



2010 Minerals Yearbook

FERROALLOYS

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Domestic survey data and tables and the world production table were prepared by Glenn J. Wallace, international data coordinator.

Ferroalloys are alloys of iron employed to add chemical elements into molten metal, usually during steelmaking. Ferroalloys impart distinctive qualities to steel and cast iron or serve important functions during production and are, therefore, closely associated with the iron and steel industry, the leading consumer of ferroalloys. The leading ferroalloy-producing countries in 2010 were, in decreasing order of production, China, South Africa, India, Russia, and Kazakhstan (table 7). These countries accounted for 82% of world ferroalloy production. World production of bulk ferroalloys—chromium, manganese, and silicon—was estimated to have been 34.1 million metric tons (Mt) in 2010, a 16% increase compared with the revised figure of 29.3 Mt for 2009 (table 7).

Eleven companies in the United States produced 8 ferroalloys at 12 plants (table 1). With the exception of ferrosilicon, production statistics for most ferroalloys were concealed to avoid disclosing company proprietary data (table 7). U.S. reported consumption of bulk ferroalloys in 2010 was approximately 0.9 Mt of manganese and silicon ferroalloys (table 3) and about 0.3 Mt of contained chromium in ferrochromium (table 4). Comparing reported consumption in 2010 with that of 2009, ferrochromium increased by 12%, ferromanganese (including silicomanganese) increased by 12%, and ferrosilicon decreased by 3%. The United States was a net importer of ferroalloys and ferroalloy metals in 2010. On a gross weight basis and compared with that in 2009, U.S. total ferroalloy and ferroalloy metal imports increased by 104% and exports increased by 28%, which resulted in a net import increase of 64% (table 6).

Boron, chromium, cobalt, copper, molybdenum, nickel, niobium (columbium), phosphorus, silicon, titanium, tungsten, vanadium, zirconium, and the rare-earth elements are some of the other alloying elements used for the characteristics they provide to steels and cast irons (Brown and Murphy, 1985, p. 265).

Ferrochromium

The leading world chromite ore-producing countries in 2010 were South Africa (more than 10 Mt), India (more than 3 Mt), and Kazakhstan (more than 3 Mt). More than 95% of chromite ore production was smelted in electric-arc furnaces to produce ferrochromium for the metallurgical industry. The leading world ferrochromium-producing countries were China (2 Mt), Kazakhstan (1.3 Mt), and South Africa (3.6 Mt). India produced in excess of 0.8 Mt of ferrochromium. Most of the 8.71 Mt of ferrochromium produced was consumed in the manufacture of stainless steel. The leading stainless steel producing areas of the world—Asia (primarily China, India, Japan, the Republic of Korea, and Taiwan), Europe (primarily Western Europe and

Scandinavia including Belgium, Finland, France, Germany, Italy, Spain, Sweden, and the United Kingdom), and the Americas (primarily Brazil and the United States)—accounted for most of world stainless steel production. World stainless steel production exceeded 30 Mt in 2010.

In response to anticipated future increases in demand, new ferrochromium-producing plants were under construction or planned in Kazakhstan and South Africa. Four industry trends were evolving—ferrochromium was being increasingly produced using environmentally friendly, energy- and recovery-efficient, prereduction, closed-furnace processes; chromium was being recovered from ferrochromium slag; the ferrochromium and stainless steel production industries were consolidating ownership; and strategic alliances between those two industries were being developed.

After the financial crisis of 2008 and subsequent economic downturn, 2010 was a year of recovery with ferrochromium production marginally exceeding the prefinancial-crisis level and reaching an historic high.

Ferromanganese

Two manganese ferroalloys, ferromanganese and silicomanganese, are key ingredients for steelmaking. Manganese ferroalloys were produced domestically by two companies—Eramet Marietta Inc. (owned by France's Eramet Group) and Felman Production Inc. (owned by Ukraine's Privat Group) (table 1). In addition to domestic production in 2010, the United States had to import 623,000 metric tons (t) of ferromanganese and silicomanganese (gross weight). Of that amount, 75% was imported from South Africa (274,000 t), Georgia (79,200 t), Norway (73,300 t), and Ukraine (40,300 t). China was the leading world producer of manganese ferroalloys, with output about 145% greater than that of the next three major producers—India, South Africa, and Ukraine—combined (table 7).

Ferromolybdenum

Chile, China, and the United States accounted for about 79% of world production of molybdenite ore in 2010. Three other molybdenite ore-producing countries—Canada, Mexico, and Peru—supplied an additional 15% of world production. Molybdenite concentrates are roasted to form molybdic oxide, which can be converted into ferromolybdenum, molybdenum chemicals, or molybdenum metal. About 46% of the total reported molybdenum consumed in the United States (19,200 t) was in the form of molybdic oxides, and about 24% was consumed as ferromolybdenum. Although the United States was the second leading molybdenum-producing country in the world, it imported almost one-half of its ferromolybdenum requirements in 2010. The steel industry accounted for most of the ferromolybdenum

consumed in the United States in 2010, principally in the production of stainless and full alloy steels (table 4).

Ferronickel

In the United States, the steel industry accounted for virtually all the ferronickel consumed in 2010, with more than 97% used in stainless, heat-resistant, and certain alloy steels. No ferronickel was produced in the United States in 2010.

In 2010, the major ferronickel-producing countries were Japan (348,000 t), Colombia (145,000 t), and New Caledonia (145,000 t). Together, these three countries accounted for about 57% of world production if China is excluded. Indonesia, Greece, Ukraine, Macedonia, and the Republic of Korea, in descending order of gross-weight output, accounted for an additional 30%—again excluding China. China was not included in these calculations because its industry produced large tonnages of nickel pig iron in addition to a spectrum of conventional ferronickel grades, for an estimated combined output of 900,000 t gross weight. The nickel content of individual Chinese products varied from about 1.6% to as much as 80%, depending upon customer end use.

The Brazilian nickel industry completed construction of two greenfield ferronickel complexes during the fourth quarter of 2010. In October, Vale S.A. began ramping up production at its new \$2.84 billion Onça Puma complex in the Ourilandia do Norte District, Para State. The Onça and Puma Mines, which lie 16 kilometers (km) from one another, have a combined 82.7 Mt of saprolitic reserves averaging 1.73% nickel. Ores from the two open pits were blended in coal-fired rotary kilns and then charged into electric furnaces to produce ferronickel. Commercial production of molten alloy at the Onça Puma complex began in March 2011. The smelter was expected to become fully operational in late 2012 with a production capacity of 53,000 t/yr of nickel-in-ferronickel (Hatch Ltd., undated, p. 22; Vale S.A., 2011).

In December 2010, Anglo American plc started its Barro Alto smelter in Goiás State to process saprolitic ore from the adjoining Barro Alto Mine. Some ore from the Barro Alto Mine was already being processed at Anglo's existing Codemin ferronickel plant, located 170 km away in Niquelandia. In 2010, the Codemin plant produced 8,500 t of nickel-in-ferronickel from Barro Alto and Codemin ores. The Codemin open pit had 7.7 Mt of proven and probable lateritic reserves averaging 1.28% nickel. The Barro Alto open pit had 47.5 Mt of proven and probable lateritic reserves grading 1.68% nickel. The Barro Alto smelter was comprised of two 185-meter-long rotary kilns for calcining the raw ore and two 83-megawatt (MW) electric-arc furnaces for final smelting. The first molten ferronickel at Barro Alto was poured in March 2011. The Barro Alto smelter was expected to be fully operational in late 2012 with a production capacity of 41,000 t/yr of nickel-in-ferronickel. Capital expenditures for the Barro Alto smelter totaled \$1.9 billion (Anglo American plc, 2011a; b, 59–68).

Société Minière du Sud Pacifique and its joint-venture partner, Xstrata plc, continued development of the Koniambo laterite deposit in New Caledonia. Nickel was to be extracted from saprolite ore and converted to ferronickel using an improved version of the pyrometallurgical process employed at Xstrata's

Falcondo smelting and refining complex in the Dominican Republic. The bulk of the \$3.85 billion project's infrastructure was completed by the beginning of 2010. Erection of the smelter and 270 MW powerplant was essentially finished by January 2011, with commissioning scheduled for the second half of 2012. When fully operational in 2014, the Koniambo smelter would be capable of producing 60,000 t/yr of nickel in ferronickel shot. The shot was expected to average 35% nickel, 63% iron, and 0.9% cobalt (Usmar, 2011).

On December 31, 2009, Horsehead Holding Corp. (Pittsburgh, PA) acquired The International Metals Reclamation Co. (INMETCO) from Vale Inco Ltd. of Toronto, Canada. INMETCO operated the sole secondary smelter in North America dedicated to recycling both chromium and nickel from waste materials. The INMETCO smelter, in Ellwood City, PA, has been producing a remelt alloy since 1978 that typically averages 13% chromium and 12% nickel. The remelt alloy was used as a substitute for ferrochromium and ferronickel in the production of stainless steel (Horsehead Holding Corp., 2010).

Ferrosilicon

Silicon ferroalloy consumption is driven by cast iron and steel production, where silicon alloys are used as deoxidizers. Some silicon metal was also used as an alloying agent with iron. On the basis of silicon content, U.S. net production of silicon ferroalloys (ferrosilicon and miscellaneous silicon alloys) was 176,000 t, 27% more than that in 2009. On a gross-weight basis, U.S. net production of ferrosilicon in 2010 (246,000 t) also increased by 27% compared with that of 2009 (table 7). China produced more ferrosilicon than the rest of the world combined and about five times that of the next two major producing countries—Russia and the United States—combined.

Ferrotitanium

Titanium is used in steelmaking for deoxidation, grain-size control, and carbon and nitrogen control and stabilization. During steelmaking, titanium is usually introduced as ferrotitanium because of its lower melting temperature and higher density compared with those of titanium scrap. Steels with relatively high titanium content include interstitial-free, stainless, and high-strength low-alloy steels. Ferrotitanium is usually produced by induction melting of titanium scrap with iron or steel; however, it also is produced directly from titanium mineral concentrates. The standard grades of ferrotitanium are 30% and 70% titanium. U.S. producers of ferrotitanium were Global Titanium Inc. (Detroit, MI), with 10,000 t/yr of ferrotitanium production capacity, and RTI International Metals, Inc. (Canton, OH), with 7,260 t/yr of ferrotitanium and specialty alloy production capacity. The leading ferrotitanium producing countries were China, India, Russia, Ukraine, the United Kingdom, and the United States.

In the United States, reported domestic consumption of titanium products in steel and other alloys was 11,700 t (gross weight), a 25% decrease compared with that of 2009. Increased global steel production in 2010 increased the need for ferrotitanium. Because of increased consumption from steel producers, the average price range for 70%-grade ferrotitanium

increased to \$3.18 to \$3.25 per pound, compared with \$2.12 to \$2.20 per pound in 2009.

Ferrotungsten

Tungsten is an important alloying element in high-speed and other tool steels, and is used to a lesser extent in some stainless and structural steels. Tungsten can be added to steel melts as (1) ferrotungsten, which is a master alloy containing between 75% and 80% tungsten; (2) tungsten melting base, which is a master alloy containing up to 36% tungsten; (3) tungsten metal scrap; or (4) scheelite ore concentrates (Lassner and Schubert, 1999, p. 307–312; Roskill Information Services Ltd., 2007, p. 167–168, 174, 178–179).

World ferrotungsten production was dominated by China. In 2010, Chinese production increased to an estimated 6,000 t, gross weight, of ferrotungsten, from about 5,000 t in 2009, but remained below the 10,000 t/yr typically produced between 2000 and 2008. Chinese ferrotungsten exports increased by 10% in 2010 to 1,280 t, gross weight, from 1,160 t, gross weight, in 2009 (China Metal Market—Precious & Minor Metals Monthly, 2011; Fang, 2011, p. 8). U.S. reported consumption of ferrotungsten was significantly lower than that of 2009. Ferrotungsten prices increased from those of 2009, with the Platts Metals Week price ranging between \$25.50 and \$52.00 per kilogram of contained tungsten during the year.

Ferrovandium

In 2010, China, Russia, and South Africa accounted for 98% of world vanadium mine production. In these three countries, vanadium was primarily recovered from titanium-bearing magnetite ore processed to produce pig iron. The process produces a slag containing 20% to 24% vanadium pentoxide, which can be further processed to ferrovandium containing 40% to 50% vanadium.

In 2010, vanadium recovery from various industrial waste materials, such as vanadium-bearing fly ash, petroleum residues, pig iron slag, and spent catalysts was the leading source of U.S. vanadium production. A small amount of vanadium was obtained as a coproduct from the mining of uraniumiferous sandstones on the Colorado Plateau.

The domestic steel industry accounted for the majority of U.S. reported vanadium consumption in 2010, principally in carbon, full alloy and high-strength, low-alloy steels. Ferrovandium supplied 84% of the 5,000 t of vanadium consumed in the United States; this was a 6% increase compared with the revised figure of 79% for 2009. Steel manufacturing consumed almost all of the ferrovandium in 2010 (table 4).

Outlook

The near-term trend for domestic ferroalloy consumption was expected to follow closely that of U.S. steel production. Details of the outlook for the steel industry are discussed in the Outlook section of the Iron and Steel chapter of the 2010 USGS Minerals Yearbook, volume I, Metals and Minerals. Crude steel production in the United States increased by 36% to 80.5 Mt in 2010 from that in 2009 (Fenton, 2012; table 1). World raw steel production increased by 14% to 1.42 billion metric tons (Gt) in

2010 from that in 2009, with a 33% increase in North American raw steel production to 109.5 Mt. Raw steel production in China, the leading world producer, increased by 9.5% to about 627 Mt. MEPS (International) Ltd. (2011) forecast that world raw steel production would increase by 5% to 1.49 Gt in 2011 from that in 2010, and by 4.4% in 2012.

Changes in steel production reflect changes in apparent use of steel. According to the World Steel Association (2011), world apparent steel use would increase by 5.9% to 1.36 Gt in 2011 and by 6% to 1.44 Gt in 2012. Domestic apparent steel use was expected to increase by 13% in 2011 to 90.5 Mt, as a result of continued recovery in U.S. manufacturing.

Chromium, manganese, silicon, and other ferroalloy metals are discussed in more detail, including domestic data coverage, outlook, and U.S. Government stockpile information, in the respective mineral commodity chapters in the U.S. Geological Survey Minerals Yearbook, volume I, Metals and Minerals.

References Cited

- Anglo American plc, 2011a, Anglo American delivers first production from Barro Alto nickel project in Brazil: London, United Kingdom, Anglo American plc. press release, March 31, 1 p. (Accessed May 7, 2012, at http://www.angloamerican.com/media/releases/2011pr/barro_alto?p=1.)
- Anglo American plc, 2011b, Fact Book 2010/11: London, United Kingdom, Anglo American plc, 128 p. (Accessed May 7, 2012, at http://www.angloamerican.com/~media/Files/A/Anglo-American-Plc/media/fact_book/2011/nickel_factbook_1011.)
- Brown, R.E., and Murphy, G.F., 1985, Ferroalloys, in Mineral facts and problems: U.S. Bureau of Mines Bulletin 675, p. 265–275.
- China Metal Market—Precious & Minor Metals Monthly, 2011, Highlight—Tungsten market in Jan. 2011: China Metal Market—Precious & Minor Metals Monthly, no. 132, March, p. 1–6.
- Fang, Jiyun, 2011, Update of China tungsten market and its forecast: International Tungsten Industry Association Annual General Meeting, 24th, Nice, France, September 20–22, 2011, Presentation, 54 p.
- Fenton, M.D., 2012, Iron and steel, in Metals and minerals: U.S. Geological Survey Minerals Yearbook 2010, v. I, p. 37.1–37.17. (Accessed May 14, 2012, at http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/myb1-2010-feste.pdf.)
- Hatch Ltd., [undated], Onça Puma nickel in production, in Annual review—2011: Mississauga, Ontario, Canada, Hatch Ltd., 55 p.
- Horsehead Holding Corp., 2010, Horsehead Holding Corp. closes on acquisition of The International Metals Reclamation Company (“INMETCO”): Pittsburgh, PA, Horsehead Holding Corp. news release, January 4, 1 p. (Accessed April 20, 2012, at <http://www.horsehead.net/pressreleases.php?showall=no&news=&ID=57>.)
- Lassner, Erik, and Schubert, W.D., 1999, Tungsten—Properties, chemistry, technology of the element, alloys, and chemical compounds: New York, NY, Plenum Publishers, 422 p.
- MEPS (International) Ltd., 2011, Record high steel production forecast for 2011—Further growth in 2012: Sheffield, United Kingdom, MEPS Steel News, January 21. (Accessed July 5, 2011, at <http://www.meps.co.uk/CrudeProductionNews2011.htm>.)
- Roskill Information Services Ltd., 2007, The economics of tungsten (9th ed.): London, United Kingdom, Roskill Information Services Ltd., 220 p.
- Usmar, Shaun, 2011, Xstrata Nickel’s Koniombo project—A cornerstone asset: Hong Kong, China, Xstrata plc presentation, March, 21 p. (Accessed May 7, 2012, at http://www.xstrata.com/content/assets/pdf/xni_speech_201103291.en.pdf.)
- World Steel Association, 2011, Short range outlook: Brussels, Belgium, World Steel Association, April 18. (Accessed January 24, 2012, at <http://www.worldsteel.org/media-centre/press-releases/2011/april-sro.html>.)
- Vale, S.A., 2011, Vale starts nickel production at Onça Puma: Rio de Janeiro, Brazil, Vale S.A. press release, March 11, 1 p. (Accessed May 7, 2012, via <http://www.vale.com.br/en-US/Pages/default.aspx>.)

TABLE 1
DOMESTIC PRODUCERS OF FERROALLOYS IN 2010

Company	Plant location	Products ¹							
		FeCr	FeMo	FeMn	FeNb	FeSi	FeTi	FeV	SiMn
Bear Metallurgical Co.	Butler, PA		X					X	
CC Metals & Alloys, LLC	Calvert City, KY					X			
Core Metals Group ²	Bridgeport, AL					X			
Eramet Marietta Inc.	Marietta, OH	X		X					X
Felman Production Inc.	Letart, WV								X
Global Titanium Inc.	Detroit, MI						X		
Globe Metallurgical Inc. ²	Beverly, OH					X			
Metallurg Vanadium Corp.	Cambridge, OH							X	
Reading Alloys Inc.	Robesonia, PA				X				
RTI International Metals, Inc.	Canton, OH						X		
Stratcor, Inc.	Hot Springs, AR							X	
Thompson Creek Metals Co. Inc.	Langeloth, PA		X						

¹FeCr, ferrochromium; FeMo, ferromolybdenum; FeMn, ferromanganese; FeNb, ferroniobium; FeSi, ferrosilicon; FeTi, ferrotitanium; FeV, ferrovanadium; SiMn, silicomanganese.

²Owned by Globe Specialty Metals.

TABLE 2
GOVERNMENT INVENTORY OF FERROALLOYS, DECEMBER 31, 2010^{1,2}

(Metric tons of alloys unless otherwise specified)

Alloy	Inventory
Ferrochromium:	
High-carbon	95,400
Low-carbon	59,000
Ferromanganese, high-carbon	368,000

¹Data are rounded to no more than three significant digits.

²Data are uncommitted inventory.

Source: Defense Logistics Agency, DLA Strategic Materials.

TABLE 3
 REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ALLOYING ELEMENTS BY END USE IN 2010^{1,2}

(Metric tons of alloys unless otherwise specified)

End use	FeB	Manganese		FeP	FeSi	FeTi
		FeMn	SiMn			
Steel:						
Carbon and high-strength low-alloy	477	247,000	62,100	3,630	37,100 ^{3,4,5}	6,370
Stainless and heat-resisting	(3)	8,790	14,200	(3)	46,600 ³	3,300
Other alloy	(3)	28,900	16,700	(3)	13,100 ^{3,5}	392
Tool	(3)	(5)	(3)	--	(3)	(5)
Unspecified	279	--	904	735	50,800 ⁵	--
Total steel	756	285,000	93,900	4,360	148,000	10,100
Cast irons	(6)	6,970	460	(6)	88,300 ⁵	16
Superalloys	34	(7)	--	(6)	(6)	522
Alloys (excluding alloy steels and superalloys)	(6)	705	2,920	(6)	52,200 ^{4,5}	1,020
Miscellaneous and unspecified	401	(7)	(7)	1,010	177,000 ⁴	42
Grand total	1,190	292,000	97,300	5,370	465,000	11,700
Total 2009	1,110 ^r	255,000 ^r	92,800 ^{r,8}	4,420 ^r	479,000	9,300 ^r
Percentage of 2009	107	115	105	121	97	125
Consumer stocks, December 31	191	30,000 ⁹	28,000 ⁹	805	14,200	1,410

^rRevised. -- Zero.

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

²FeB, ferroboration, including other boron materials; FeMn, ferromanganese, including manganese metal; SiMn, silicomanganese; FeP, ferrophosphorus, including other phosphorus materials; FeSi, ferrosilicon, including silicon metal, silvery pig iron, silicon carbide, and inoculant alloys; FeTi, ferrotitanium, including titanium scrap and other titanium materials.

³All or part included with "Steel, unspecified."

⁴All or part included with "Cast irons."

⁵All or part included with "Steel, other alloy."

⁶All or part included with "Miscellaneous and unspecified."

⁷All or part included with "Alloys (excluding alloy steels and superalloys)."

⁸Internal evaluation indicates that silicomanganese consumption is considerably understated.

⁹Consumer and producer stocks.

TABLE 4
 REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ALLOYING ELEMENTS BY END USE IN 2010^{1,2}

(Metric tons of contained elements unless otherwise specified)

End use	FeCr	FeMo	FeNb	FeNi	FeV	FeW
Steel:						
Carbon	4,140	281	1,630	--	821	--
High-strength low-alloy	2,710	117	(3)	(3)	(4)	--
Stainless and heat-resisting	207,000	721	726	11,100	120	(3)
Other alloy	28,300	3,090	(3)	(3)	3,260	(3)
Tool	(4)	(4)	(3)	(3)	(4)	(3)
Unspecified	--	--	1,810	103	--	129
Total	242,000	4,210	4,160	11,200	4,200	129
Cast irons	677	334	--	--	(4)	--
Superalloys	7,480	(5)	1,400	W	6	(3)
Alloys (excluding alloy steels and superalloys)	2,180	126	24	W	(4)	(3)
Miscellaneous and unspecified	--	--	--	220	--	--
Grand total	253,000	4,670	5,590	11,400	4,210	129
Total 2009	226,000 ^r	4,170	4,350 ^r	9,210 ^r	3,910	246
Percentage of 2009	112	112	128	124	108	52
Consumer stocks, December 31	7,250	347	462	821	181	23

^rRevised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified." -- Zero.

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

²FeCr, ferrochromium, including other chromium ferroalloys and chromium metal; FeMo, ferromolybdenum, including calcium molybdate; FeNb, ferroniobium, including nickel niobium; FeNi, ferronickel; FeV, ferrovanadium, including other vanadium-carbon-iron ferroalloys; and FeW, ferrotungsten.

³Included with "Steel, unspecified."

⁴Included with "Steel, other alloy."

⁵Included with "Alloys (excluding alloy steels and superalloys)."

TABLE 5
FERROALLOY PRICES IN 2010

	High	Low	Average
Chromium:			
Ferrochromium:			
0.05% carbon ¹	242.65	237.86	240.26
0.10% carbon ¹	217.82	213.37	215.60
0.15% carbon ¹	203.24	197.70	200.47
Over 4% carbon:			
49–51% chromium ¹	119.31	115.08	117.20
60–65% chromium ¹	128.42	123.94	126.18
Manganese:			
Medium-carbon ferromanganese ¹	175.00	105.00	129.09
Standard high-carbon ferromanganese ²	1,600.00	1,290.00	1,403.41
Silicomanganese ³	73.00	58.00	64.27
Molybdenum:			
Ferromolybdenum ⁴	18.69	18.23	18.46
Molybdenum oxide ⁴	16.07	15.63	15.85
Silicon:			
50% ferrosilicon ¹	126.00	88.00	109.33
75% ferrosilicon ¹	116.00	77.00	97.18
Silicon metal ¹	165.00	115.00	140.05
Vanadium, ferrovanadium ⁴	14.69	14.16	14.42

¹Cents per pound of contained element.

²Dollars per gross ton.

³Cents per pound.

⁴Dollars per pound of contained element.

Sources: Platts Metals Week and Ryan's Notes.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF FERROALLOYS AND FERROALLOY METALS IN 2010¹

Alloy	Imports			Exports		
	Gross weight (metric tons)	Contained weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained weight (metric tons)	Value (thousands)
Ferroalloys:						
Chromium ferroalloys:						
Ferrochromium containing:						
More than 4% carbon	454,000	261,000	\$597,000	6,530	3,150	\$7,810
Not more than 4% carbon	XX	XX	XX	2,490	1,060	4,820
More than 3% but not more than 4% carbon	1,170	697	1,290	XX	XX	XX
More than 0.5% but not more than 3% carbon	2,370	1,450	5,320	XX	XX	XX
Not more than 0.5% carbon	49,900	34,300	159,000	XX	XX	XX
Ferrochromium-silicon	17,000	7,210	28,200	106	37	225
Total	524,000	305,000	791,000	9,130	4,250	12,900
Manganese ferroalloys:						
Ferromanganese containing:						
More than 4% carbon	201,000	155,000	237,000	XX	XX	XX
More than 2% but not more than 4% carbon	291	238	629	XX	XX	XX
More than 1% but not more than 2% carbon	85,900	68,400	163,000	XX	XX	XX
Not more than 1% carbon	39,500	33,500	92,800	XX	XX	XX
Ferromanganese, all grades	XX	XX	XX	19,100	XX	27,800
Silicomanganese	297,000	197,000	373,000	9,360	XX	13,100
Total	623,000	454,000	866,000	28,500	XX	40,900
Silicon ferroalloys:						
Ferrosilicon containing:						
More than 55% silicon	XX	XX	XX	18,800	11,600	18,200
More than 55% but not more than 80% silicon and more than 3% calcium	4,410	2,910	9,040	XX	XX	XX
Magnesium ferrosilicon	14,500	6,500	26,000	XX	XX	XX
Ferrosilicon, other ²⁻³	210,000	147,000	307,000	6,590	3,110	11,400
Total	229,000	157,000	342,000	25,400	14,700	29,600
Other ferroalloys:						
Ferrocerium and other pyrophoric alloys	148	XX	3,110	XX	XX	XX
Ferromolybdenum	5,330	3,560	130,000	1,430	978	33,100
Ferronickel	30,200	9,420	186,000	69	31	1,280
Ferroniobium	9,660	XX	237,000	395	XX	4,190
Ferrophosphorus	7,650	XX	4,180	1,030	XX	2,000
Ferrotitanium and ferrosilicon-titanium	2,740	XX	11,500	2,570	XX	12,200
Ferrotungsten and ferrosilicon-tungsten	462	357	11,000	(4)	(4)	11
Ferrovandium	1,660	1,340	41,100	882	611	18,100
Ferrozirconium	45	XX	246	569	XX	1,200
Ferroalloys, other	8,730	XX	27,900	4,570	XX	9,210
Total	66,600	14,700	652,000	11,500	1,620	81,300
Total ferroalloys	1,440,000	930,000	2,650,000	74,500	20,600	165,000
Metals:						
Chromium (total, all grades)	13,000	XX	148,000	597	XX	18,400
Manganese:						
Metal, including alloys and waste and scrap	XX	XX	XX	3,660	XX	10,300
Unwrought	34,600	XX	91,800	XX	XX	XX
Other manganese, wrought	617	XX	3,110	XX	XX	XX
Silicon:						
Less than 99% silicon	29,200	27,600	66,000	12,600	12,200	33,700
Less than 99.99% but not less 99% silicon	141,000	138,000	372,000	3,330	3,300	8,390
Not less than 99.99% silicon	4,870	XX	309,000	49,900	XX	2,660,000
Total metals	223,000	166,000	990,000	70,100	15,500	2,730,000
Grand total	1,670,000	1,100,000	3,640,000	145,000	36,100	2,890,000

See footnotes at end of table.

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF FERROALLOYS AND FERROALLOY METALS IN 2010¹

XX Not applicable.

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

²Includes less than 55% silicon and 55% to 80% silicon, other.

³Includes imports of ferrosilicon containing 80% to 90% silicon and more than 90% silicon.

⁴Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
Albania, electric furnace, ferrochromium	17,040	--	11,916	7,556	8,000
Argentina, electric furnace:					
Ferrosilicon ^e	24,400	15,000	10,400	11,300	11,000
Silicomanganese	9,268	8,917	9,172	6,644	6,000
Total ^e	33,700	23,900	19,600	17,900	17,000
Armenia, electric furnace:					
Ferromolybdenum	4,865	5,977	5,325	5,144	5,126 ⁶
Ferrotungsten	42	45	45 ^e	40 ^e	40
Total	4,907	6,022	5,370	5,180	5,170
Australia, electric furnace: ^e					
Ferromanganese	125,000	115,000	147,000	87,000	136,000
Silicomanganese	120,000	110,000	125,000	74,000	131,000
Silicon metal	35,000	35,000	35,000	30,000	30,000
Total	280,000	260,000	307,000	191,000	297,000
Austria, electric furnace: ^e					
Ferronickel, including ferronickel molybdenum	2,250 ^r	2,250 ^r	2,000 ^r	1,750 ^r	1,500
Other	3,600	3,600	3,600	2,000	2,000
Total	5,850 ^r	5,850 ^r	5,600 ^r	3,750 ^r	3,500
Bhutan, electric furnace, ferrosilicon, exports ^e	21,600 ^r	40,300 ^r	30,800 ^r	90,800 ^r	54,500
Bosnia and Herzegovina, electric furnace, net exports: ^e					
Ferrosilicon	1,300	860	640	470	870
Silicon metal	15,200	11,600	12,400	11,000	17,300
Total	16,500	12,500	13,000	11,500	18,200
Brazil, electric furnace:					
Ferrochromium ⁷	166,577	195,890	194,324 ^r	131,048 ^r	170,000 ^p
Ferrochromium silicon	11,600 ^e	11,600 ^e	11,507	11,510	11,600 ^p
Ferromanganese	280,770	205,000 ^r	190,000 ^r	75,000 ^{r,e}	103,000 ^{p,6}
Ferronickel	39,256 ^r	39,672 ^r	36,544 ^r	37,708 ^r	33,860 ^{p,6}
Ferroniobium (ferrocolumbium)	41,566	52,442	53,839 ^r	34,746 ^r	35,000 ^p
Ferrosilicon ^e	146,000	146,000	144,832 ⁶	145,000	145,000
Ferrotitanium	5,000 ^{r,e}	4,988 ^r	4,002 ^r	482 ^{r,e}	498 ^p
Silicomanganese ^e	292,230 ⁶	214,000	198,000	79,000 ^r	107,000
Silicon metal ^e	133,000	133,000	131,940 ⁶	132,000	132,000
Other ^e	19,500	19,500	19,344 ⁶	19,350	19,400
Total	1,135,499 ^r	1,022,092 ^r	984,332 ^r	665,844 ^r	757,000
Bulgaria, electric furnace, ferrosilicon ^e	10,000	10,000	6,000 ^r	3,000 ^r	--
Canada, electric furnace: ^e					
Ferroniobium (ferrocolumbium)	6,298 ⁶	6,571 ⁶	6,644 ⁶	7,000 ^r	7,000
Ferrosilicon	35,000	35,000	35,000	27,200 ^r	35,400
Ferrovanadium	1,000	1,000	1,000	900	900
Silicon metal	30,000	30,000	50,000	30,000	30,000
Total	72,300	72,600	92,600	65,100 ^r	73,300
Chile, electric furnace, ferromolybdenum	14,001	14,828	16,918	10,820 ⁶	12,485 ⁶
China: ^e					
Blast furnace:					
Ferromanganese	600,000	600,000	600,000	350,000 ^r	350,000
Other	60,000	50,000	50,000	30,000	30,000
Total, blast furnace	660,000	650,000	650,000	380,000 ^r	380,000

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
China—Continued: ^e					
Electric furnace:					
Ferchromium	1,000,000	1,300,000	1,500,000	1,810,000 ^r	2,000,000
Ferromanganese	1,400,000	1,930,000	2,100,000	2,070,000 ^r	2,300,000
Ferromolybdenum	90,000	60,000	80,000	90,000	90,000
Ferronickel and high nickel pig iron ⁸	390,000	845,000	590,000	600,000	900,000
Ferrosilicon	4,020,000	4,710,000	4,900,000	5,100,000 ^r	5,300,000
Ferrotitanium	4,000 ^r	10,000 ^r	14,000 ^r	300 ^r	500
Silicomanganese	3,600,000	4,340,000	5,000,000	5,430,000 ^r	5,700,000
Silicon metal	900,000	950,000	980,000	1,230,000 ^r	1,500,000
Other	2,630,000	3,560,000	3,230,000	6,620,000 ^r	7,600,000
Total, electric furnace	14,000,000	17,700,000	18,400,000	23,000,000 ^r	25,400,000
Total, blast and electric furnaces	14,700,000	18,400,000 ^r	19,000,000	23,300,000 ^r	25,800,000
Colombia, electric furnace, ferronickel	151,967 ^r	145,282 ^r	126,638 ^r	153,628 ^r	145,239 ⁶
Czech Republic, electric furnace, other ^e	2,800	2,800	2,800	--	--
Dominican Republic, electric furnace, ferronickel	76,659	75,067	47,408	--	-- ⁶
Egypt, electric furnace: ^e					
Ferromanganese	30,000	30,000	30,000	30,000	30,000
Ferrosilicon	50,000	48,000 ^r	59,000 ^r	78,000 ^r	78,000
Total	80,000	78,000 ^r	89,000 ^r	108,000 ^r	108,000
Finland, electric furnace, ferrochromium	243,350	241,760	233,550	123,310	125,000
France, electric furnace: ^e					
Ferromanganese	137,000	144,000	46,600	46,000	138,000
Ferrosilicon	34,000 ^r	31,000 ^r	30,000 ^r	18,300 ^r	27,000
Silicomanganese	63,300	65,400	60,200	54,100	54,000
Silicon metal	100,000 ^r	120,000 ^r	118,000 ^r	80,000 ^r	112,000
Other	60,000	60,000	60,000	60,000	60,000
Total	394,000 ^r	420,000 ^r	315,000 ^r	258,000 ^r	391,000
Georgia, electric furnace:					
Ferromanganese	5,130	5,000 ^e	5,000 ^e	NA ^r	NA ⁶
Silicomanganese	116,945	120,000 ^e	120,000 ^e	112,016 ^r	203,464 ⁶
Total	122,075	125,000 ^e	125,000 ^e	112,016 ^r	203,464 ⁶
Germany, electric furnace:					
Ferchromium	26,710	22,030	26,960	13,667	20,000
Silicon metal	35,500	35,245	35,000 ^e	20,000 ^e	35,000
Other ^{e,9}	24,100	5,000	5,000	--	--
Total	86,310	62,275	66,960	33,667	55,000
Greece, electric furnace, ferronickel	88,000 ^e	90,000 ^e	87,664	42,423	66,000
Iceland, electric furnace, ferrosilicon	113,798	110,000 ^e	100,000 ^e	112,993 ^r	114,231 ⁶
India, electric furnace: ¹⁰					
Ferroaluminum	9,947	9,377	8,170	7,017	7,000
Ferroboration	80	80	83	90	95
Ferchromium ¹¹	634,200 ^r	820,000 ^r	750,000 ^r	873,385 ^r	850,000
Ferromanganese	296,726	391,210	384,577	389,465	390,000
Ferromolybdenum	3,120	2,899	2,162	2,822	3,000
Ferronickel magnesium	97	122	221	209	210
Ferrosilicomagnesium	11,387	13,525	13,400	17,132	17,000
Ferrosilicon	68,000 ^r	80,000 ^r	92,000 ^r	101,337 ^r	101,000

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
India, electric furnace—Continued: ¹⁰					
Ferrosilicozirconium	178	109	87	120	150
Ferrotitanium	1,761	1,937	1,661	2,379	2,200
Ferrotungsten	54	51	150	150	160
Ferrovandium	1,139	1,585	1,501	1,769	1,800
Silicomanganese	782,962	911,402	891,458	1,099,838	1,000,000
Total	1,809,651 ^r	2,232,297 ^r	2,145,470 ^r	2,495,713 ^r	2,370,000
Indonesia, electric furnace:					
Ferromanganese ^e	12,000	12,000	12,000	12,000	12,000
Ferronickel	72,300	92,500	87,800	62,700 ^r	93,300
Silicomanganese ^e	5,000	6,000	7,000	7,000	8,000
Total	89,300	110,500	106,800	81,700 ^{r,e}	113,000
Iran, electric furnace: ^e					
Ferromanganese	7,000	8,000	8,000	8,000	8,000
Ferrosilicon	-- ^r	-- ^r	-- ^r	-- ^r	-- ⁶
Ferromanganese	-- ^r	-- ^r	-- ^r	-- ^r	-- ⁶
Ferrosilicon	45,000	45,000	45,000	45,000	45,000
Total	52,000	53,000	53,000	53,000	53,000
Italy, electric furnace: ^e					
Ferromanganese	4,500	4,800	8,500	5,500	17,000
Silicomanganese	33,500	37,000	25,500	17,000	23,000
Other ¹²	10,000	10,000	10,000	10,000	10,000
Total	48,000	51,800	44,000	32,500	50,000
Japan, electric furnace:					
Ferromanganese ¹³	13,056	12,016	13,888	7,698 ^r	16,208 ⁶
Ferromanganese	406,162	420,151	431,181	361,375	453,265 ⁶
Ferromolybdenum	4,229	4,573	4,554	3,598	4,615 ⁶
Ferronickel	335,884	351,503	301,361	284,884	348,420 ⁶
Ferrotitanium	NA	NA	NA	NA	NA
Ferrovandium	2,042 ^r	3,205 ^r	3,477	2,560	4,190 ⁶
Silicomanganese	59,424	52,901	58,884	49,205	49,865 ⁶
Other ¹⁴	13,123 ^r	13,982 ^r	14,478	12,957	16,374 ⁶
Total	833,920	858,331	827,823 ^r	722,277 ^r	892,937 ⁶
Kazakhstan, electric furnace:					
Ferromanganese	1,190,673 ^r	1,307,536	1,220,315	1,173,286 ^r	1,250,000
Ferrosilicon	117,607 ^r	145,695	133,828	60,829 ^r	150,000
Ferromanganese ^e	-- ^r	-- ^r	-- ^r	-- ^r	--
Ferrosilicon	85,924 ^r	59,886	54,964	33,100 ^r	20,000
Silicomanganese	218,323 ^r	188,445	179,939	200,374 ^r	215,000 ⁶
Silicon metal	--	--	--	--	1,500
Other ^e	-- ^r	-- ^r	-- ^r	-- ^r	--
Total	1,612,527 ^r	1,701,562 ^r	1,589,046 ^r	1,467,589 ^r	1,640,000
Korea, North, electric furnace, other ^e					
	10,000	10,000	10,000	10,000	10,000
Korea, Republic of, electric furnace:					
Ferromanganese	169,202	209,321	251,125	250,000 ^{r,e}	250,000
Ferronickel	--	--	6,600	56,911 ^r	55,215 ⁶
Silicomanganese	94,119	105,607	76,184	80,000 ^{r,e}	80,000
Other	3,653	4,224	4,000 ^e	-- ^r	--
Total	266,974	319,152	337,909	387,000 ^r	385,000

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
Kosovo, ferronickel	--	3,500 ^{r,15}	24,300 ^{r,15}	27,700 ^{r,e}	30,400
Macedonia, electric furnace:					
Ferromanganese	--	--	12,623	--	-- ⁶
Ferronickel	47,600 ^r	66,600 ^r	65,300 ^r	52,200 ^{r,e}	60,900
Ferrosilicon	59,023	34,215	42,674	7,657	67,000
Silicomanganese	--	70,472	54,931	--	-- ⁶
Total	106,623 ^r	171,287 ^r	175,528 ^r	59,857 ^r	128,000
Mexico, electric furnace: ¹⁶					
Ferromanganese	62,485	74,578	97,366	42,492	42,000
Silicomanganese	97,457	109,286	114,320	85,065	85,000
Total	159,942	183,864	211,686	127,557	127,000
New Caledonia, electric furnace, ferronickel	162,400	151,100	144,300	147,200	145,000 ⁶
Norway, electric furnace: ^c					
Ferromanganese	245,000	245,000	309,000	205,000	297,000
Ferrosilicon	93,000	217,000	250,575 ⁶	207,337 ⁶	210,000
Silicomanganese	230,000	225,000	252,000	200,000	249,000
Silicon metal	100,000	145,782 ⁶	180,135 ⁶	169,643 ⁶	170,000
Other ⁹	15,000	15,000	15,000	15,000	15,000
Total	683,000	848,000	1,010,000	797,000	941,000
Peru, electric furnace, ferrosilicon ^c	600	600	600	600	600
Poland:					
Blast furnace, ferromanganese	4,100	2,100	8,500 ^r	1,700 ^{r,e}	2,000
Electric furnace:					
Ferrosilicon	13,034	58,538	56,031	9,685 ^r	10,000
Silicomanganese	3,310	15,600	25,100 ^r	14,000 ^{r,e}	15,000
Total, electric furnace	16,344	74,138	81,131 ^r	23,700 ^r	25,000
Total, blast and electric furnaces	20,444	76,238	89,631 ^r	25,400 ^r	27,000
Romania, electric furnace:					
Ferrochromium	--	--	W	W	W
Ferromanganese	3,329	--	--	--	--
Silicomanganese	53,085	26,868	10,000	--	20,000
Total	56,414	26,868	10,000	W ^r	20,000
Russia: ^e					
Blast furnace:					
Ferromanganese	130,000	120,000	110,000	88,000 ^{r,6}	171,600 ⁶
Ferrophosphorus	3,500	3,500	3,500	3,000	3,600
Spiegeleisen	7,000	7,000	7,000	6,500	5,500
Total, blast furnace	141,000	131,000	121,000	97,500 ^r	181,000
Electric furnace:					
Ferrochromium	600,000	570,000	490,000	378,000 ⁶	414,000
Ferrochromium silicon	4,000	4,000	4,000	3,500	4,200
Ferronickel:					
High-nickel ^{6,17}	16,085	19,031	17,971	17,489	19,763
Other ^{6,18}	12,340	12,840	13,440	14,040	14,600
Feroniobium (ferrocolumbium)	--	121	121	120	121
Ferrosilicon	882,300 ⁶	896,100 ⁶	850,000	745,000	916,000
Ferrotitanium	NA	NA	NA	NA	4,000

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
Russia, electric furnace—Continued:					
Ferrovandium	11,000	12,000	12,000	8,029 ^{r,6}	13,507 ⁶
Silicomanganese	40,000	40,000	40,000	98,700 ^{r,6}	147,900 ⁶
Silicon metal	54,500	54,000	54,000	23,900 ^r	48,700
Other	22,000	22,000	22,000	20,000	18,000
Total, electric furnace	1,640,000	1,630,000	1,500,000	1,310,000 ^r	1,600,000
Total, blast and electric furnaces	1,780,000	1,760,000	1,620,000	1,410,000 ^r	1,780,000
Saudi Arabia, electric furnace, other ^c	85,000	85,000	90,000	80,000 ^r	90,000
Slovakia, electric furnace:					
Ferromanganese	19	--	--	--	--
Ferromanganese	59,391	74,065	61,194	21,000 ^{r,e}	25,000
Ferrosilicon	16,155	8,583	10,844	8,622	37,034 ⁶
Silicomanganese	59,128	71,587	59,940	32,000 ^{r,e}	35,000
Other ^c	5,000	5,000	--	--	--
Total	139,693	159,235	131,978	61,600 ^r	97,000
Slovenia, electric furnace, ferrosilicon	12,550	6,000 ^e	--	--	--
South Africa, electric furnace:					
Ferromanganese	3,030,000	3,551,983 ^r	3,268,659 ^r	2,346,131 ^r	3,607,132 ⁶
Ferromanganese	656,235	698,654	503,000	260,000 ^e	530,000 ⁶
Ferromanganese, high-nickel	133	6,667	5,733	1,067	1,040 ⁶
Ferrosilicon	148,900	140,000	135,000	120,000 ^e	130,000
Ferrovandium ^c	18,000	19,000	19,000	17,000	18,000
Silicomanganese ^c	247,000	302,000	233,000	110,000	230,000
Silicon metal	58,000 ^r	53,000 ^r	55,000 ^r	38,000 ^{r,e}	53,200
Total	4,158,268 ^r	4,771,304 ^r	4,219,392 ^r	2,892,198 ^r	4,570,000
Spain, electric furnace: ^c					
Ferromanganese	148,000 ^r	155,000 ^r	163,000 ^r	68,000 ^r	152,000
Ferrosilicon	67,000	71,000	74,000 ^r	44,000 ^r	64,400
Silicomanganese	145,000 ^r	153,000 ^r	160,000 ^r	67,000 ^r	150,000
Silicon metal	32,000	32,000	33,000 ^r	23,000 ^r	32,500
Other	5,000	5,000	5,000	5,000	5,000
Total	397,000 ^r	416,000 ^r	435,000 ^r	207,000 ^r	404,000
Sweden, electric furnace:					
Ferromanganese	136,374	124,403	117,053	31,345	36,000
Ferrosilicon ^c	4,000	5,000	5,000	5,000	5,000
Total	140,374	129,403	122,053	36,345	41,000
Thailand, electric furnace, silicon metal	--	--	--	NA	22,500
Turkey, electric furnace:					
Ferromanganese	67,975	69,730	79,840 ^r	41,028	60,000
Ferrosilicon ^c	2,000 ^r	5,000	4,500 ^r	4,000	4,000
Total	69,975 ^r	74,730	84,340 ^r	45,028	64,000
Ukraine:					
Blast furnace:					
Ferromanganese	30,000	26,700	16,000	--	-- ⁶
Spiegeleisen ^c	4,450 ^r	4,730 ^r	2,000 ^r	-- ^r	--
Total, blast furnace ^c	34,500 ^r	31,400 ^r	18,000 ^r	-- ^r	--

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^e
Ukraine, electric furnace—Continued:					
Ferromanganese	373,000	368,000	362,400 ^r	129,400	280,100 ⁶
Ferronickel	79,338	79,530	89,825	61,449	62,000
Ferrosilicon	169,000	218,000	152,800	150,300	195,500 ⁶
Ferrotitanium	NA	NA	NA	NA	NA
Silicomanganese	1,168,000	1,281,000	894,900 ^r	741,900	940,400 ⁶
Other ^e	22,200 ^r	23,700 ^r	23,000 ^r	23,900 ^r	28,500 ⁶
Total, electric furnace	1,811,538 ^r	1,970,230 ^r	1,522,925 ^r	1,106,949 ^r	1,506,500 ⁶
Total, blast and electric furnaces	1,845,988 ^r	2,001,660 ^r	1,540,925 ^r	1,106,949 ^r	1,506,500 ⁶
United Kingdom, electric furnace, ferrotitanium	NA	NA	NA	NA	NA
United States, electric furnace:					
Ferrochromium ¹⁹	W	W	W	W	W
Ferromanganese ²⁰	W	W	W	W	W
Ferрониobium (ferrocolumbium)	NA	NA	NA	NA	NA
Ferrosilicon ²¹	194,000	220,000	248,000	194,000 ^r	246,000 ⁶
Ferrotitanium	NA	NA	NA	NA	NA
Silicon metal ²¹	W	W	W	W	W
Other ²²	W	W	W	W	W
Total	194,000	220,000	248,000	194,000 ^r	246,000 ⁶
Uruguay, electric furnace, ferrosilicon ^c	200	200	200	200	200
Venezuela, electric furnace: ^e					
Ferromanganese	15,000	15,000	15,000	15,000	15,000
Ferronickel ⁶	75,313	68,506	42,300	40,113	40,150
Ferrosilicon	95,000 ^r	94,000 ^r	88,000 ^r	52,100 ^r	76,800
Silicomanganese	35,000	35,000	35,000	35,000	35,000
Total	220,000 ^r	213,000 ^r	180,000 ^r	142,000 ^r	167,000
Zimbabwe, electric furnace:					
Ferrochromium	200,673	187,327	145,430	72,223	150,000
Ferrochromium silicon	1,024	3,097	1,612	603	--
Total	201,697	190,424	147,042	72,826	150,000
Grand total:	32,800,000	38,000,000 ^r	37,300,000 ^r	38,000,000 ^r	44,300,000
Of which:					
Blast furnace:					
Ferromanganese	764,000	749,000	735,000 ^r	440,000 ^r	524,000
Spiegeleisen	11,500 ^r	11,700 ^r	9,000 ^r	6,500 ^r	5,500
Other ²³	63,500	53,500	53,500	33,000	33,600
Total, blast furnace	839,000 ^r	814,000	797,000 ^r	479,000 ^r	563,000
Electric furnace:					
Ferrochromium ²⁴	7,330,000 ^r	8,410,000 ^r	8,060,000 ^r	7,020,000 ^r	8,710,000
Ferrochromium silicon	134,000 ^r	164,000	151,000	76,400 ^r	166,000
Ferromanganese	4,430,000 ^r	5,100,000 ^r	5,130,000 ^r	4,070,000 ^r	5,170,000
Ferromolybdenum	116,000 ^r	88,300 ^r	109,000 ^r	112,000 ^r	115,000
Ferronickel ^{17,18}	1,550,000 ^r	2,050,000 ^r	1,690,000 ^r	1,600,000 ^r	2,020,000
Ferрониobium (ferrocolumbium)	47,900	59,100	60,600 ^r	41,900 ^r	42,100
Ferrosilicon	6,410,000 ^r	7,310,000 ^r	7,430,000 ^r	7,310,000 ^r	7,890,000
Ferrovandium ^e	33,200 ^r	36,800 ^r	37,000	30,300 ^r	38,400
Silicomanganese	7,470,000 ^r	8,490,000 ^r	8,630,000 ^r	8,590,000 ^r	9,480,000

See footnotes at end of table.

TABLE 7—Continued
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE^{1,2}

(Metric tons, gross weight)

Country, furnace type, and alloy type ^{3,4,5}	2006	2007	2008	2009	2010 ^c
Grand total, electric furnace—Continued:					
Silicon metal	1,490,000 ^r	1,600,000 ^r	1,680,000 ^r	1,790,000 ^r	2,180,000
Grand total—Continued:					
Of which:					
Other ²⁵	2,960,000 ^r	3,890,000	3,560,000 ^r	6,910,000 ^r	7,910,000
Total, electric furnace	32,000,000	37,200,000 ^r	36,500,000 ^r	37,500,000 ^r	43,700,000

^cEstimated. ^pPreliminary. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; not included in “Total.” -- Zero.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through October 7, 2011.

³In addition to the countries listed, ferrotungsten is produced in China, Russia, and Vietnam; Austria, China, and Germany are thought to have produced ferroniobium (ferrocolumbium); and Iran is thought to have produced ferromolybdenum and silicomanganese, but production information is inadequate for the formulation of estimates of output levels.

⁴To the extent possible, ferroalloy production of each country has been separated according to the furnace from which production is obtained; production derived from metallothermic operations is included with electric furnace production.

⁵To the extent possible, ferroalloy production of each country has been separated to show the following individual major types of ferroalloys: ferrochromium, ferrochromium silicon, ferromanganese, ferromolybdenum, ferronickel, ferroniobium (ferrocolumbium), ferrosilicon, ferrovandium, silicomanganese, silicon metal, and spiegeleisen. Ferroalloys other than those listed that have been identified specifically in sources, as well as those ferroalloys not identified specifically, but which definitely exclude those listed previously in this footnote, have been reported as “Other.” Where one or more of the individual ferroalloys listed separately in this footnote have been inseparable from other ferroalloys owing to a nation’s reporting system, deviations are indicated by individual footnotes.

⁶Reported figure.

⁷Includes high- and low-carbon ferrochromium.

⁸China currently makes several different types of ferronickel. These products range from a low-nickel pig iron (8.5%–9.0% nickel) to high-nickel ferronickel carbonyl powder (70%–80% nickel). The gross weight figures are based on average estimated content ranging from 20%–25% nickel.

⁹Includes, if any, ferrochromium silicon, ferronickel, and silicomanganese.

¹⁰Reported on a fiscal-year basis, which is from April 1 to March 31.

¹¹Includes charge chrome and ferrochrome.

¹²Excludes calcium-silicon.

¹³Includes high- and low-carbon ferrochromium and ferrochromium silicon.

¹⁴Includes calcium-silicon, ferrocolumbium, and other ferroalloys.

¹⁵On February 17, 2008, the Kosovo Assembly declared independence from Serbia.

¹⁶Salable products from Cía Minera Autlán S.A. de C.V.

¹⁷Low-iron ferronickel containing greater than 85% nickel.

¹⁸Includes ferronickel chromium and Ni-resist cast iron produced from scrap.

¹⁹U.S. output of ferrochromium includes chromium metal, high- and low-carbon ferrochromium, ferrochromium silicon, and other chromium materials.

²⁰U.S. output of ferromanganese includes silicomanganese.

²¹Net production.

²²May include ferroboration, ferrocolumbium, ferromolybdenum, ferrophosphorus, ferrotitanium, ferrovandium, nickel columbium, and silvery pig iron.

²³Includes ferrophosphorus and data contained in “Blast furnace: Other.”

²⁴Ferrochromium includes ferrochromium silicon, if any, for Japan, South Africa, and the United States.

²⁵Includes ferroaluminum, ferroboration, ferronickel magnesium, ferrosilicon magnesium, ferrosilicozirconium, ferrotitanium, and ferrotungsten.