarter, the increase in magnesium consumption that had begun in the third quarter of 2009 led to a drawdown in stocks, which fueled purchases, and, as a result, led to increased prices (McBeth and Yee, 2010). U.S. magnesium demand remained slow through the second quarter, and the summer is generally a time of reduced consumption because of automotive plant closures. General Motors Corp., however, announced that it would keep 9 of its 11 automobile assembly plants operating during the traditional shutdown period from June 28 to July 9 because of increased demand for automobiles. The decision to keep the plants operating through the summer was intended to increase production by 56,000 vehicles (Metal-Pages, 2010b). Press reports indicated that although U.S. magnesium consumption had diminished from the level before the economic recession, domestic supplies were barely sufficient to meet this consumption level, which led to stable prices in the third quarter of 2010 (Metal-Pages, 2010d). The weakening economy, concern about automotive markets, and a reduction in inventories by consumers were the principal reasons for the price decline in the fourth quarter.

Magnesium contracts in North America for 2011 reportedly settled between $2.30 and $2.35 per pound for pure magnesium or diecasting alloy and $1.80 to $1.90 per pound for secondary 90/10 magnesium alloy (McBeth, 2010b).

Foreign Trade

Total magnesium exports for 2010 were about 25% less than those in 2009 (table 5). Canada (43%), Mexico (22%), and Singapore (15%) were the principal destinations.

Magnesium imports for consumption in 2010 were about 12% higher than those in 2009 (table 6). Magnesium metal (containing at least 99.8% by weight of magnesium) imports were 15% lower compared with those in 2009, but alloy imports were 143% higher. Israel (35%) was the principal source of magnesium imports, mostly metal and alloys, and Canada (21%) was the second ranked source of magnesium imports, mostly waste and scrap.

Taiwan, with a 22% share of magnesium alloy imports into the United States in 2010, has increased its imports significantly because recycler Pinda Technology Co. Ltd. signed an agreement with U.S.-based Greenwich Metals Ltd. to market its product in the United States. Pinda Technology can produce 7,200 t/yr of magnesium from diecasting scrap but had been producing at about 4,000 t/yr because of a shortage of scrap. Pinda Technology's material is marketed to U.S. diecasters as an alternative to domestically produced magnesium (Riley, 2011).

World Review

European Union.—A ad hoc working group under the Raw Materials Supply Group that was formed by the European Union (EU) analyzed 41 materials to determine their economic importance and supply risk, and determined that magnesium was 1 of 14 critical materials. The group recommended a number of steps to improve the availability of reliable, consistent statistical information; improve the knowledge of the availability of resources and their flow into products through the value-added chains of the EU economies; encourage more research into life-cycle assessments for raw materials and their products on a cradle-to-grave basis; and create a working group to analyze the impact of emerging technologies on demand for raw materials (European Commission Enterprise and Industry, 2010, p. 5–10).

Australia.—Latrobe Magnesium Ltd. continued to develop its process to recover magnesium from coal fly ash. Experimental work demonstrated progressive reductions in sulfur and iron in the fly ash, which resulted in increased metallic magnesium recoveries of up to 94%. Based on this, Latrobe Magnesium began a prefeasibility study, which was expected to be completed by the end of March 2011, to develop a 5,000-t/yr magnesium plant. Construction time for the plant was estimated to be 12 months. In December 2010, the company signed an extension of its existing agreement with Hazelwood Power. Under the agreement, Hazelwood Power agreed to supply ash from the Hazelwood Power Station, provide land adjacent to the Hazelwood Power Station on which to construct a primary magnesium plant, and supply electricity at a competitive price (Latrobe Magnesium Ltd., 2011, p. 4–6).

Canada.—Gossan Resources Ltd. (Winnipeg, Manitoba) reported that results from recently completed phase 3 bench-scale tests confirmed that the Zuliani process produced magnesium metal under atmospheric conditions at high raw material efficiencies. Compared to a magnesium metal plant using the Pidgeon process in China, the Zuliani process used 33% less ferrosilicon and 23% less dolomite to produce an equivalent quantity of magnesium. As a result of the successful tests, Gossan planned phase 4 testing of the Zuliani process, which would increase the experimental scale by more than 100 times compared to the phase 3 bench-scale tests. Gossan planned to recover magnesium from a dolomite deposit in south-central Manitoba (Gossan Resources Ltd., 2010).

China.—According to the China Nonferrous Metals Industry Association, China produced 654,000 metric tons (t) of magnesium in 2010, 31% more than 2009 production. Approximately 384,000 t of magnesium was exported in 2010, with about one-half as unwrought magnesium (China Metal Market—Precious & Minor Metals Monthly, 2011).

In May, China Direct Industries, Inc. announced that it was restarting production of primary magnesium at two facilities in China—Baotou Changxin Magnesium Co., Ltd. (Inner Mongolia), with a capacity of 20,000 t/yr and Taiyuan Changxin Magnesium Co. Ltd. (Shanxi Province), with a capacity of 10,000 t/yr. The company scheduled production at the facilities to begin in July or August 2010 after the plants had been idle throughout 2009 because of weak demand. China Direct also operated Shanxi Gu County Golden Magnesium Co. Ltd. (Shanxi Province) with a production capacity of 12,000 t/yr; production at this plant reportedly reached its full capacity in May (China Direct Industries, Inc., 2010).

The municipal government of Anshan in Liaoning Province secured investment, through Magnesium Resources Corp. of China Ltd., to build a magnesium plant in the city's Haicheng district. Magnesium Resources was expected to invest up to $1.5 billion in the construction of the facility, which would have a production capacity of 200,000 t/yr of magnesium metal and 50,000 t/yr of magnesium alloys. The first phase of the project was expected to be completed in mid-2010 (Metal-Pages, 2010a).

Fugu Xintian Magnesium Alloy Co. Ltd. (Shaanxi Province) planned to expand its magnesium ingot production capacity to 20,000 t/yr from 10,000 t/yr. The company planned to invest $8.8 million to set up a new production line with a capacity of 10,000 t/yr of pure magnesium and 10,000 t/yr of magnesium alloy to be completed by yearend 2010. The company also produced 40,000 t/yr of coal tar at its plant, which served as the fuel supply for magnesium ingot production and reduced the plant's production cost (Metal-Pages, 2010e).

As part of its 5-year plan, China's Government would close currently producing magnesium plants with a production capacity of less than 15,000 t/yr and require that all new plants have a production capacity of at least 20,000 t/yr. The new rules were scheduled to be implemented in 2011. In addition, the new regulations require magnesium plants to consume a maximum of 5.5 to 6.0 t of coal per ton of magnesium produced; some plants have consumed as much as 11 to 18 t of coal per ton of magnesium. The goals of the new regulations were to eliminate small plants that produce substandard (less than 99.9%-pure) magnesium and to reduce emissions (Leung and Yee, 2010).

Malaysia.—The first production of magnesium from CVM Minerals Ltd.'s (Kuala Lumpur) plant in Malaysia began in June, although the plant had not ramped up to commercial-scale production by yearend. The facility in Taiping in the state of Perak used locally mined dolomite feedstock for a Pidgeon-process plant using natural gas to fuel the process. The initial production capacity was 15,000 t/yr. CVM planned to double the capacity to 30,000 t/yr in the future and to begin producing magnesium alloys (CVM Minerals Ltd., 2010, p. 8).

Mexico.—Garfield Alloys Inc. (Garfield Heights, OH) announced that it was closing its Garfield Alloys de Mexico S. de R.L. de C.V. subsidiary, which opened in 2005 with a 4,000 t/yr capacity to recycle various types of magnesium scrap. Production at the plant stopped in December, and the closure was expected to be completed in the first quarter of 2011. Garfield Alloys determined that capacity at its existing U.S. operations in Bellevue, OH, (MagReTech), which recycles class I scrap, and outside Cleveland, OH, which processes magnesium dross, would be sufficient to meet customer needs (McBeth, 2010a).

Outlook

U.S. magnesium consumption was expected to continue to be directly correlated to the global economy. If the economy recovers, magnesium consumption in the United States should return to its earlier levels. A significant portion of U.S. demand for magnesium will depend on its use in aluminum alloys. Aluminum production in 2011 was expected to increase from that in 2010, with U.S. aluminum producers bringing some additional capacity onstream that had been shut since 2008 and 2009. As of June 1, 2011, however, the U.S. aluminum industry was operating at only 60% of its total production capacity.

Most of the growth in magnesium use in the past decade 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, automotive manufacturers may be less likely to choose magnesium than other lightweight materials, such as plastic, because of the limited availability from multiple producers. Because of antidumping duties assessed on magnesium imported from China, the leading producer, 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. 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. According to Ward's Automotive Group (2011), U.S. light vehicle production for the first half of 2011 was 8.8% higher than that in 2010, which is likely to lead to increased magnesium diecasting production and use in 2011.

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

	2006	2007	2008	2009	2010
United States:					
Production:					
Primary magnesium	W	W	W	W	W
Secondary magnesium	94,900 r	89,300 r	88,400 r	68,600 r	72,000
Exports	12,300	14,800	14,400	19,600	14,800
Imports for consumption	75,300	71,800	83,300	47,300	52,700
Consumption, primary	77,600	72,200	64,500	50,900	55,700
Yearend stocks, producer	W	W	W	W	W
Price[2] dollars per pound	1.35–1.45	2.00–2.50	3.05–3.25	2.20–2.40	2.35–2.50
World, primary production[e]	675,000	751,000	670,000	598,000 r	757,000

[e]Estimated. [r]Revised. 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)

	2009	2010
KIND OF SCRAP		
New scrap:		
Magnesium-base	17,200	21,100
Aluminum-base	30,900 r	30,500
Total	48,100 r	51,500
Old scrap:		
Magnesium-base	1,210	1,210
Aluminum-base	19,300 r	19,300
Total	20,500 r	20,500
Grand total	68,600 r	72,000
FORM OF RECOVERY		
Magnesium alloy ingot[2]	W	W
Magnesium alloy castings	7,970	6,520
Aluminum alloys	51,700 r	54,600
Other[3]	8,900	10,900
Total	68,600 r	72,000

[r]Revised. 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	2009	2010
For structural products:		
Castings:		
Die	19,100	19,600
Permanent mold	107 r	163
Sand	410	424
Wrought products[2]	1,090 r	2,120
Total	20,700	22,300
For distributive or sacrificial purposes:		
Aluminum alloys	23,000	23,800
Cathodic protection (anodes)	686	709
Iron and steel desulfurization	3,970	5,960
Nodular iron	72	412
Reducing agent for titanium, zirconium, hafnium, uranium, beryllium	1,120	882
Other[3]	1,350	1,630
Total	30,200	33,400
Grand total	50,900	55,700

[r]Revised.

[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

		2009	2010
U.S. spot dealer import	dollars per pound	2.25–2.40	2.25–2.40
U.S. spot Western	do.	2.20–2.40	2.35–2.50
China	dollars per metric ton	2,630–2,700	2,900–2,950
European free market	do.	2,700–2,800	2,950–3,050

do. Ditto.

Source: Platts Metals Week.

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

Country	Waste and scrap		Metal		Alloys		Powder, sheets, tubing, ribbons, wire, other forms	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2009:								
Brazil	--	--	220	$648	2,090	$10,100	21	$761
Canada	2,050	$4,630	2,610	8,470	5,290	22,100	217	3,330
Mexico	165	453	520	1,800	1,050	4,760	881	5,480
Singapore	--	--	2,550	9,150	262	944	9	191
United Kingdom	--	--	--	--	10	51	340	10,300
Other	67	119	221	461	488	2,470	581	10,500
Total	2,280	5,200	6,120	20,500	9,190	40,400	2,050	30,500
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

-- 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]

Country	Waste and scrap		Metal		Alloys, magnesium content		Powder, sheets, tubing, ribbons, wire, other forms, magnesium content	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2009:								
Canada	14,800	$24,300	22	$112	687	$3,360	2	$85
China	50	49	4,970	22,600	133	649	122	1,530
Israel	--	--	15,300	58,500	1,040	4,890	--	--
Kazakhstan	--	--	333	918	--	--	--	--
Mexico	805	1,290	25	210	683	2,660	6	323
Russia	--	--	307	1,200	8	75	2	102
United Kingdom	1,410	4,520	5	32	703	10,600	26	1,300
Other[r]	3,840	10,200	433	3,160	1,530	7,530	47	838
Total	20,900	40,300	21,400	86,800	4,790	29,800	205	4,170
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

[r]Revised. -- Zero.

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

Source: U.S. Census Bureau.

TABLE 7

WORLD ANNUAL PRIMARY MAGNESIUM

PRODUCTION CAPACITY, DECEMBER 31, 2010[1]

(Metric tons)

Country	Capacity
Brazil	22,000
China	1,080,000
India	900
Israel	32,000
Kazakhstan	30,000
Russia	80,000
Serbia	5,000
Ukraine	15,000
United States	52,000
Total	1,320,000

[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	2006	2007	2008	2009	2010
Brazil	6,000	18,000	15,000	16,000	16,000
Canada	65,000 [3]	16,300 [3]	2,000 [3]	--	--
China	520,000	625,000	559,000	501,000	654,000
Israel	24,581 [4]	29,618 [4]	32,051 [4]	19,405 [r, 4]	25,000
Kazakhstan	21,000	21,000	21,000	21,000	21,000
Russia[3]	35,000	37,000	37,000	37,000	37,000
Serbia	1,500	2,000	1,500	1,500	1,500
Ukraine	2,200	2,500	2,000	2,000	2,000
United States	W	W	W	W	W
Total	675,000	751,000	670,000	598,000 [r]	757,000

[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 July 13, 2011.

[3]Includes secondary.

[4]Reported figure.