



# 2009 Minerals Yearbook

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## FERROALLOYS

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# FERROALLOYS

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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 2009 were, in decreasing order of production, China, South Africa, India, Kazakhstan, and Russia (table 7). These countries accounted for 83% of world ferroalloy production. World production of bulk ferroalloys—chromium, manganese, and silicon—was estimated to have been 29.4 million metric tons (Mt) in 2009, a 7% decrease compared with the revised figure of 31.5 Mt for 2008 (table 7).

Growth in most ferroalloy industries in response to China's economic growth and infrastructure development during the past few years has put strains on world mine production, ferroalloy production, and transportation facilities. South Africa, a leading ferroalloy producer, experienced electricity shortages in 2007 through 2009, which affected all ferroalloy producers in the country. India's electrical power infrastructure was challenged to the extent that ferroalloy producers in India have constructed their own electrical power generation plants to ensure electrical power supply. Coke, an essential ingredient in ferroalloy production, was also in short supply. Transportation delays were experienced in several countries owing to a shortage of rail haulage cars and port loading problems.

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 2009 was approximately 0.8 Mt of manganese and silicon ferroalloys (table 3) and about 0.2 Mt of contained chromium in ferrochromium (table 4). Comparing reported consumption in 2009 with that of 2008, ferrochromium decreased by 9%, ferromanganese (including silicomanganese) decreased by 20%, and ferrosilicon decreased by 14%. The United States was a net importer of ferroalloys and ferroalloy metals in 2009. On a gross weight basis and compared with that in 2008, U.S. total ferroalloy and ferroalloy metal imports decreased by 58% and exports decreased by 14%, which resulted in a net import decrease of 61% (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 2009 were India (more than 3 Mt), Kazakhstan (more than 3 Mt), and South Africa (more than 6 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 (1.6 Mt), Kazakhstan (1.1 Mt), and South Africa (2.8 Mt). India produced in excess of 0.8 Mt of ferrochromium. Most of the 7.2 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, 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 25 Mt in 2009.

In response to anticipated future demand growth, 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.

Factors affecting world ferrochromium supply in 2009 included electricity shortages, raw material availability, and transportation constraints. As a result, world ferrochromium production was 11% less than that of 2008. The world financial downturn of 2008 and subsequent world recession reduced the need for ferrochromium, which permitted facility development and planning to take place without the stress of material shortages.

## 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). Despite domestic production in 2009, the United States had to import 284,000 metric tons (t) of ferromanganese and silicomanganese (gross weight). Of that amount, 78% was imported from, in decreasing order, South

Africa (146,000 t), Australia (29,356 t), Norway (25,400 t), and Georgia (20,300 t). China was the leading world producer of manganese ferroalloys, with output about 190% greater than that of the next three major producers—India, Japan, and Ukraine—combined (table 7).

### **Ferromolybdenum**

Chile, China, and the United States accounted for about 80% of world production of molybdenite ore in 2009. Three other molybdenite ore-producing countries—Canada, Mexico, and Peru—supplied an additional 13% of world production. Molybdenite concentrates are roasted to form molybdic oxide, which can be converted into ferromolybdenum, molybdenum chemicals, or molybdenum metal. About 47% of the total reported molybdenum consumed in the United States (18,100 t) was in the form of molybdic oxides, and about 23% 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 2009. The steel industry accounted for most of ferromolybdenum consumed in the United States in 2009, principally in the production of stainless and full alloy steels (table 4).

### **Ferronickel**

In 2009, the major ferronickel-producing countries were, in descending order of gross weight output, Japan (285,000 t), Colombia (160,000 t), and New Caledonia (147,000 t). Together, these three countries accounted for about 60% of world production excluding China. Indonesia, Ukraine, Republic of Korea, and Macedonia, in descending order of gross weight output, all produced between 53,000 t and 63,000 t of ferronickel, accounting for 24% of world production, again excluding China. China was a special case and 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 600,000 t gross weight. The nickel content of individual Chinese products varied from about 1.6% to as much as 80%, depending upon customers' end use.

The Falcondo ferronickel operation in the Dominican Republic was on care-and-maintenance status during 2009 and had no production. The production loss from the Dominican Republic was more than offset by production from the new Gwangyang ferronickel smelter in the Republic of Korea. The Gwangyang smelter [a joint venture of Pohang Iron and Steel Co. Ltd. (POSCO) and Société Minière du Sud Pacifique (SMSP)] was commissioned in October 2008. The smelter was designed to process laterite ore, averaging 2.2% nickel, from SMSP's mines in New Caledonia. The Gwangyang ferronickel is produced by the rotary kiln—electric furnace process. By yearend 2009, the Korean smelter was operating close to design capacity—30,000 metric tons per year (t/yr) of nickel in shot averaging 17% to 18% nickel (Rodd and others, 2010).

Brazil had three ferronickel smelting complexes under construction at yearend 2009—Barro Alto (Anglo American plc), Goiás State, Niquelandia (Grupo Votorantim), Goiás State,

and Onca Puma (Vale S.A.), Para State. Of the three, the Barro Alto smelter was expected to become operational first in early 2011, initially producing 18,000 t/yr of nickel in ferronickel. In the South Pacific, Xstrata plc and the SMSP Group planned to commission their Koniambo smelter near Kone, New Caledonia, in mid-2012. The Koniambo smelter would be capable of producing 60,000 t/yr of nickel in ferronickel (Xstrata plc, 2010, p. 14, 50, 82).

In the United States, the steel industry accounted for virtually all the ferronickel consumed in 2009, with more than 95% used in stainless and heat-resisting steels. No ferronickel was produced in the United States in 2009 from either domestic or imported ores, but International Metals Reclamation Company Inc., Ellwood City, PA, produced a remelt alloy from recycled materials, which typically averaged 13% chromium and 12% nickel. Stainless steel producers substituted the remelt alloy for ferrochromium and ferronickel. Almost all U.S. ferronickel exports were either re-exports or material upgraded for specialty purposes.

### **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 126,000 t, 22% less than the revised amount of 161,000 t in 2008. On a gross weight basis, U.S. net production of ferrosilicon in 2009 (194,000 t) also decreased by 22% compared with that of 2008 (table 7). China produced more ferrosilicon than the rest of the world combined and more than five times that of the next two major producing countries—Norway and Russia—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. Ferrosilicon-titanium also is produced to allow the simultaneous addition of silicon and titanium. The leading ferrotitanium producing countries included China, India, Russia, Ukraine, United Kingdom, and the United States.

Global consumption of ferrotitanium was estimated to be about 50,000 t of contained titanium in 2009. In the United States, reported domestic consumption of titanium products in steel and other alloys was 9,290 t (gross weight), a 23%

decrease compared with that of 2008. Decreased global steel production in late 2008 and 2009 reduced the need for ferrotitanium worldwide; in response, ferrotitanium producers idled production capacity. In addition to curtailments that took place in 2008, F.E. Mottram Ltd. (United Kingdom) idled nearly all of its 5,000 t/yr of ferrotitanium production capacity (Metal-Pages, 2009). Even with production cutbacks, excess ferrotitanium inventories were on hand throughout the year.

Because of reduced consumption from steel producers, the average published price for 70%-grade ferrotitanium plummeted to \$1.35 per pound (less than one-half of the yearend price in 2008). By yearend, however, the price increased to \$2.16 per pound, a 28% decrease compared with that in 2008.

## 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, 199, p. 307–312; Roskill Information Services Ltd., 2007, p. 167–168, 174, 178–179).

World ferrotungsten production was dominated by China. In 2009, China produced an estimated 10,000 t, gross weight, of ferrotungsten. Chinese ferrotungsten exports decreased by 76% in 2009 to 1,160 t, gross weight, from 4,835 t, gross weight, in 2008. The decrease in ferrotungsten exports illustrated the effect of the global economic downturn on specialty steel production (Beijing Antaika Information Development Co., Ltd., 2010). U.S. reported consumption of ferrotungsten decreased slightly compared with that of 2008. Ferrotungsten prices decreased from those of 2008, with the Platts Metals Week price ranging between \$25.50 and \$30.00 per kilogram of contained tungsten during the year.

## Ferrovanadium

In 2009, 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 ferrovanadium containing 40% to 50% vanadium.

In 2009, 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 uraniferous sandstones on the Colorado Plateau.

The domestic steel industry accounted for the majority of U.S. reported vanadium consumption in 2009, principally in

carbon, full alloy and high-strength, low-alloy steels. Of the 5,000 t of vanadium consumed in the United States, 78% came from ferrovanadium, a 3% decrease compared with the revised number of 2008. Steel manufacturing consumed almost all of the ferrovanadium in 2009 (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 2009 USGS Minerals Yearbook, volume I, Metals and Minerals. Crude steel production in the United States decreased by 35% to 59.3 Mt in 2009 from that in 2008 (American Iron and Steel Institute, 2010, p. 75). MEPS (International) Ltd. (2010) forecast world raw steel production would increase to 1.4 billion metric tons in 2010 from that in 2009, with a 21% increase in North American raw steel production to 100.5 Mt.

Changes in steel production reflect changes in apparent use of steel. The World Steel Association (2010) reported that U.S. apparent steel use in 2009 decreased by 36% to 59.2 Mt, owing to U.S. economic problems. However, domestic apparent steel use was expected to increase by 33% in 2010 and then by 9% to 86.1 Mt in 2011, as a result of the recovery in U.S. manufacturing and the rebuilding of steel stocks.

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.

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TABLE 1  
DOMESTIC PRODUCERS OF FERROALLOYS IN 2009

Company	Plant location	Products <sup>1</sup>							
		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 <sup>2</sup>	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. <sup>2</sup>	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						

<sup>1</sup>FeCr, ferrochromium; FeMo, ferromolybdenum; FeMn, ferromanganese; FeNb, ferroniobium; FeSi, ferrosilicon; FeTi, ferrotitanium; FeV, ferrovandium; SiMn, silicomanganese.

<sup>2</sup>Owned by Globe Specialty Metals.

TABLE 2  
GOVERNMENT INVENTORY OF FERROALLOYS, DECEMBER 31, 2009<sup>1,2</sup>

(Metric tons of alloys unless otherwise specified)

Alloy	Inventory
Ferrochromium:	
High-carbon	113,000
Low-carbon	61,500
Ferromanganese, high carbon	403,000

<sup>1</sup>Data are rounded to no more than three significant digits.

<sup>2</sup>Data are uncommitted inventory.

Source: Defense Logistics Agency, DLA Strategic Materials (formerly Defense National Stockpile Center).



TABLE 3  
 REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ALLOYING ELEMENTS BY END USE IN 2009<sup>1,2</sup>

(Metric tons of alloys unless otherwise specified)

End use	FeB	Manganese		FeP	FeSi	FeTi
		FeMn	SiMn			
<b>Steel:</b>						
Carbon and high-strength low-alloy	470	196,000	62,000	2,920	28,400 <sup>3,4,5</sup>	4,830
Stainless and heat-resisting	(3)	9,710	14,200	(3)	41,100 <sup>3</sup>	2,600
Other alloy	(3)	28,700	13,500	(3)	11,300 <sup>3,5</sup>	348
Tool	(3)	(3)	(3)	--	(3)	(6)
Unspecified	272	3,180	922	678	56,900 <sup>5</sup>	--
Total steel	742	238,000	90,600	3,600	138,000	7,780
Cast irons	(5)	6,910 <sup>7</sup>	406	(5)	88,200 <sup>5</sup>	12
Superalloys	37	350 <sup>7</sup>	--	4	(4), (5)	462
Alloys (excluding alloy steels and superalloys)	(5)	11,300	2,750	(5)	50,800 <sup>4,5</sup>	993
Miscellaneous and unspecified	334	(7)	(7)	816	179,000 <sup>4</sup>	42
Grand total	1,110	257,000	93,700 <sup>8</sup>	4,420	456,000	9,290
Total 2008	1,140	327,000 <sup>r</sup>	113,000 <sup>8</sup>	5,210	532,000 <sup>r</sup>	12,000 <sup>r</sup>
Percentage of 2008	98	79	83	85	86	77
Consumer stocks, December 31	183	32,000 <sup>9</sup>	25,800 <sup>9</sup>	823	13,600	1,250

<sup>1</sup>Revised. -- Zero.

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

<sup>2</sup>FeB, 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.

<sup>3</sup>All or part included with "Steel, unspecified."

<sup>4</sup>All or part included with "Cast irons."

<sup>5</sup>All or part included with "Miscellaneous and unspecified."

<sup>6</sup>All or part included with "Steel, other alloy."

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

<sup>8</sup>Internal evaluation indicates that silicomanganese consumption is considerably understated.

<sup>9</sup>Consumer and producer stocks.

TABLE 4  
 REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ALLOYING ELEMENTS BY END USE IN 2009<sup>1,2</sup>

(Metric tons of contained elements unless otherwise specified)

End use	FeCr	FeMo	FeNb	FeNi	FeV	FeW
Steel:						
Carbon and high-strength low-alloy	4,180	414	1,620	--	W	(3)
Stainless and heat-resisting	188,000	768	551	8,470	119	(3)
Other alloy	8,200	2,500	(4)	400	1,710	(3)
Tool	(4)	W	(4)	--	64	(3)
Unspecified	16,000	--	1,030	--	--	--
Total	217,000	3,680	3,200	8,870	1,900	246
Cast irons	(5)	314	--	--	W	--
Superalloys	6,920	15	1,130	W	11	(3)
Alloys (excluding alloy steels and superalloys)	9,400 <sup>6</sup>	75	21	W	W	(3)
Miscellaneous and unspecified	(5)	86	--	260	2,000	--
Grand total	233,000	4,170	4,350	9,130	3,910	246
Total 2008	255,000 <sup>r</sup>	5,560	5,380 <sup>r</sup>	11,200 <sup>r</sup>	4,190	253
Percentage of 2008	91	75	81	81	93	97
Consumer stocks, December 31	6,990	325	321	733	232	16

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified."  
 -- Zero.

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

<sup>2</sup>FeCr, 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.

<sup>3</sup>Included with "Steel, total."

<sup>4</sup>Included with "Steel, unspecified."

<sup>5</sup>Included with "Alloys (excluding alloy steels and superalloys)."

<sup>6</sup>Includes "Cast irons," "Alloys (excluding alloy steel and superalloys)," and "Miscellaneous and unspecified" uses.

TABLE 5  
FERROALLOY PRICES IN 2009

	High	Low	Average
<b>Chromium:</b>			
<b>Ferrochromium:</b>			
0.05% carbon <sup>1</sup>	280.00	210.00	234.79
0.10% carbon <sup>1</sup>	255.00	190.00	207.28
0.15% carbon <sup>1</sup>	210.00	175.00	190.80
<b>Over 4% carbon:</b>			
49–51% chromium <sup>1</sup>	92.00	66.00	80.12
60–65% chromium <sup>1</sup>	92.00	65.75	80.95
<b>Manganese:</b>			
Medium-carbon ferromanganese <sup>1</sup>	140.00	80.00	100.52
Standard high-carbon ferromanganese <sup>2</sup>	1,475.00	880.00	1,208.16
Silicomanganese <sup>3</sup>	73.00	34.00	50.72
<b>Molybdenum:</b>			
Ferromolybdenum <sup>4</sup>	12.69	12.22	12.46
Molybdenum oxide <sup>4</sup>	11.41	11.05	11.23
<b>Silicon:</b>			
50% ferrosilicon <sup>1</sup>	90.00	60.00	76.93
75% ferrosilicon <sup>1</sup>	81.00	52.00	68.91
Silicon metal <sup>1</sup>	140.00	102.00	116.37
Vanadium, ferrovanadium <sup>4</sup>	11.19	10.71	10.95

<sup>1</sup>Cents per pound of contained element.

<sup>2</sup>Dollars per gross ton.

<sup>3</sup>Cents per pound.

<sup>4</sup>Dollars 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 2009<sup>1</sup>

Alloy	Imports			Exports		
	Gross weight (metric tons)	Contained weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained weight (metric tons)	Value (thousands)
<b>Ferroalloys:</b>						
Chromium ferroalloys:						
Ferrochromium containing:						
More than 4% carbon	198,000	109,000	\$167,000	3,200	1,770	\$4,270
Not more than 4% carbon	XX	XX	XX	1,560	710	2,440
More than 3% but not more than 4% carbon	3,180	1,720	1,720	XX	XX	XX
More than 0.5% but not more than 3% carbon	2,110	1,280	4,290	XX	XX	XX
Not more than 0.5% carbon	36,600	24,800	111,000	XX	XX	XX
Ferrochromium-silicon	7,560	3,120	9,140	19	6	109
Total	248,000	140,000	294,000	4,780	2,490	6,820
Manganese ferroalloys:						
Ferromanganese containing:						
More than 4% carbon	106,000	81,600	119,000	XX	XX	XX
More than 2% but not more than 4% carbon	637	496	986	XX	XX	XX
More than 1% but not more than 2% carbon	26,600	21,400	52,600	XX	XX	XX
Not more than 1% carbon	20,100	17,200	42,700	XX	XX	XX
Ferromanganese, all grades	XX	XX	XX	24,200	XX	27,900
Silicomanganese	130,000	83,500	135,000	18,800	XX	17,500
Total	284,000	204,000	351,000	42,900	XX	45,400
Silicon ferroalloys:						
Ferosilicon containing:						
More than 55% silicon	XX	XX	XX	10,600	6,950	10,700
More than 55% but not more than 80% silicon and more than 3% calcium	1,650	1,070	2,760	XX	XX	XX
Magnesium ferosilicon	11,100	5,150	20,500	XX	XX	XX
Ferosilicon, other <sup>2,3</sup>	90,100	63,300	103,000	3,650	1,720	6,200
Total	103,000	69,600	126,000	14,200	8,670	16,900
Other ferroalloys:						
Ferrocerium and other pyrophoric alloys and other	1,100	XX	5,370	XX	XX	XX
Ferromolybdenum	3,040	2,030	50,100	1,200	827	22,400
Ferronickel	19,500	6,200	84,900	54	32	1,050
Ferroniobium	4,490	XX	109,000	240	XX	2,740
Ferrophosphorus	138	XX	617	1,130	XX	2,080
Ferrotitanium and ferosilicon-titanium	2,540	XX	6,750	2,020	XX	7,360
Ferrotungsten and ferosilicon-tungsten	60	46	1,260	2	1	55
Ferrovandium	476	353	12,600	971	672	15,000
Ferrozirconium	(4)	XX	7	566	XX	1,140
Ferroalloys, other	4,710	XX	13,900	3,130	XX	6,840
Total	36,000	8,620	284,000	9,310	1,530	58,600
Total ferroalloys	670,000	422,000	1,060,000	71,200	12,700	128,000
<b>Metals:</b>						
Chromium (total, all grades)	7,570	XX	74,900	411	XX	13,300
Manganese:						
Metal, including alloys and waste and scrap	XX	XX	XX	3,150	XX	8,090
Unwrought	21,500	XX	55,000	XX	XX	XX
Other manganese, wrought	614	XX	2,450	XX	XX	XX
Silicon:						
Less than 99% silicon	10,800	10,100	25,000	4,200	4,070	8,030
Less than 99.99% but not less 99% silicon	102,000	100,000	256,000	1,840	1,830	4,340
Not less than 99.99% silicon	2,850	XX	196,000	31,800	XX	2,060,000
Total metals	145,000	110,000	609,000	41,400	5,900	2,090,000
Grand total	815,000	532,000	1,660,000	113,000	18,600	2,220,000

XX Not applicable.

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

TABLE 6—Continued

U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF FERROALLOYS AND FERROALLOY METALS IN 2009<sup>1</sup>

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<sup>2</sup>Includes less than 55% silicon and 55% to 80% silicon, other.

<sup>3</sup>Includes imports of ferrosilicon containing 80% to 90% silicon and more than 90% silicon.

<sup>4</sup>Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3,4,5</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Albania, electric furnace, ferrochromium	34,400	17,040	--	11,916	7,556 <sup>6</sup>
Argentina, electric furnace:					
Ferro silicon <sup>e</sup>	25,700 <sup>f</sup>	24,400 <sup>f</sup>	15,000 <sup>f</sup>	10,400 <sup>f</sup>	11,300
Silicomanganese	13,290 <sup>f</sup>	9,268 <sup>f</sup>	8,917 <sup>f</sup>	9,172 <sup>f</sup>	6,644 <sup>6</sup>
Total <sup>c</sup>	39,000 <sup>f</sup>	33,700 <sup>f</sup>	23,900 <sup>f</sup>	19,600 <sup>f</sup>	17,900
Armenia, electric furnace, ferromolybdenum	2,260	4,865	5,977	5,325 <sup>f</sup>	5,144 <sup>6</sup>
Australia, electric furnace: <sup>e</sup>					
Ferromanganese	120,000	125,000	115,000 <sup>f</sup>	147,000 <sup>f</sup>	87,000
Silicomanganese	120,000 <sup>f</sup>	120,000 <sup>f</sup>	110,000 <sup>f</sup>	125,000 <sup>f</sup>	74,000
Silicon metal	35,000	35,000	35,000	35,000	30,000
Total	275,000 <sup>f</sup>	280,000 <sup>f</sup>	260,000 <sup>f</sup>	307,000 <sup>f</sup>	191,000
Austria, electric furnace: <sup>e</sup>					
Ferro nickel, including ferro nickel molybdenum	3,100	2,800	2,800	1,550 <sup>f</sup>	2,150
Other	4,000	3,600 <sup>f</sup>	3,600 <sup>f</sup>	3,600 <sup>f</sup>	2,000
Total	7,100	6,400 <sup>f</sup>	6,400 <sup>f</sup>	5,150 <sup>f</sup>	4,150
Bhutan, electric furnace, ferro silicon <sup>c</sup>	20,000	20,000	21,000	36,600	36,600
Bosnia and Herzegovina, electric furnace, net exports: <sup>e</sup>					
Ferro silicon	14,600 <sup>f</sup>	1,300 <sup>f</sup>	860 <sup>f</sup>	640 <sup>f</sup>	470
Silicon metal	5,290 <sup>f</sup>	15,200 <sup>f</sup>	11,600 <sup>f</sup>	12,400 <sup>f</sup>	11,000
Total	19,900 <sup>f</sup>	16,500 <sup>f</sup>	12,500 <sup>f</sup>	13,000 <sup>f</sup>	11,500
Brazil, electric furnace:					
Ferro chromium <sup>7</sup>	197,653	166,577	195,890	194,323 <sup>f</sup>	194,500 <sup>p,6</sup>
Ferro chromium silicon	11,600	11,600 <sup>e</sup>	11,600 <sup>e</sup>	11,507 <sup>f</sup>	11,510 <sup>p,6</sup>
Ferromanganese	182,400	280,770	205,000 <sup>f,e</sup>	190,000 <sup>f,e</sup>	66,000
Ferro nickel	28,500 <sup>f,e</sup>	29,100 <sup>f,e</sup>	27,636 <sup>f</sup>	29,223 <sup>f</sup>	26,700 <sup>p</sup>
Ferro niobium (ferrocolumbium)	38,819 <sup>f</sup>	41,566 <sup>f</sup>	52,442 <sup>f</sup>	38,490 <sup>f</sup>	38,500 <sup>p</sup>
Ferro silicon	146,000 <sup>f</sup>	146,000 <sup>f,e</sup>	146,000 <sup>f,e</sup>	144,832 <sup>f</sup>	145,000 <sup>p</sup>
Ferrotitanium	NA	NA	NA	NA	NA
Silicomanganese	297,600	292,230	214,000 <sup>f,e</sup>	198,000 <sup>f,e</sup>	69,000
Silicon metal	133,400 <sup>f</sup>	133,000 <sup>f,e</sup>	133,000 <sup>f,e</sup>	131,940 <sup>f</sup>	132,000 <sup>p</sup>
Other	19,500 <sup>f</sup>	19,500 <sup>f,e</sup>	19,500 <sup>f,e</sup>	19,344 <sup>f</sup>	19,350 <sup>p,6</sup>
Total	1,055,472 <sup>f</sup>	1,120,343 <sup>f</sup>	1,005,068 <sup>f,e</sup>	957,659 <sup>f</sup>	703,000 <sup>p</sup>
Bulgaria, electric furnace, ferro silicon <sup>c</sup>	10,000	10,000	10,000	6,260 <sup>f</sup>	2,600
Canada, electric furnace: <sup>e</sup>					
Ferro niobium (ferrocolumbium)	5,621 <sup>6</sup>	6,298 <sup>6</sup>	6,571 <sup>6</sup>	6,644 <sup>6</sup>	6,000
Ferro silicon	35,000	35,000	35,000	35,000	37,000
Ferro vanadium	1,000	1,000	1,000	1,000	900
Silicon metal	30,000	30,000	30,000	50,000	30,000
Total	71,600	72,300	72,600	92,600	73,900
Chile, electric furnace, ferromolybdenum	9,248	14,001	14,828	16,918	10,820 <sup>6</sup>
China: <sup>c</sup>					
Blast furnace:					
Ferromanganese	500,000	600,000	600,000	600,000	500,000
Other	60,000	60,000	50,000	50,000	30,000
Total, blast furnace	560,000	660,000	650,000	650,000	530,000
Electric furnace:					
Ferro chromium	850,000	1,000,000	1,300,000	1,500,000 <sup>f</sup>	1,550,000
Ferromanganese	1,150,000	1,400,000	1,930,000	2,100,000	2,300,000
Ferromolybdenum	80,000	90,000	60,000	80,000 <sup>f</sup>	90,000

See footnotes at end of table.

TABLE 7—Continued  
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3, 4, 5</sup>	2005	2006	2007	2008	2009 <sup>c</sup>
China—Continued: <sup>c</sup>					
Electric furnace—Continued:					
Ferronickel and high nickel pig iron <sup>8</sup>	48,000	390,000	845,000	590,000	600,000
Ferrosilicon	3,300,000	4,020,000	4,710,000	4,900,000	5,200,000
Ferrotitanium	NA	NA	NA	NA	NA
Silicomanganese	3,000,000	3,600,000	4,340,000	5,000,000 <sup>r</sup>	5,200,000
Silicon metal	840,000	900,000	950,000	980,000	950,000
Other	920,000 <sup>r</sup>	2,630,000 <sup>r</sup>	3,560,000 <sup>r</sup>	3,230,000 <sup>r</sup>	3,050,000
Total, electric furnace	10,200,000	14,000,000	17,700,000	18,400,000	19,000,000
Total, blast and electric furnaces	10,700,000	14,700,000	18,300,000	19,000,000 <sup>r</sup>	19,500,000
Colombia, electric furnace, ferronickel	122,700 <sup>r</sup>	118,900 <sup>r</sup>	114,600 <sup>r</sup>	112,784 <sup>r</sup>	160,477 <sup>6</sup>
Czech Republic, electric furnace, other <sup>c</sup>	2,700	2,800	2,800	2,800	--
Dominican Republic, electric furnace, ferronickel	73,962	76,659	75,067 <sup>r</sup>	47,408 <sup>r</sup>	-- <sup>6</sup>
Egypt, electric furnace: <sup>c</sup>					
Ferromanganese	30,000	30,000	30,000	30,000	30,000
Ferrosilicon	55,000	50,000	50,000	50,000	50,000
Total	85,000	80,000	80,000	80,000	80,000
Finland, electric furnace, ferrochromium	234,881	243,350	241,760	233,550	123,310 <sup>6</sup>
France, electric furnace: <sup>c</sup>					
Ferromanganese	113,000 <sup>r</sup>	137,000 <sup>r</sup>	144,000 <sup>r</sup>	46,600 <sup>r</sup>	46,000
Ferrosilicon	67,000	67,000	71,000	25,000 <sup>r</sup>	25,000
Silicomanganese	52,300	63,300	65,400 <sup>r</sup>	60,200 <sup>r</sup>	54,100
Silicon metal	75,000 <sup>r</sup>	85,000 <sup>r</sup>	85,000 <sup>r</sup>	85,000 <sup>r</sup>	51,000
Other	65,000	60,000	60,000	60,000	60,000
Total	372,000 <sup>r</sup>	412,000 <sup>r</sup>	425,000 <sup>r</sup>	277,000 <sup>r</sup>	236,000
Georgia, electric furnace:					
Ferromanganese	13,945	5,130	5,000 <sup>e</sup>	5,000 <sup>e</sup>	4,500
Silicomanganese	109,414	116,945	120,000 <sup>e</sup>	120,000 <sup>e</sup>	105,000
Total	123,359	122,075	125,000 <sup>e</sup>	125,000 <sup>e</sup>	110,000
Germany, electric furnace:					
Ferrochromium	22,672	26,710	22,030	26,960	13,667 <sup>6</sup>
Silicon metal	29,349	35,500	35,245	35,000 <sup>r, e</sup>	20,000
Other <sup>e, 9</sup>	25,400	24,100	5,000	5,000	--
Total	77,421	86,310	62,275	66,960 <sup>r</sup>	33,667 <sup>6</sup>
Greece, electric furnace, ferronickel <sup>c</sup>	95,000	88,000	90,000	87,664 <sup>r, 6</sup>	42,423 <sup>6</sup>
Hungary, electric furnace: <sup>e, 10</sup>					
Ferrosilicon	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Silicon metal	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Total	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Iceland, electric furnace, ferrosilicon <sup>c</sup>	120,000	113,798 <sup>6</sup>	110,000 <sup>r</sup>	100,000 <sup>r</sup>	125,000
India, electric furnace: <sup>11</sup>					
Ferroaluminum	7,214	9,947	9,377	8,170	7,017 <sup>6</sup>
Ferroboration	75	80	80	83	90 <sup>6</sup>
Ferrochromium <sup>12</sup>	662,297 <sup>r</sup>	801,368 <sup>r</sup>	948,601 <sup>r</sup>	817,239 <sup>r</sup>	892,100 <sup>6</sup>
Ferrochromium silicon <sup>c</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Ferromanganese	273,057 <sup>r</sup>	296,726 <sup>r</sup>	391,210 <sup>r</sup>	384,577 <sup>r</sup>	389,465 <sup>6</sup>
Ferromolybdenum	2,827	3,120	2,899	2,162	2,822 <sup>6</sup>
Ferronickel magnesium	--	97	122	221	209 <sup>6</sup>
Ferriobium (ferrocolumbium)	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--

See footnotes at end of table.

TABLE 7—Continued  
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3, 4, 5</sup>	2005	2006	2007	2008	2009 <sup>c</sup>
<b>India, electric furnace—Continued:</b>					
Ferrosilicomagnesium	11,171	11,387	13,525	13,400	17,132 <sup>6</sup>
Ferrosilicon	93,000 <sup>r</sup>	92,000 <sup>r</sup>	86,000 <sup>r</sup>	93,000 <sup>r</sup>	91,000
Ferrosilicozirconium	87	178	109	87	120 <sup>6</sup>
Ferrotitanium	735	1,761	1,937	1,661	2,379 <sup>6</sup>
Ferrotungsten	63	54	51	150	150 <sup>6</sup>
Ferrovandium	877	1,139	1,585	1,501	1,769 <sup>6</sup>
Silicomanganese	596,372 <sup>r</sup>	782,962 <sup>r</sup>	911,402 <sup>r</sup>	891,458 <sup>r</sup>	1,099,838 <sup>6</sup>
Other	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
<b>Total</b>	<b>1,647,775<sup>r</sup></b>	<b>2,000,819<sup>r</sup></b>	<b>2,366,898<sup>r</sup></b>	<b>2,213,709<sup>r</sup></b>	<b>2,504,091<sup>6</sup></b>
<b>Indonesia, electric furnace:</b>					
Ferromanganese <sup>c</sup>	12,000	12,000	12,000	12,000	12,000
Ferronickel	36,690	72,300	92,500	87,800 <sup>r</sup>	62,750 <sup>6</sup>
Silicomanganese <sup>c</sup>	4,000	5,000	6,000	7,000	7,000
<b>Total</b>	<b>52,690</b>	<b>89,300</b>	<b>110,500</b>	<b>106,800<sup>r</sup></b>	<b>81,800</b>
<b>Iran, electric furnace:<sup>c</sup></b>					
Ferrochromium	8,000	7,000	8,000	8,000	8,000
Ferromanganese	NA	NA	NA	NA	NA
Ferrosilicon	50,000	45,000	45,000	45,000	45,000
<b>Total</b>	<b>58,000</b>	<b>52,000</b>	<b>53,000</b>	<b>53,000</b>	<b>53,000</b>
<b>Italy, electric furnace:<sup>c</sup></b>					
Ferromanganese	9,000 <sup>r</sup>	4,500 <sup>r</sup>	4,800 <sup>r</sup>	8,500 <sup>r</sup>	5,500
Silicomanganese	21,500 <sup>r</sup>	33,500 <sup>r</sup>	37,000 <sup>r</sup>	25,500 <sup>r</sup>	17,000
Other <sup>13</sup>	10,000	10,000	10,000	10,000	10,000
<b>Total</b>	<b>40,500<sup>r</sup></b>	<b>48,000<sup>r</sup></b>	<b>51,800<sup>r</sup></b>	<b>44,000<sup>r</sup></b>	<b>32,500</b>
<b>Japan, electric furnace:</b>					
Ferrochromium <sup>14</sup>	12,367	13,056	12,016	13,888 <sup>r</sup>	7,698 <sup>6</sup>
Ferromanganese	448,616	406,162	420,151	431,181 <sup>r</sup>	361,375 <sup>6</sup>
Ferronickel	391,074	335,884	351,503	301,361 <sup>r</sup>	284,884 <sup>6</sup>
Ferrovandium	--	--	--	3,477	2,560 <sup>6</sup>
Ferrotitanium	NA	NA	NA	NA	NA
Silicomanganese	94,725	59,424	52,901	58,884 <sup>r</sup>	49,205 <sup>6</sup>
Other <sup>15</sup>	16,436	19,394	21,760	14,478 <sup>r</sup>	12,957 <sup>6</sup>
<b>Total</b>	<b>963,218</b>	<b>833,920</b>	<b>858,331</b>	<b>823,269<sup>r</sup></b>	<b>718,679<sup>6</sup></b>
<b>Kazakhstan, electric furnace:</b>					
Ferrochromium	1,156,168	1,200,000 <sup>e</sup>	1,307,536	1,220,315	1,100,000
Ferrochromium silicon	97,870	100,000 <sup>e</sup>	145,695	133,828	125,000
Ferromanganese <sup>c</sup>	2,100	2,100	2,100	2,100	1,900
Ferrosilicon	104,185	105,000 <sup>e</sup>	59,886	54,964	55,400
Silicomanganese	170,214	220,000 <sup>e</sup>	188,445	179,939	160,000
Other <sup>c</sup>	9,000	9,000	9,000	9,000	8,500
<b>Total</b>	<b>1,539,537</b>	<b>1,640,000<sup>e</sup></b>	<b>1,712,662</b>	<b>1,600,146</b>	<b>1,450,000</b>
<b>Korea, North, electric furnace, other<sup>c</sup></b>					
	10,000	10,000	10,000	10,000	10,000
<b>Korea, Republic of, electric furnace:</b>					
Ferromanganese	124,434	169,202	209,321	251,125	250,000
Ferronickel	--	--	--	6,600	56,900
Silicomanganese	74,193	94,119	105,607	76,184	80,000
Other	3,670	3,653	4,224	4,000 <sup>e</sup>	4,000
<b>Total</b>	<b>202,297</b>	<b>266,974</b>	<b>319,152</b>	<b>337,909</b>	<b>391,000</b>

See footnotes at end of table.

TABLE 7—Continued  
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3, 4, 5</sup>	2005	2006	2007	2008	2009 <sup>c</sup>
Kosovo, ferronickel	--	--	2,100 <sup>r, 1</sup>	18,500 <sup>r, 1</sup>	12,400
Macedonia, electric furnace:					
Ferromanganese	--	--	--	12,623	--
Ferronickel	36,800	49,500	68,200	66,900 <sup>r, c</sup>	53,100
Ferrosilicon	71,249	59,023	34,215	42,674	7,657 <sup>6</sup>
Silicomanganese	--	--	70,472	54,931	--
Total	108,049	108,523	172,887	177,128 <sup>r</sup>	60,757 <sup>6</sup>
Mexico, electric furnace: <sup>17</sup>					
Ferromanganese	89,642	62,485	74,578	97,366	42,492 <sup>6</sup>
Silicomanganese	104,780	97,457	109,286	114,320	85,065 <sup>6</sup>
Total	194,422	159,942	183,864	211,686	127,557 <sup>6</sup>
New Caledonia, electric furnace, ferronickel	155,800	162,400	151,100	144,300	147,200 <sup>6</sup>
Norway, electric furnace: <sup>c</sup>					
Ferromanganese	250,000	245,000	245,000	309,000 <sup>r</sup>	205,000
Ferrosilicon	165,000	93,000	217,000 <sup>r</sup>	250,575 <sup>r, 6</sup>	207,337 <sup>6</sup>
Silicomanganese	230,000	230,000	225,000	252,000 <sup>r</sup>	200,000
Silicon metal	105,000	100,000	145,782 <sup>r, 6</sup>	180,135 <sup>r, 6</sup>	169,643 <sup>6</sup>
Other <sup>9</sup>	15,000	15,000	15,000	15,000	15,000
Total	765,000	683,000	848,000 <sup>r</sup>	1,010,000 <sup>r</sup>	797,000
Peru, electric furnace, ferrosilicon <sup>c</sup>	600	600	600	600	600
Poland:					
Blast furnace, ferromanganese	7,800	4,100	2,100 <sup>r</sup>	4,100 <sup>r, c</sup>	4,100
Electric furnace:					
Ferrosilicon	65,118 <sup>r</sup>	13,034 <sup>r</sup>	58,538	56,031	56,000
Silicomanganese	10,242	3,310	15,600 <sup>r</sup>	24,000 <sup>r, c</sup>	24,000
Total, electric furnace	75,360	16,344	74,138	80,031	80,000
Total, blast and electric furnaces	83,160 <sup>r</sup>	20,444 <sup>r</sup>	76,238 <sup>r</sup>	84,131 <sup>r</sup>	84,100
Romania, electric furnace:					
Ferromanganese	18,625	3,329	--	--	--
Silicomanganese	100,957	53,085	26,868	10,000	--
Total	119,582	56,414	26,868	10,000	--
Russia: <sup>e</sup>					
Blast furnace:					
Ferromanganese	110,000	130,000	120,000	110,000	100,000
Ferrophosphorus	3,500	3,500	3,500	3,500	3,000
Spiegeleisen	7,000	7,000	7,000	7,000	6,500
Total, blast furnace	121,000	141,000	131,000	121,000	110,000
Electric furnace:					
Ferchromium	578,000 <sup>6</sup>	600,000	570,000	490,000 <sup>r, c</sup>	378,000 <sup>6</sup>
Ferchromium silicon	4,000	4,000	4,000	4,000	3,500
Ferronickel:					
High-nickel <sup>18</sup>	14,800 <sup>6</sup>	16,085 <sup>6</sup>	19,031 <sup>6</sup>	17,971 <sup>6</sup>	17,489 <sup>6</sup>
Other <sup>19</sup>	11,800 <sup>r</sup>	12,300 <sup>r</sup>	12,800 <sup>r</sup>	13,400 <sup>r</sup>	14,000
Feroniobium (ferrocolumbium)	--	--	121	121	120
Ferrosilicon	742,000 <sup>6</sup>	882,300 <sup>6</sup>	896,100 <sup>6</sup>	850,000	745,000
Ferrotitanium	NA	NA	NA	NA	NA
Ferrovanadium	12,880 <sup>6</sup>	11,000	12,000	12,000	11,500

See footnotes at end of table.

TABLE 7—Continued  
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3,4,5</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Russia—Continued: <sup>e</sup>					
Electric furnace—Continued:					
Silicomanganese	48,000	40,000	40,000	40,000	35,000
Silicon metal	58,000	54,500	54,000	54,000	54,000
Other	22,000	22,000	22,000	22,000	20,000
Total, electric furnace	1,490,000	1,640,000	1,630,000	1,500,000	1,280,000
Total, blast and electric furnaces	1,610,000	1,780,000	1,760,000	1,620,000 <sup>r</sup>	1,390,000
Saudi Arabia, electric furnace, other <sup>e</sup>	--	85,000	85,000	90,000	90,000
Slovakia, electric furnace:					
Ferrochromium	867	19	--	--	--
Ferromanganese	43,458	59,391	74,065	61,194	60,000
Ferrosilicon	16,512	16,155	8,583	10,844 <sup>r</sup>	8,622 <sup>6</sup>
Silicomanganese	47,843	59,128	71,587	59,940	60,000
Other <sup>e</sup>	5,000	5,000	5,000	--	--
Total	113,680	139,693	159,235	131,978 <sup>r</sup>	129,000
Slovenia, electric furnace, ferrosilicon	15,529	12,550	6,000 <sup>e</sup>	--	--
South Africa, electric furnace:					
Ferrochromium	2,812,000	3,030,000	3,552,000 <sup>r</sup>	3,269,000 <sup>r</sup>	2,800,000
Ferromanganese	570,574	656,235	698,654	503,000 <sup>r</sup>	260,000
Ferronickel, high-nickel	120	133	6,667	5,733	1,067 <sup>6</sup>
Ferrosilicon	127,000	148,900	140,000 <sup>r</sup>	135,000 <sup>r</sup>	120,000
Ferrovanadium <sup>e</sup>	19,000	18,000	19,000	19,000 <sup>r</sup>	17,000
Silicomanganese <sup>e</sup>	231,000	247,000	302,000	233,000 <sup>r</sup>	110,000
Silicon metal	53,500	53,300	50,300	51,800 <sup>r</sup>	39,000
Other <sup>e,21</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Total	3,813,194 <sup>r</sup>	4,153,568 <sup>r</sup>	4,768,621 <sup>r</sup>	4,216,533 <sup>r</sup>	3,350,000
Spain, electric furnace: <sup>e</sup>					
Ferromanganese	10,000	10,000	10,000	10,000	10,000
Ferrosilicon	70,000	67,000	71,000	22,000	22,000
Silicomanganese	100,000	100,000	100,000	30,000 <sup>r</sup>	30,000
Silicon metal	32,000	32,000	32,000	12,000 <sup>r</sup>	8,000
Other	5,000	5,000	5,000	5,000	5,000
Total	217,000	214,000	218,000	79,000 <sup>r</sup>	75,000
Sweden, electric furnace:					
Ferrochromium	127,451	136,374	124,403	117,053	31,345 <sup>6</sup>
Ferrosilicon <sup>e</sup>	9,800	4,000	5,000	5,000	5,000
Total	137,251	140,374	129,403	122,053	36,345 <sup>6</sup>
Turkey, electric furnace:					
Ferrochromium	26,043	67,975	69,730	75,840 <sup>r</sup>	41,028 <sup>6</sup>
Ferrosilicon <sup>e</sup>	--	5,000	5,000	5,000	4,000
Total	26,043	72,975	74,730	80,840 <sup>r</sup>	45,028 <sup>6</sup>
Ukraine:					
Blast furnace: <sup>e</sup>					
Ferromanganese	79,000 <sup>r,6</sup>	30,000 <sup>r,6</sup>	26,700 <sup>r,6</sup>	16,000 <sup>r,6</sup>	--
Spiegeleisen	5,000	5,000	4,450 <sup>r</sup>	4,730 <sup>r</sup>	4,700
Total, blast furnace	84,000	35,000	31,200	20,700	4,700
Electric furnace:					
Ferromanganese	359,000	373,000	368,000	361,501 <sup>r</sup>	129,400 <sup>6</sup>
Ferronickel	61,166 <sup>r</sup>	79,338 <sup>r</sup>	79,530 <sup>r</sup>	89,825 <sup>r</sup>	61,449 <sup>6</sup>

See footnotes at end of table.



TABLE 7—Continued  
 FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

(Metric tons, gross weight)

Country, furnace type, and alloy type <sup>3,4,5</sup>	2005	2006	2007	2008	2009 <sup>6</sup>
Ukraine—Continued:					
Electric furnace—Continued:					
Ferrosilicon	228,000	169,000 <sup>r</sup>	218,000 <sup>r</sup>	152,800 <sup>r</sup>	150,300 <sup>6</sup>
Ferrotitanium	NA	NA	NA	NA	NA
Silicomanganese	1,040,000	1,168,000	1,281,000	958,667 <sup>r</sup>	741,900 <sup>6</sup>
Other <sup>c</sup>	25,000	25,000	25,000	43,127 <sup>r,6</sup>	23,882 <sup>6</sup>
Total, electric furnace	1,713,166	1,814,338	1,971,530	1,605,920	1,106,931 <sup>6</sup>
Total, blast and electric furnaces	1,797,166 <sup>r</sup>	1,849,338 <sup>r</sup>	2,002,680 <sup>r</sup>	1,626,650 <sup>r</sup>	1,111,631 <sup>6</sup>
United Kingdom, electric furnace, ferrotitanium	NA	NA	NA	NA	NA
United States, electric furnace:					
Ferrochromium <sup>20</sup>	W	W	W	W	W
Ferromanganese <sup>21</sup>	W	W	W	W	W
Ferroniobium (ferrocolumbium)	NA	NA	NA	NA	NA
Ferrosilicon <sup>22</sup>	164,000	194,000	220,000	248,000 <sup>r</sup>	194,000 <sup>6</sup>
Ferrotitanium	NA	NA	NA	NA	NA
Silicon metal <sup>22</sup>	143,000	W	W	W	W
Other <sup>23</sup>	W	W	W	W	W
Total	307,000	194,000	220,000	248,000 <sup>r</sup>	194,000 <sup>6</sup>
Uruguay, electric furnace, ferrosilicon <sup>e</sup>	200	200	200	200	200
Venezuela, electric furnace: <sup>6</sup>					
Ferromanganese	15,000	15,000	15,000	15,000	15,000
Ferronickel	73,063 <sup>r,6</sup>	75,313 <sup>r,6</sup>	68,506 <sup>r,6</sup>	42,300 <sup>r,6</sup>	40,113 <sup>6</sup>
Ferrosilicon	92,000 <sup>r,6</sup>	92,000 <sup>r</sup>	92,000 <sup>r</sup>	92,000 <sup>r</sup>	83,000
Silicomanganese	35,000	35,000	35,000	35,000	35,000
Total	215,000 <sup>r</sup>	217,000 <sup>r</sup>	211,000 <sup>r</sup>	184,000 <sup>r</sup>	173,000
Zimbabwe, electric furnace:					
Ferrochromium	238,507 <sup>r</sup>	200,673 <sup>r</sup>	187,327 <sup>r</sup>	145,430 <sup>r</sup>	72,223 <sup>6</sup>
Ferrosilicon	4,882 <sup>r</sup>	1,024 <sup>r</sup>	3,097 <sup>r</sup>	1,612 <sup>r</sup>	603 <sup>6</sup>
Total	243,389 <sup>r</sup>	201,697 <sup>r</sup>	190,424 <sup>r</sup>	147,042 <sup>r</sup>	72,826 <sup>6</sup>
Grand total:	28,000,000 <sup>r</sup>	32,800,000 <sup>r</sup>	37,900,000 <sup>r</sup>	37,000,000 <sup>r</sup>	34,600,000
Of which:					
Blast furnace:					
Ferromanganese	697,000 <sup>r</sup>	764,000 <sup>r</sup>	749,000 <sup>r</sup>	730,000 <sup>r</sup>	604,000
Spiegeleisen	12,000	12,000	11,500 <sup>r</sup>	11,700 <sup>r</sup>	11,200
Other <sup>24</sup>	63,500	63,500	53,500	53,500	33,000
Total, blast furnace	772,000 <sup>r</sup>	840,000 <sup>r</sup>	814,000 <sup>r</sup>	795,000 <sup>r</sup>	648,000
Electric furnace:					
Ferrochromium <sup>25</sup>	6,960,000 <sup>r</sup>	7,510,000 <sup>r</sup>	8,540,000 <sup>r</sup>	8,120,000 <sup>r</sup>	7,220,000
Ferrosilicon	118,000 <sup>r</sup>	117,000 <sup>r</sup>	164,000 <sup>r</sup>	151,000 <sup>r</sup>	141,000
Ferromanganese	3,830,000 <sup>r</sup>	4,290,000 <sup>r</sup>	4,950,000 <sup>r</sup>	4,980,000 <sup>r</sup>	4,280,000
Ferromolybdenum	85,100	98,000	68,900	87,500	98,000
Ferronickel <sup>19</sup>	1,150,000 <sup>r</sup>	1,510,000 <sup>r</sup>	2,010,000	1,660,000 <sup>r</sup>	1,580,000
Ferroniobium (ferrocolumbium) <sup>26</sup>	44,400 <sup>r</sup>	47,900 <sup>r</sup>	59,100 <sup>r</sup>	45,300 <sup>r</sup>	44,600
Ferrosilicon	5,810,000 <sup>r</sup>	6,490,000 <sup>r</sup>	7,330,000 <sup>r</sup>	7,370,000 <sup>r</sup>	7,430,000
Ferovanadium <sup>e</sup>	33,800	31,100	33,600	37,000	33,700
Silicomanganese	6,500,000 <sup>r</sup>	7,430,000 <sup>r</sup>	8,440,000 <sup>r</sup>	8,560,000 <sup>r</sup>	8,240,000
Silicon metal	1,540,000 <sup>r</sup>	1,470,000 <sup>r</sup>	1,560,000 <sup>r</sup>	1,630,000 <sup>r</sup>	1,490,000
Other <sup>27</sup>	1,180,000 <sup>r</sup>	2,970,000 <sup>r</sup>	3,890,000 <sup>r</sup>	3,570,000 <sup>r</sup>	3,360,000
Total, electric furnace	27,300,000 <sup>r</sup>	32,000,000 <sup>r</sup>	37,000,000 <sup>r</sup>	36,200,000 <sup>r</sup>	33,900,000

See footnotes at end of table.

TABLE 7—Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE<sup>1,2</sup>

<sup>6</sup>Estimated. <sup>†</sup>Revised. W Withheld to avoid disclosing company proprietary data; not included in “Total.” NA Not available. -- Zero.

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

<sup>2</sup>Table includes data available through August 20, 2010.

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

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

<sup>5</sup>To 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, ferriobium (ferrocolumbium), ferrosilicon, ferrovanadium, 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.

<sup>6</sup>Reported figure.

<sup>7</sup>Includes high- and low-carbon ferrochromium.

<sup>8</sup>China currently makes several different types of ferronickel. These products range from a low nickel pig iron (for example, Zhejiang Huaguang Smelting Group Co., Ltd., 8.5% to 9.0% nickel) to high nickel ferronickel carbonyl powder (Jilin Jien Nickel Industry Co., Ltd., 70% to 80% nickel). The gross weight figures are based on average estimated content ranging from 20% to 25% nickel.

<sup>9</sup>Includes, if any, ferrochromium silicon, ferronickel, and silicomanganese.

<sup>10</sup>Hungary is thought to produce some blast furnace ferromanganese.

<sup>11</sup>Reported on a fiscal year basis, which is from April 1 to March 31.

<sup>12</sup>Includes charge chrome and ferrochrome.

<sup>13</sup>Excludes calcium-silicon.

<sup>14</sup>Includes high- and low-carbon ferrochromium and ferrochromium silicon.

<sup>15</sup>Includes calcium-silicon, ferrocolumbium, ferromolybdenum, ferrovanadium, and other ferroalloys.

<sup>16</sup>On February 17, 2008, the Kosovo Assembly declared independence from Serbia. Serbia’s ferronickel data for 2004–07 are not available.

<sup>17</sup>Salable products from Cía Minera Autlán S.A. de C.V.

<sup>18</sup>Low-iron ferronickel containing greater than 85% nickel.

<sup>19</sup>Includes ferronickel chromium and Ni-resist cast iron produced from scrap.

<sup>20</sup>U.S. output of ferrochromium includes chromium metal, high- and low-carbon ferrochromium, ferrochromium silicon, and other chromium materials.

<sup>21</sup>U.S. output of ferromanganese includes manganese metal and silicomanganese.

<sup>22</sup>Net production.

<sup>23</sup>May include ferroboration, ferrocolumbium, ferromolybdenum, ferrophosphorus, ferrotitanium, ferrovanadium, nickel columbium, and silvery pig iron.

<sup>24</sup>Includes ferrophosphorus and data contained in “Blast furnace: Other.”

<sup>25</sup>Ferrochromium includes ferrochromiumsilicon, if any, for Japan, South Africa, and the United States.

<sup>26</sup>In addition to the countries listed, Austria, China, and Germany are thought to have produced ferriobium (ferrocolumbium), but production information is inadequate to make reliable estimates of output levels.

<sup>27</sup>Includes ferroaluminum, ferroboration, ferronickel magnesium, ferrosilicon magnesium, ferrosilicozirconium, ferrotitanium, and ferrotungsten.