

# FERROALLOYS

By Michael Fenton

Ferroalloys are alloys of iron that contain one or more other chemical elements. These alloys are used to add these other elements into molten metal, usually in steelmaking. The following text contains some salient information on the ferroalloys chromium, manganese, and silicon. These and other ferroalloys are discussed in more detail, including domestic data coverage and outlook, in the respective commodity chapters in the Minerals Yearbooks. These chapters are also published individually in the Mineral Industry Surveys Annual Review series. The tables in this chapter comprise information on all ferroalloys for which data are available.

The major world producers of chromite ore are India, Kazakstan, South Africa, and Turkey; Brazil, Finland, and Zimbabwe were significant producers. Most chromite ore is smelted in an electric arc furnace to produce ferrochromium for use by the metallurgical industry. Stainless steel manufacture is the major end use of ferrochromium. The major producer of ferrochromium is South Africa; China, Finland, India, Japan, Kazakstan, and Zimbabwe are significant producers. The major producers of stainless steel—Western Europe, Scandinavia, Japan, and the United States—account for about 70% of world production.

Manganese ferroalloys are used to provide a key ingredient for steelmaking (Matricardi and Downing, 1995). Most of U.S. supply was imported; France and South Africa were leading sources. The sole domestic producer of manganese ferroalloys was Elkem Metals Co. at its plant in Marietta, OH.

China was by far the largest foreign producer of

manganese ferroalloys, with an output more than twice that of either South Africa or Ukraine, the countries with the next largest outputs. Japanese and South African companies established joint ventures for production of refined and/or specialty grades of ferromanganese and silicomanganese in South Africa.

Demand for silicon ferroalloys is driven principally by the production of steel and cast iron (Dosaj, 1997). On the basis of content, U.S. production of silicon ferroalloys corresponded to roughly two-thirds of apparent consumption; Norway was the leading source of U.S. imports. China was estimated to be easily the world's largest producer of silicon ferroalloys. China's output was almost as great as that of the next four largest producing countries combined, which were Norway, Russia, Ukraine, and the United States. Silicon metal, which like ferrosilicon, was produced in submerged-arc electric furnaces, was used not as a ferroalloy, but rather for alloying with aluminum and for production of chemicals, especially silicones.

## References Cited

- Dosaj, V., 1997, Silicon and silicon alloys—Chemical and metallurgical, *in* Kirk-Othmer encyclopedia of chemical technology (4th ed.): New York, Wiley, v. 21, p. 1104-1122.
- Matricardi, L., and Downing, J., 1995, Manganese and manganese alloys, *in* Kirk-Othmer encyclopedia of chemical technology (4th ed.): New York, Wiley, v. 15, p. 963-990.

TABLE 1  
GOVERNMENT INVENTORY OF FERROALLOYS, DECEMBER 31, 1996 1/

(Metric tons of alloy unless otherwise specified)

Alloy	Stockpile grade	Nonstockpile grade	Total
<b>Ferrochromium:</b>			
High-carbon	695,000	601	695,000
Low-carbon	272,000	10,400	283,000
Ferrochromium-silicon	51,400	1,240	52,700
Ferrocolumbium (kilograms contained columbium)	385,000	151,000	535,000
<b>Ferromanganese:</b>			
High-carbon	968,000	--	968,000
Medium-carbon	17,700	--	17,700
Ferrotungsten (kilograms contained tungsten)	385,000	533,000	918,000
Silicomanganese	183	--	183

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: Defense Logistics Agency; Inventory of Stockpile Material L-1.

TABLE 2  
REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ADDITIVES IN 1996, BY END USE 1/ 2/

(Metric tons of alloys unless otherwise specified)

End use	FeMn	SiMn	FeSi	FeTi	FeP	FeB
<b>Steel:</b>						
Carbon	257,000	93,500	52,800	3,090	3,750	687
Stainless and heat-resisting	13,100	6,020	40,500	1,560	(3/)	31
Other alloy	44,400	36,600	33,900	691	936	432
Tool	(4/)	(4/)	2,830	(3/)	--	--
Unspecified	578	371	142	(3/)	(3/)	--
Total steel	315,000	137,000	130,000	5,340	4,690	1,150
Cast irons	9,020	797	158,000	(5/)	930	(5/)
Superalloys	(5/)	--	346	747	--	46
Alloys (excluding alloy steels and superalloys)	1,140	(6/)	63,600	1,230	43	82
Miscellaneous and unspecified	(5/)	(6/)	265,000	(5/)	11	--
Grand total	326,000	137,000	617,000	7,310	5,670	1,280
Total 1995	348,000	130,000	537,000 r/	5,340 r/	5,860 r/	1,150 r/
Percentage of 1995	93	105	115	137	97	111
Consumer stocks, Dec. 31	27,300 7/	7,760 7/	20,300	721	1,030	220

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

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

3/ Included with "Steel: Other alloy."

4/ Included with "Steel: Unspecified."

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

6/ Withheld to avoid disclosing company proprietary data.

7/ Includes producer stocks.

TABLE 3  
REPORTED U.S. CONSUMPTION OF FERROALLOYS AS ALLOYING ELEMENTS IN 1996, BY END USE 1/ 2/

(Metric tons of contained elements unless otherwise specified)

End use	FeCr	FeMo	FeW	FeV	FeCb	FeNi
Steel:						
Carbon	8,770	316	--	1,820	1,030	--
Stainless and heat-resisting	135,000 3/	343	2	22	413	21,800
Other alloy	25,300 3/	1,920	33	1,920	1,050	--
Tool	3,060	73	434	433	(4/)	--
Unspecified	474	25	--	W	7	--
Total steel	173,000	2,670	469	4,200	2,500	21,800
Cast irons	1,750	905	--	W	--	W
Superalloys	8,180 5/	57	W	16	509	--
Alloys (excluding alloy steels and superalloys)	1,680	87	W	389 6/	W	W
Miscellaneous and unspecified 7/	4,920	68	55	50	7	1,110
Grand total	190,000	3,790	522	4,650	3,020	22,900
Total 1995	193,000	3,370 r/	576 r/	4,650 r/	2,750 r/	21,700 r/
Percentage of 1995	98	112	91	100	110	106
Consumer stocks, Dec. 31	16,300 8/ 9/	966	27	301	290	8,690 10/

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ FeCr, ferrochromium, including other chromium ferroalloys and chromium metal; FeMo, ferromolybdenum, including calcium molybdate; FeW, ferrotungsten, including scheelite; FeV, ferrovandium, including other vanadium-carbon-iron ferroalloys; FeCb, ferrocolumbium, including nickel columbium; FeNi, ferronickel.

3/ Part included with "Steel: Unspecified."

4/ Included with "Steel: Unspecified."

5/ Part included with "Alloys (excluding alloy steels and superalloys)."

6/ Part included with "Miscellaneous and unspecified."

7/ Includes mill products made from metal powder, pigments, catalysts, and other chemicals or ceramic uses.

8/ Includes some producer stocks.

9/ Part withheld to avoid disclosing company proprietary data.

10/ Secondary stocks not yet available.

TABLE 4  
FERROALLOY PRICES IN 1996

	High	Low	Average 1/
Standard-grade ferromanganese 2/	575.00	480.00	531.88
Medium-carbon ferromanganese 3/	56.00	46.50	52.81
Silicomanganese 4/	39.50	23.75	28.35
Charge-grade ferrochromium 3/	64.00	39.80	51.27
High-carbon ferrochromium 3/	65.00	38.50	45.09
Low-carbon ferrochromium 3/	180.00	112.00	137.14
50%-grade ferrosilicon 3/	66.00	63.00	64.00
75%-grade ferrosilicon 3/	64.50	52.00	62.20
Silicon metal 4/	98.00	73.00	89.70
Ferromolybdenum 5/	7.00	4.30	5.11
Molybdenum oxide 5/	5.50	2.90	3.79
Ferrovandium 6/	16.40	14.80	15.43

1/ Annual weighted average.

2/ Dollars per long ton.

3/ Cents per pound of contained element.

4/ Cents per pound.

5/ Dollars per pound of contained element.

6/ Dollars per kilogram of contained element.

Source: Platt's Metal Week.

TABLE 5  
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF FERROALLOYS AND FERROALLOY METALS IN 1996 1/

(Metric tons unless otherwise specified)

Alloy	Imports			Exports		
	Gross weight	Contained weight	Value (thousands)	Gross weight	Contained weight	Value (thousands)
<b>Ferroalloys:</b>						
<b>Chromium ferroalloys:</b>						
<b>Ferrochromium containing:</b>						
More than 4% of carbon	359,000	207,000	\$202,000	12,800	7,800	\$9,650
More than 3% but not more than 4% of carbon	36	23	47	XX	XX	XX
Not more than 3% of carbon	60,700	38,400	87,200	2,780	1,630	4,020
Ferrochromium-silicon	49,600	17,300	32,500	252	88	286
Total	470,000	263,000	322,000	15,800	9,520	14,000
<b>Manganese ferroalloys:</b>						
<b>Ferromanganese containing:</b>						
More than 4% of carbon	284,000	220,000	126,000	XX	XX	XX
More than 2% of carbon	XX	XX	XX	3,120	2,460	1,970
More than 1% but not more than 2% of carbon	78,100	62,900	62,900	XX	XX	XX
Not more than 1% of carbon	11,500	10,200	17,300	XX	XX	XX
Ferromanganese, other	XX	XX	XX	6,680	5,280	6,880
Silicomanganese	323,000	213,000	188,000	5,270	3,420	4,390
Total	697,000	506,000	394,000	15,100	11,200	13,200
<b>Silicon ferroalloys:</b>						
<b>Ferrosilicon containing:</b>						
More than 55% of silicon	XX	XX	XX	12,400	7,560	10,500
More than 55% but not more than 80% of silicon and more than 3% of calcium	1,070	740	1,240	XX	XX	XX
More than 55% but not more than 80% of silicon and not more than 3% of calcium	180,000	136,000	164,000	XX	XX	XX
Magnesium ferrosilicon	8,910	4,100	9,230	39,300	19,700	35,600
Ferrosilicon, other	16,900	5,930	8,810	XX	XX	XX
Total	207,000	147,000	183,000	51,700	27,300	46,100
<b>Other ferroalloys:</b>						
Ferrocerium and other pyrophoric alloys and other	120	(2/)	1,980	XX	XX	XX
Ferromolybdenum	7,870	4,960	54,300	985	581	9,930
Ferronickel	43,400	16,000	111,000	5,650	3,330	32,700
Ferroniobium (columbium)	4,570	(2/)	42,100	254	(2/)	1,490
Ferrophosphorus	10,600	(2/)	5,920	4,420	(2/)	1,760
Ferrotitanium and ferrosilicon-titanium	7,720	(2/)	17,100	777	(2/)	2,330
Ferrotungsten and ferrosilicon-tungsten	702	535	3,410	3	2	22
Ferrovandium	2,470	1,880	28,300	638	479	8,830
Ferrozirconium	212	(2/)	413	101	(2/)	228
Ferroalloys, other	33,900	(2/)	53,000	2,970	(2/)	6,080
Total	111,000	XX	317,000	15,800	XX	63,300
Total ferroalloys	1,480,000	XX	1,220,000	98,400	XX	137,000
<b>Metals:</b>						
Chromium	8,730	(2/)	61,300	1,330	(2/)	12,800
<b>Manganese:</b>						
Unwrought, other	10,100	(2/)	16,800	16,600	(2/)	23,000
Other, other	841	(2/)	2,600	3,630	(2/)	5,760
<b>Silicon:</b>						
Less than 99% of silicon	40,300	38,100	56,400	9,080	8820	13,200
Less than 99.99% but not less 99% of silicon	40,000	39,100	65,400	5,180	5,140	8,050
Not less than 99.99% of silicon	1,520	1,520	92,400	2,750	2,750	188,000
Total	102,000	XX	295,000	38,600	XX	251,000
Grand total	1,590,000	XX	1,510,000	137,000	XX	387,000

XX Not applicable.

1/ Data rounded by the U.S. Geological Survey to three significant digits; may not add to totals shown.

2/ Not recorded.

Source: Bureau of the Census.

TABLE 6  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
Albania: Electric furnace, ferrochromium	21,650 r/	35,600 r/	33,764 r/	42,986 r/	31,189 5/
Argentina: Electric furnace:					
Ferromanganese	4,524	5,400	8,117 r/	5,836 r/	6,000
Ferrosilicon	8,073	19,579	11,669 r/	9,000 e/	10,000
Silicomanganese	30,790	18,500	29,358 r/	27,344 r/	28,000 5/
Other 6/	3,600 r/	5,821 r/	3,700 r/ e/	3,850 r/ e/	3,750
Total	46,987	49,300	52,844 r/	46,030 r/	47,800
Australia: Electric furnace: e/					
Ferromanganese	55,000	75,000	100,000	110,000 r/	110,000
Ferrosilicon	17,000	--	--	--	--
Silicomanganese	75,000	75,000	100,000	100,000 r/	95,000
Silicon metal	30,000	30,000	30,000	30,000	30,000
Total	177,000	180,000	230,000	240,000	235,000
Austria: Electric furnace: e/					
Ferronickel	9,750 5/	8,000 5/	5,250	6,200	5,000
Other	5,900	5,900	5,900	5,900	5,900
Total	15,700	13,900	11,200	12,100	10,900
Belgium: Electric furnace, ferromanganese e/	25,000	25,000	25,000	25,000	25,000
Bhutan: Electric furnace, ferrosilicon e/	--	--	2,000	12,000	12,000
Bosnia and Herzegovina: Electric furnace: e/					
Ferrosilicon	5,000 5/	1,000	1,000	1,000	1,000
Silicon metal	2,000 5/	200	200	200	200
Other	500 5/	--	--	--	--
Total	7,500 5/	1,200	1,200	1,200	1,200
Brazil: Electric furnace:					
Ferrochromium 7/	91,100	83,892	77,163	95,840	72,609 5/
Ferrochromiumsilicon e/	6,760	4,500	5,000	5,000	5,000
Ferromanganese	178,937	201,518	200,000	130,000 e/	160,000
Ferronickel	34,968	34,732	35,260	34,000 e/	34,000
Ferrosilicon	243,838	248,147 r/	198,505	243,824	240,000
Silicomanganese	299,995	284,147	248,000	167,000 e/	210,000
Silicon metal	93,734	106,000	110,000	116,000 r/ e/	165,000
Other e/	76,654 5/	76,000	76,000	76,000	76,000
Total	1,025,986	1,038,936 r/	949,928	867,664 r/	963,000
Bulgaria: Electric furnace: e/					
Ferrosilicon	18,000	18,000	8,000 r/	7,550 r/	8,300
Other	2,000	2,000	2,000	2,000	2,000
Total	20,000	20,000	10,000 r/	9,550 r/	10,300
Canada: Electric furnace: e/					
Ferrosilicon	55,000	55,000	55,000	56,000	56,000
Ferrovanadium	2,000	2,000	2,000	1,000	1,000
Silicon metal	20,000	20,000	20,000	22,000	22,000
Total	77,000	77,000	77,000	79,000	79,000
Chile: Electric furnace:					
Ferrochromium	2,110	680	1,579	2,730	2,700
Ferromanganese	7,460	8,916	8,500 e/	8,500 e/	8,500
Ferromolybdenum	2,310	2,202	2,300 e/	2,300 e/	2,300
Ferrosilicon e/	3,830	7,550	5,600	5,600	5,500
Silicomanganese	1,564	1,612	1,700	1,600 e/	1,600
Total e/	17,300	21,000	19,700	20,700	20,600
China: e/ 8/					
Blast furnace:					
Ferromanganese	550,000	520,000	567,000	400,000 r/	400,000
Other	180,000	200,000	210,000	210,000	200,000
Electric furnace:					
Ferrochromium	410,000	372,000	370,000	400,000	450,000
Ferromanganese	200,000	220,000	350,000	605,000 r/	550,000
Ferrosilicon	834,000	1,040,000	1,100,000	1,210,000 r/	1,200,000
Silicomanganese	420,000	525,000	657,000	830,000 r/	800,000
Other	56,000	58,000	110,000	80,000	100,000
Total	2,650,000	2,930,000	3,360,000	3,740,000 r/	3,700,000
Colombia: Electric furnace, ferronickel	49,256	48,624	50,827	59,917	57,335 5/

See footnotes at end of table.

TABLE 6--Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
<b>Croatia: Electric furnace:</b>					
Ferrochromium	56,456	27,336	31,704 r/	26,081 r/	10,559 5/
Ferromanganese e/	10,000	10,000	10,000	10,000	10,000
Silicomanganese e/	15,000	40,000	30,000	30,000	30,000
Total e/	81,500	77,300	71,700	66,100 r/	50,600
<b>Czech Republic: 9/ Electric furnace e/</b>					
	XX	1,000	1,000	1,000	1,000
<b>Czechoslovakia: 10/ Electric furnace: e/</b>					
Ferrochromium 7/ 11/	52,500 5/	XX	XX	XX	XX
Ferromanganese 12/	70,000	XX	XX	XX	XX
Ferrosilicon	15,000	XX	XX	XX	XX
Silicon metal	5,000	XX	XX	XX	XX
Other 13/	10,000	XX	XX	XX	XX
Total	153,000	XX	XX	XX	XX
<b>Dominican Republic: Electric furnace, ferronickel</b>					
	72,447	62,787	80,989	81,297	80,000 5/
<b>Egypt: Electric furnace:</b>					
Ferromanganese e/	10,000	30,000	35,000	35,000	35,000
Ferrosilicon	36,038	40,136	44,000 r/	44,000 r/ e/	44,000
Total	46,038	70,136	79,000 r/	79,000 r/ e/	79,000
<b>Finland: Electric furnace, ferrochromium</b>					
	187,100	218,370	253,501 r/	246,805 r/	236,000
<b>France:</b>					
Blast furnace, ferromanganese	280,000 e/	300,000	294,000	304,000 r/	300,000
<b>Electric furnace:</b>					
Ferrochromium	6,694	--	--	--	--
Ferromanganese	60,000	57,000	66,200	100,000 r/	80,000
Ferrosilicon	98,000	84,000 r/	111,000	108,000 r/	110,000
Silicomanganese 14/	80,000	80,000	75,000 e/	80,000 e/	80,000
Silicon metal	66,000 r/	59,000	66,000 r/	71,000 r/	65,000
Other e/ 15/	32,000	29,000	20,000	20,000	20,000
Total e/	623,000 r/	609,000 r/	632,000 r/	683,000 r/	655,000
<b>Georgia: Electric furnace: e/</b>					
Ferromanganese	100,000	100,000	10,000	5,000	5,000
Silicomanganese	50,000	50,000	40,000	25,000	15,000
Other	10,000	10,000	5,000	5,000	5,000
Total	160,000	160,000	55,000	35,000	25,000
<b>Germany: e/</b>					
Blast furnace, ferromanganese 16/	130,000	100,000	--	--	--
<b>Electric furnace:</b>					
Ferrochromium	26,520 5/	16,400 5/	17,283 5/	18,000 r/ 5/	16,000
Ferromanganese 12/	30,000	20,000	20,000	20,000	20,000
Ferrosilicon	20,000	20,000	20,000	20,000	20,000
Silicon metal	500	500	500	500	500
Other 13/	30,000	30,000	30,000	30,000	30,000
Total	237,000	187,000	87,800	88,500 r/	86,500
<b>Greece: Electric furnace, ferronickel</b>					
	73,429	52,067	77,129	81,733	86,000
<b>Hungary: 17/ Electric furnace: e/</b>					
Ferrosilicon	7,000	7,000	7,000	7,000	7,000
Silicon metal	1,000	1,000	1,000	1,000	1,000
Other	1,000	1,000	1,000	--	--
Total	9,000	9,000	9,000	8,000	8,000
<b>Iceland: Electric furnace, ferrosilicon</b>					
	51,651	67,375	66,003	71,410 r/	72,000
<b>India: Electric furnace: e/</b>					
Ferrochromium 18/	192,674 r/ 5/	234,500 5/	251,459 5/	300,000	300,000
Ferrochromiumsilicon	9,000	8,000	8,000	9,000	9,000
Ferromanganese	198,000	137,291 5/	150,000	150,000	150,000
Ferrosilicon	90,000	67,600	85,000	85,000	85,000
Silicomanganese	93,000	85,000 5/	140,000	120,000 r/	120,000
Other	6,500	8,600	8,500	8,500	8,500
Total	589,000 r/	541,000	643,000	673,000 r/	673,000
<b>Indonesia: Electric furnace:</b>					
Ferromanganese e/	--	10,000	10,000	14,000	14,000
Ferronickel	27,530 r/	26,330 r/	28,725 r/	53,675	55,000
Silicomanganese e/	--	--	--	7,000	7,000
Total	27,530 r/	36,330 r/	38,725 r/	74,675	76,000

See footnotes at end of table.

TABLE 6--Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
Iran: Electric furnace: e/					
Ferrochromium 19/	--	--	5,000	115,000 r/ 5/	150,000
Ferosilicon	--	--	--	10,000	20,000
Total	--	--	5,000	125,000 r/	170,000
Italy: Electric furnace:					
Ferrochromium	60,315	53,504	22,650	51,017	29,915 5/
Ferromanganese e/	17,079 5/	17,000	16,000	16,000	16,000
Ferosilicon	3,350	--	--	--	--
Silicomanganese e/	50,000	50,000	40,000	40,000	50,000
Silicon metal	10,000	10,000 e/	--	--	--
Other e/ 20/	12,000	12,000	12,000	12,000	10,000
Total e/	153,000	143,000	90,700	119,000	106,000
Japan: Electric furnace:					
Ferrochromium 21/	267,857	204,719	192,989	210,445	193,695 5/
Ferromanganese	361,941	382,912	345,153	346,977	343,104 5/
Ferronickel	237,350	257,316	242,447	351,337	328,699 5/
Ferosilicon	37,656	29,084	12,208	3,650	-- 5/
Silicomanganese	96,360	64,758	69,183	64,870	75,802 5/
Other 22/	12,189	13,666	14,647	12,353	13,206 5/
Total	1,013,353	952,455	876,627	989,632	954,506 5/
Kazakstan: Electric furnace: e/					
Ferrochromium	400,000	327,896 5/	200,000	486,000 r/ 5/	352,000 5/
Ferrochromiumsilicon	40,000	30,000	20,000	25,000	20,000
Ferosilicon	500,000	450,000	250,000 r/	256,000 r/	119,000
Silicomanganese	--	--	40,000	20,000	50,000
Other	20,000	15,000	10,000	10,000	10,000
Total	960,000	823,000	520,000 r/	797,000 r/	551,000
Korea, North: Electric furnace: e/					
Ferromanganese 12/	70,000	70,000	70,000	70,000	70,000
Ferosilicon	30,000	30,000	30,000	30,000	30,000
Other 13/	20,000	20,000	20,000	20,000	20,000
Total	120,000	120,000	120,000	120,000	120,000
Korea, Republic of: Electric furnace:					
Ferromanganese	85,867	100,630	120,020	119,000 r/ e/	126,000
Ferosilicon	55	--	--	--	--
Silicomanganese	82,582	81,996	89,023	97,800 r/ e/	83,000
Total	168,504	182,626	209,043	217,000 r/ e/	209,000
Macedonia: Electric furnace: e/					
Ferrochromium	3,958 5/	4,376 5/	3,164 5/	3,765 5/	3,780 5/
Ferrochromiumsilicon	1,500	--	--	--	--
Ferronickel	4,500	3,500	3,500	3,500	3,000
Ferosilicon	30,000	20,000	20,000	15,000	15,000
Silicon metal	1,000	1,000	1,000	1,000	1,000
Total	41,000 r/	28,900 r/	27,700 r/	23,300 r/	22,800
Mexico: Electric furnace:					
Ferrochromium	70 e/	--	--	--	-- 5/
Ferromanganese	79,000	70,000 e/	67,000 e/	58,000	69,000 5/
Ferosilicon e/	5,000 5/	400	400	--	-- 5/
Silicomanganese	51,000	55,000 e/	64,000 e/	67,700	93,000 5/
Other e/	300 5/	300	300	--	-- 5/
Total e/	135,000	126,000	132,000	125,700 5/	162,000 5/
New Caledonia: Electric furnace, ferronickel	127,580	147,400	157,952	168,800	169,000
Norway: Electric furnace:					
Ferrochromium	102,000	80,000	120,000	137,000 r/	110,000 5/
Ferromanganese	202,680	226,018	248,648	225,000 e/	225,000
Ferosilicon	367,034	399,559	452,984	474,000 r/	462,000 5/
Silicomanganese	213,106	218,566	197,328	200,000 e/	200,000
Silicon metal	73,000 r/	81,000 r/	92,000 r/	101,000 r/	110,000
Other e/ 14/	14,000	14,000	14,000	15,000	15,000
Total e/	972,000 r/	1,020,000 r/	1,120,000 r/	1,150,000 r/	1,120,000
Peru: Electric furnace, ferosilicon e/	600	600	600	600	600

See footnotes at end of table.

TABLE 6--Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
<b>Philippines: Electric furnace:</b>					
Ferrochromium	27,400	11,908	16,186	50,450 r/	--
Ferromanganese e/	5,000	5,000	5,000	5,000	--
Ferrosilicon e/	10,000	10,000	10,000	10,000	--
Total e/	42,400	26,900	31,200	65,500	--
<b>Poland:</b>					
Blast furnace: Ferromanganese	43,400 r/	56,400	66,300 r/	46,300 r/	45,000
<b>Electric furnace:</b>					
Ferrochromium	35,322	38,449	7,353 r/	18,334	18,000
Ferromanganese	4,800	1,100	-- r/	-- r/	--
Ferrosilicon	36,100	43,100	54,200 r/	70,400 r/	70,000
Silicomanganese e/	25,000	25,000	25,000	25,000	25,000
Silicon metal e/	1,300 r/	1,300 r/	1,300 r/	1,300 r/	1,300
Other e/ 13/	25,000	20,000	20,000	20,000	20,000
Total e/	171,000 r/	185,000 r/	174,000 r/	181,000 r/	179,000
<b>Romania: Electric furnace:</b>					
Ferrochromium	6,971 r/	3,907	3,885	15,053	9,650 5/
Ferromanganese e/	27,100 r/	16,400	31,300	28,410 5/	20,200
Ferrosilicon	23,300	23,600	28,385	19,320	23,827 5/
Silicomanganese e/	28,200	22,000	35,200	57,149 5/	78,600
Silicon metal e/	430 5/	400	300	300	300
Total e/	86,000 r/	66,300	99,100	120,000	133,000
<b>Russia: e/</b>					
<b>Blast furnace:</b>					
Ferromanganese	200,000	150,000	55,000	55,000	55,000
Ferrophosphorus	30,000	25,000	20,000	20,000	20,000
Spiegeleisen	10,000	8,000	7,000	7,000	7,000
<b>Electric furnace:</b>					
Ferrochromium	400,000	255,900 5/	265,525 5/	200,000	50,000
Ferrochromiumsilicon	60,000	40,000	40,000	30,000	5,000
Ferronickel	46,000	47,000	59,000	77,000	75,000
Ferrosilicon	500,000	400,000	350,000	350,000	350,000
Silicomanganese	--	--	--	700	--
Silicon metal	60,000	50,000	40,000	40,000	40,000
Other	60,000	50,000	40,000	40,000	40,000
Total	1,370,000	1,030,000	877,000	820,000 r/	642,000
Serbia and Montenegro: Electric furnace, ferronickel	6,481	1,283	1,763	2,414	6,554 5/
<b>Slovakia: 10/ Electric furnace: e/</b>					
Ferrochromium	XX	50,600 5/	48,555 5/	65,260 5/	65,000
Ferromanganese	XX	22,000	25,000	25,000	25,000
Ferrosilicon	XX	22,000	30,000	30,000	30,000
Silicomanganese	XX	12,000	12,000	12,000	12,000
Other	XX	8,000	8,000	8,000	8,000
Total	XX	115,000 r/	124,000 r/	140,000 r/	140,000
<b>Slovenia: Electric furnace: e/</b>					
Ferrochromium	17,104 5/	9,000 5/	12,592 5/	18,876 5/	19,000
Ferrosilicon	14,000	12,000	12,000	12,000	10,000
Other 6/	5,400 r/	200 r/	200 r/	200 r/	200
Total	36,500	21,200	24,800	31,100	29,200
<b>South Africa: Electric furnace:</b>					
Ferrochromium 23/	770,600	833,600	1,103,612	1,386,400 r/	1,400,000
Ferromanganese	269,807	393,372	590,535	507,000 r/	480,000
Ferrosilicon	63,900	98,800	119,714	92,667 r/	96,000
Silicomanganese	266,556	268,123	290,400	251,000 r/	250,000
Silicon metal	34,528	38,279	36,169	30,082	35,000
Other e/	1,000	1,000	1,000	1,000	1,000
Total e/	1,410,000	1,630,000	2,140,000	2,270,000 r/	2,260,000

See footnotes at end of table.



TABLE 6--Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
<b>Spain: Electric furnace: e/</b>					
Ferchromium	--	2,390 5/	2,300 5/	1,320 5/	805 5/
Ferromanganese	50,000	40,000	35,000	25,000	25,000
Ferrosilicon	40,000	30,000	25,000	30,000	30,000
Silicomanganese	40,000	35,000	35,000	50,000 r/	50,000
Silicon metal	10,000	5,000	3,000	5,000	5,000
Other	5,000	5,000	4,000	5,000	5,000
Total	145,000	117,000	104,000	116,000 r/	116,000
<b>Sweden: Electric furnace:</b>					
Ferchromium	133,300	127,543	134,076	130,170 r/	138,110 5/
Ferrosilicon	15,451	20,381	21,392 r/	21,970 r/	21,000
Total	148,751	147,924	155,468 r/	152,140 r/	159,000
<b>Switzerland: Electric furnace: e/</b>					
Ferrosilicon	3,000	3,000	-- r/	-- r/	--
Silicon metal	2,000	2,000	-- r/	-- r/	--
Total	5,000	5,000	-- r/	-- r/	--
<b>Taiwan: Electric furnace:</b>					
Ferromanganese	38,000	13,628	7,000	5,000 e/	5,000
Ferrosilicon	2,606	689	500 e/	400 e/	500
Silicomanganese	4,000	--	--	--	--
Total	44,606	14,317	7,500	5,400 e/	5,500
<b>Thailand: Electric furnace:</b>					
Ferromanganese	549	70	140	150 e/	150
Silicomanganese	4,275	1,503	689	650 e/	650
Total	4,824	1,573	829	800 e/	800
<b>Turkey: Electric furnace:</b>					
Ferchromium	85,755	90,030	97,585	94,251 r/	101,450 5/
Ferrosilicon	1,250	4,680	4,930	11,900 r/	12,000
Total	87,005	94,710	102,515	106,151 r/	113,000
<b>Ukraine: e/</b>					
<b>Blast furnace:</b>					
Ferromanganese	50,000	40,000	30,000	25,000 r/	30,000
Spiegeleisen	5,000	4,000	3,000	2,500	2,500
<b>Electric furnace:</b>					
Ferromanganese	250,000 r/	140,000 r/	170,000 r/	170,000 r/	190,000
Ferronickel	98,333 r/ 5/	50,000	23,000	23,000	8,300
Ferrosilicon	500,000	400,000	300,000 r/	300,000	300,000
Silicomanganese	1,100,000 r/	735,000 r/	600,000 r/	600,000 r/	650,000
Other	40,000	30,000	25,000	25,000	25,000
Total	2,040,000 r/	1,400,000 r/	1,150,000 r/	1,150,000 r/	1,210,000
<b>United Kingdom:</b>					
Blast furnace, ferromanganese	137,000	45,000	--	--	--
Electric furnace, other e/	10,000	10,000	--	--	--
Total e/	147,000	55,000	--	--	--
<b>United States: Electric furnace:</b>					
Ferchromium 24/	60,900	63,000	67,400	72,500	36,800 5/
Ferronickel	18,200	9,930	--	16,800	30,500 5/
Ferrosilicon	346,000	323,000	359,000	358,000	362,000 5/
Silicon metal	159,000	159,000	158,000	158,000	171,000 5/
Other 25/	190,000	161,000	200,000	188,000	99,000 5/
Total	773,000	715,000	784,000	793,000	699,000 5/
Uruguay: Electric furnace, ferrosilicon e/	250	250	250	200 r/	250
<b>Venezuela: Electric furnace: e/</b>					
Ferromanganese	8,570	--	--	--	--
Ferrosilicon	40,000	47,000	41,000	50,000 r/	50,000
Silicomanganese	32,100	42,200	40,000	40,000	40,000
Total	80,700	89,200	81,000	90,000 r/	90,000
<b>Zimbabwe: Electric furnace:</b>					
Ferchromium	190,994	124,000	182,852	254,142	261,918 5/
Ferchromiumsilicon	20,282	10,000 e/	36,531	46,667	33,175 5/
Ferromanganese	--	2,151	--	--	--
Total	211,276	136,151	219,383	300,809	295,093 5/

See footnotes at end of table.

TABLE 6--Continued  
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE TYPE, AND ALLOY TYPE 1/ 2/

(Metric tons, gross weight)

Country, furnace type, 3/ and alloy type 4/	1992	1993	1994	1995	1996 e/
Grand total:	16,900,000 r/	15,900,000 r/	16,200,000 r/	17,500,000 r/	17,000,000
Of which:					
Blast furnace:					
Ferromanganese 26/	1,390,000	1,210,000	1,010,000 r/	830,000 r/	830,000
Spiegeleisen 26/	15,000	12,000	10,000	9,500	9,500
Other 27/	210,000	225,000	230,000	230,000	220,000
Total, blast furnace	1,620,000	1,450,000	1,250,000 r/	1,070,000 r/	1,060,000
Electric furnace:					
Ferrochromium 28/	3,610,000 r/	3,270,000	3,520,000	4,440,000 r/	4,060,000
Ferrochromiumsilicon	97,500	62,500	89,500	90,700	52,200
Ferromanganese 29/ 30/	2,420,000 r/	2,400,000 r/	2,720,000 r/	2,820,000 r/	2,770,000
Ferronickel	806,000 r/	749,000 r/	766,000 r/	960,000 r/	938,000
Ferrosilicon	4,070,000	4,040,000 r/	3,840,000 r/	4,030,000 r/	3,870,000
Silicomanganese 29/ 31/	3,060,000 r/	2,770,000 r/	2,860,000 r/	2,910,000 r/	3,040,000
Silicon metal	569,000	564,000 r/	559,000 r/	577,000 r/	647,000
Other 32/	639,000	577,000	632,000	588,000	518,000
Total, electric furnace	15,300,000 r/	14,400,000	15,000,000 r/	16,400,000 r/	15,900,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through Aug. 25, 1997.

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

4/ To the extent possible, ferroalloy production of each country has been separated to show the following individual major types of ferroalloys: ferrochromium, ferrochromiumsilicon, ferromanganese, ferronickel, ferrosilicon, 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.

5/ Reported figure.

6/ Includes calciumsilicon.

7/ Includes high- and low-carbon ferrochromium.

8/ Estimated to have had an annual production capacity for silicon metal in excess of 200,000 tons in 1995. Data for actual production are not available.

9/ Formerly part of Czechoslovakia; data were not reported separately until 1993.

10/ Dissolved Dec. 31, 1992.

11/ All production in Czechoslovakia for 1992 came from Slovakia.

12/ Includes silicomanganese, if any.

13/ Includes ferrochromiumsilicon and ferronickel, if any.

14/ Includes silicospiegeleisen, if any.

15/ Includes ferronickel if any.

16/ Includes spiegeleisen, if any.

17/ Hungary is believed to produce some blast furnace ferromanganese.

18/ Includes ferrochrome and charge chrome.

19/ Production began in 1994. Plant capacity is estimated to be 7,000 tons per year.

20/ Series excludes calcium silicide.

21/ Includes net consumption of ferrochromiumsilicon.

22/ Includes calciumsilicon, ferrocolumbium, ferromolybdenum, ferrotungsten, ferrovanadium, and other ferroalloys.

23/ Includes production from Bophuthatswana and net production of ferrochromiumsilicon, if any.

24/ U.S. output of ferrochromium includes high- and low-carbon ferrochromium, ferrochromiumsilicon, chromium metal, and other chromium materials.

25/ May include ferroaluminum, ferrobore, and other complex boron additive alloys, ferromanganese, ferromolybdenum, ferrotitanium, ferrovanadium, manganese metal, silicomanganese, and silvery pig iron.

26/ Spiegeleisen, if any, for Germany is included with blast furnace ferromanganese.

27/ Includes ferrophosphorus and data contained in "Blast furnace: Other."

28/ Ferrochromium includes ferrochromiumsilicon, if any, for Japan, South Africa, and the United States.

29/ Ferromanganese includes silicomanganese, if any, for countries carrying footnote 12 on "Ferromanganese" data line.

30/ U.S. production under "Other."

31/ Includes silicospiegeleisen, if any, for France.

32/ Includes calciumsilicon, ferromolybdenum, ferrovanadium, and data contained in "Electric furnace: Other" for each country indicated.