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FERROALLOYS [ADVANCE RELEASE]

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Ferroalloys

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Ferroalloys, alloys of iron with one or more other elements added to steel melts, are used to impart distinctive qualities to steel or to serve important functions during steel refining, such as control of inclusions, deoxidation, and desulfurization. Ferroalloys are used in lesser amounts to produce cast iron and nonferrous alloys.

Ferroalloys can be divided into bulk ferroalloys and noble ferroalloys (also called special or specialty ferroalloys). Bulk ferroalloys are produced in large quantities and include ferrochromium (including ferrochromium-silicon), ferromanganese, ferrosilicon, and silicomanganese—also known as ferrosilicomanganese or ferrosilicon-manganese. Noble ferroalloys are produced in smaller quantities and typically include ferroboron, ferromolybdenum, ferronickel, ferroniobium, ferrophosphorus, ferrotitanium, ferrotungsten, and ferrovanadium, among others.

Production of bulk ferroalloys in 2015 decreased to 424,000 metric tons (t) from 517,000 t in 2014. Estimated production (consumption minus imports plus exports, not including stock changes) of noble ferroalloys in 2015 increased to 21,000 t from 15,100 t in 2014 (table 1). World production of total ferroalloys was estimated to have been 52.8 million metric tons (Mt) in 2015, a decrease of 9% compared with the revised amount of 57.9 Mt in 2014.

Legislation and Government Programs

The Generalized System of Preferences program expired on July 31, 2013, and was reauthorized by Congress on June 29, 2015 (U.S. Congress, 2015). As a result, imports that entered the United States during that timeframe that were previously eligible for Generalized System of Preferences duty-free treatment were subjected to regular, normal-trade-relations rates of duty (Office of the United States Trade Representative, 2014). This affected certain imports of ferroalloy materials such as ferrochromium, ferromanganese, ferroniobium, ferrosilicon, ferrotungsten, and ferrozirconium.

Production

In 2015, 12 companies in the United States produced seven ferroalloys at 13 plants (table 2). Domestic data for ferroalloy materials were collected by the USGS by means of the "Consolidated Consumers' Report," "Manganese Ore and Products," "Silicon Alloys," "Specialty Ferroalloys," and "Vanadium" surveys.

Production of bulk ferroalloys in 2015 decreased to 424,000 t from 517,000 t in 2014. Estimated production (consumption minus imports plus exports, not including stock changes) of noble ferroalloys in 2015 increased to 21,000 t from 15,100 t in 2014 (table 1). Trends of ferroalloy production closely followed those of crude steel, for which domestic production in 2015 decreased to 78.8 Mt from 88.2 Mt in 2014 (Fenton, 2017).

Consumption

U.S. reported consumption, by gross weight, of bulk ferroalloys in 2015 decreased by 4% to 1.18 Mt from 1.23 Mt in 2014 (table 1). Consumption of ferrochromium, ferromanganese, and ferrosilicon decreased by 4%, whereas silicomanganese consumption decreased by 5%. U.S. reported consumption of noble ferroalloys was 40,400 t in 2015 compared with 68,600 t in 2014 (table 1). Among noble ferroalloys, on a contained-weight basis unless otherwise noted, ferrotungsten consumption increased by 112%, whereas consumption decreased for all others, especially for ferroboron (53%, gross-weight basis), ferromolybdenum (21%), and ferrophosphorous (13%, gross-weight basis) (table 5).

Prices

The average prices for bulk ferroalloys varied in 2015. The annual average prices for grades of ferrochromium with low carbon content (not more than 3% carbon) increased by up to 3%, whereas the average prices for grades of ferrochromium with high carbon content (more than 4% carbon) decreased by up to 5% compared with those in 2014 (table 6). Compared with 2014, the average U.S. spot-market prices for medium-carbon ferromanganese were essentially unchanged, whereas high-carbon ferromanganese and silicomanganese prices decreased by 14% and 16%, respectively. Average prices for 50%-grade ferrosilicon and 75%-grade ferrosilicon increased by about 5% from those in 2014.

As for the noble ferroalloys, the 2015 annual average prices of ferromolybdenum, ferrotungsten, and ferrovanadium decreased by 44%, 35%, and 29%, respectively. The average annual price of ferrotitanium increased by 8% (table 6).

Foreign Trade

The United States was a net importer of ferroalloys in 2015. On a gross-weight basis, U.S. total bulk ferroalloy exports decreased by 18% from 2014. Among them, exports of chromium ferroalloys decreased by 77%, manganese ferroalloys decreased by 28%, and silicon ferroalloys increased by 6% compared with 2014. Exports of noble ferroalloys decreased by 31% from 2014. Of these, ferrotungsten and ferrosilicon-tungsten experienced the largest percentage decrease (63%),

followed by ferrovanadium (54%) and ferrozirconium (40%). Ferrophosphorus experienced the largest increase of exports among noble ferroalloys (79%), followed by ferroniobium (32%) (table 7).

On a gross-weight basis, U.S. total bulk ferroalloy imports decreased by 28% from 2014. Among them, imports of chromium ferroalloys decreased by 37%, manganese ferroalloys decreased by 27%, and silicon ferroalloys decreased by 12%, compared with 2014. Imports of noble ferroalloys decreased by 33% from 2014. Among these, ferromolybdenum experienced the largest decrease (69%), followed by ferronickel (39%) and ferrovanadium (36%). Ferrozirconium experienced the largest percentage increase of imports among noble ferroalloys (21%), though this quantity represents an increase of only 27 t.

Ferroalloy Review

Ferroboron.—Boron is added to steel to improve creep properties, increase hardenability, and promote neutron absorption. The primary products in which ferroboron is used include alloy steels, high-strength low-alloy steels, structural steels, and stainless steels in the nuclear industry. Borate ore is smelted in electric arc furnaces, along with aluminum and iron oxide, to produce ferroboron. The United States did not produce ferroboron and relied on imports. Exact import quantities were not available, however, as there was no harmonized tariff code specific to ferroboron.

Ferrochromium.—Chromium is added to steel to improve wear resistance, increase corrosion and oxidation resistance, increase hardenability, and promote strength at elevated temperatures. The primary end use for ferrochromium is in stainless and heat-resisting steels. Chromite ore is mostly smelted in electric arc furnaces to produce ferrochromium for the metallurgical industry.

In 2015, 41.5 Mt of stainless and heat-resisting steel was produced globally (International Stainless Steel Forum, undated). The leading stainless-steel-producing areas of the world were Asia (China, India, Japan, the Republic of Korea, and Taiwan), the European Union (primarily Austria, Belgium, Finland, France, Germany, Italy, Spain, Sweden, and the United Kingdom), and the Americas (Brazil and the United States). The leading ferrochromium-producing countries were China (37%), South Africa (31%), Kazakhstan (11%), and India (8%) (table 9). Most of the 12.0 Mt of ferrochromium produced globally in 2015 was used in the manufacture of stainless steel. The United States had no production capability and was completely import reliant for ferrochromium.

Ferromanganese and Silicomanganese.—Two manganese ferroalloys, ferromanganese and silicomanganese, are key ingredients for steelmaking that act as desulfurizing or deoxidizing agents and increase hardenability. Steelmaking is the leading use of manganese alloys in the United States, primarily for production of carbon and high-strength low-alloy steels (table 4). Manganese ore is mostly smelted in electric arc furnaces to produce ferromanganese and silicomanganese. The United States produced manganese ferroalloys at two facilities and imported 594,000 t (gross weight) of ferromanganese and silicomanganese in 2015 (table 8). The leading manganese-ferroalloy-producing country was China (53%), followed by India (14%), Ukraine (5%), and South Africa (4%) (table 9).

Ferromolybdenum.—Molybdenum is added to steel to improve corrosion resistance, increase hardenability, and promote strength at elevated temperatures. The primary products in which ferromolybdenum is used include alloy and stainless steels, alloy cast irons, carbon steel, and superalloys. Molybdenite is obtained from primary ores, such as low-grade porphyry molybdenum deposits, or as a byproduct from the production of other metals, such as low-grade porphyry copper deposits. Molybdenite concentrates are roasted to form molybdic oxide, which can then be converted into ferromolybdenum, molybdenum chemicals, or molybdenum metal. The United States produced ferromolybdenum at two facilities and imported 2,380 t (gross weight) of ferromolybdenum in 2015 (table 8). More than one-half of world ferromolybdenum production took place in China. Most of the remainder was produced in Belgium, Chile, Russia, and the United Kingdom, mainly for export, although production information was inadequate to estimate output for those countries.

Ferronickel.—Nickel is added to steel to increase atmospheric corrosion resistance, mildly increase hardenability, promote solid-solution strengthening, and promote strength at low temperatures. The primary products in which ferronickel is used include cryogenic steels, stainless steels (the leading use of ferronickel), superalloys, ultrahigh-strength steels, and wrought steels. Nickel ore mined from laterites is smelted in electric arc furnaces to produce ferronickel. In 2015, the leading ferronickel-producing country was China (55%), followed by Japan (11%), New Caledonia (8%), and Brazil (4%) (table 9). China was the only country that produced nickel pig iron, a nickel-iron alloy containing less than 15% nickel. Nickel pig iron is a low-grade product as opposed to conventional ferronickel grades, which range from 18% to 80% nickel content. The United States had no production capability and was 100% reliant on imports of ferronickel.

Ferroniobium.—Niobium is added to steel to improve toughness, improve wear resistance, increase yield strength, and promote grain refinement. The primary products in which ferroniobium is used include low-temperature structural steels, rebar, stainless steels, and superalloys. Niobium ores, most commonly mined from carbonatite deposits in zoned alkaline igneous complexes, are smelted in electric arc furnaces to produce ferroniobium for ferrous and nonferrous metallurgical uses. The United States produced ferroniobium at one facility and imported 10,100 t (gross weight) of ferroniobium in 2015 (table 8). In 2015, only three other countries produced ferroniobium—Brazil (78,500 t), Canada (8,850 t), and Russia (1,170 t) (table 9).

Ferrophosphorus.—Phosphorus is added to steel to improve atmospheric corrosion resistance, machinability, and strength. High-strength low-alloy steel is the primary product in which ferrophosphorus is used. Phosphorus is an impurity in iron ores, and ferrophosphorus is produced from slag as a byproduct of steel manufacturing. The United States did not produce ferrophosphorus and imported 6,160 t (gross weight) in 2015 (table 8). In 2015, Russia was the only country to produce ferrophosphorus (3,600 t) (table 9).

Ferrosilicon.—Silicon is added to steel to improve high-temperature oxidation resistance, increase hardenability, and promote solid-solution strengthening. The primary products in which ferrosilicon is used include automotive engine steels, electrical steels, heat-treatable and resisting steels, and ultrahigh-strength steels. Silica in the form of quartz sand or quartzite is smelted in submerged electric arc furnaces to produce ferrosilicon for the ferrous and nonferrous metallurgical industries. The United States produced ferrosilicon at four facilities and imported 237,000 t (gross weight) of ferrosilicon in 2015 (table 8). Excluding the United States, the leading silicon-ferroalloy-producing country was China (66%), followed by Russia (15%) and Norway (5%) (table 9).

Ferrotitanium.—Titanium is added to steel to act as a decarbonizing, denitrogenizing, deoxidizing, and desulfurizing agent and to promote grain refinement. The primary products which use ferrotitanium include high-strength low-alloy steels, maraging steels, and stainless steels. Ferrotitanium is typically produced by induction melting of titanium scrap with iron or steel, but it can also be produced directly from smelting titanium mineral concentrates (rutile and ilmenite). The standard grades of ferrotitanium are 30% and 70% titanium. The United States produced ferrotitanium at two facilities and imported 1,730 t (gross weight) of ferrotitanium in 2015 (table 8). The leading ferrotitanium-producing countries in 2015 were Russia (8,000 t) and India (800 t) (table 9).

Ferrotungsten.—Tungsten is added to steel to increase its hot hardness and wear resistance. The primary products in which ferrotungsten is used include high-speed and other tool steels and, to a lesser extent, some high-temperature, stainless, and structural steels. Tungsten can be added to steel melts as ferrotungsten, which is a master alloy typically containing between 75% and 85% tungsten; scheelite ore concentrates; tungsten melting base, which is a master alloy containing as much as 38% tungsten; or tungsten metal scrap. Ferrotungsten can be produced from artificial scheelite (calcium tungstate), concentrates of the tungsten minerals scheelite or wolframite, high-grade tungsten ore, or soft scrap. To make ferrotungsten, tungsten raw materials are reduced by either a carbothermic process in an electric arc furnace, a metallothermic process using silicon and (or) aluminum, or a combination of carbothermic and metallothermic processes (Lassner and Schubert, 1999, p. 307–312; Roskill Information Services Ltd., 2014, p. 234–238). In 2015, world ferrotungsten production was dominated by China. Ferrotungsten has also been produced in Brazil, Germany, India, the Republic of Korea, Russia, Sweden, and Vietnam, however available information was inadequate to make reliable estimates of output. The United States was 100% reliant on imports of ferrotungsten.

Ferrovanadium.—Vanadium is primarily used as a hardening agent in steel to impart toughness and wear resistance. The primary products in which ferrovanadium is used include high-strength low-alloy steels, structural and engineering alloy steels, and tool and die steels. Vanadium, recovered as a byproduct of titanium-bearing magnetite or from recycling of vanadium-containing materials, is smelted in electric arc furnaces to produce ferrovanadium. In 2015, secondary vanadium produced from various industrial waste materials—such as petroleum residues, pig iron slag, spent catalysts, and vanadium-bearing coal fly ash—was the leading source of U.S. ferrovanadium production. Ferrovandium was produced at three facilities, and 2,680 t was imported.

Ferrozirconium.—Zirconium is added to steel to act as a denitrogenizing and deoxidizing agent in addition to controlling sulfide inclusions. The primary products which use ferrozirconium include high-strength low-alloy steels and several nonferrous alloys. Zirconium, most commonly obtained from zircon produced as a byproduct of heavy-mineral-sands mining and processing, is added to the ladle or ingot molds during the manufacture of steel to produce ferrozirconium-bearing steels. The United States did not produce ferrozirconium and imported 158 t (gross weight) in 2015 (table 8).

Outlook

The near-term trend for domestic ferroalloy consumption is expected to follow closely that of U.S. steel production. According to the World Steel Association (2016), the steel industry will continue with a restrained growth outlook. Slowdowns in China's economic growth, as well as limited growth following the most recent recessionary periods, are major determinants of global consumption trends. Global steel consumption was expected to increase slightly to 1.50 billion metric tons (Gt) in 2016 and to 1.51 Gt in 2017. In 2016, global apparent steel consumption was expected to be distributed geographically as follows: India, 84.4 Mt (5% increase); European Union, 155 Mt (essentially unchanged); Japan, 62.7 Mt (essentially unchanged); Middle East and North Africa, 72.4 Mt (essentially unchanged); China, 666 Mt (slight decrease); Commonwealth of Independent States, 49.6 Mt (slight decrease); United States, 95 Mt (slight decrease), and Central America and South America, 40.8 Mt (10% decrease).

Details of the outlook for the U.S. steel industry are discussed in the "Outlook" section of the Iron and Steel chapter of the 2015 USGS Minerals Yearbook, volume I, Metals and Minerals. Information on individual commodities, including domestic data coverage, foreign trade by country, domestic and foreign industry developments, outlook, and U.S. Government stockpile information is presented in the respective mineral commodity chapters in the U.S. Geological Survey Minerals Yearbook, volume I, Metals and Minerals, or online at *https://minerals.usgs.gov/minerals/pubs/commodity/*.

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TABLE 1
SALIENT FERROALLOYS STATISTICS[1]

(Metric tons, gross weight)

	2011	2012	2013	2014	2015
United States:					
Bulk ferroalloys:					
Production[2]	461,000	564,000	552,000	517,000	424,000
Consumption	1,510,000	1,440,000	1,270,000	1,230,000	1,180,000
Exports[3]	52,300	37,100	30,000	29,500	24,200
Imports for consumption[3]	1,470,000	1,520,000	1,390,000	1,730,000	1,240,000
Noble ferroalloys:					
Production[e, 4, 5]	26,500	16,300	18,000	15,100	21,000
Consumption	71,600	68,900	58,400	68,600	40,400
Exports[3]	18,200	12,300	11,700	15,700	10,800
Imports for consumption[3]	77,600	81,500	91,800	115,000	76,700
World production	47,600,000 [r]	50,600,000 [r]	58,400,000 [r]	57,900,000 [r]	52,800,000

[e]Estimated. [r]Revised.
[1]Data are rounded to no more than three significant digits.
[2]Bulk ferroalloys production data for the United States include ferromanganese, ferrosilicon, and silicomanganese.
[3]Source: U.S. Census Bureau.
[4]Noble ferroalloys production data for the United States include ferromolybdenum, ferroniobium, ferrotitanium, and ferrovanadium.
[5]Calculated as consumption minus imports plus exports; only for noble ferroalloys with production in the United States.

TABLE 2
DOMESTIC PRODUCERS OF FERROALLOYS IN 2015, BY U.S. CENSUS BUREAU REGION

		Products[1]						
		Bulk ferroalloys			Noble ferroalloys			
Region and company	Plant location	FeMn	SiMn	FeSi	FeMo	FeTi	FeV	FeNb
Midwest:								
Eramet Marietta Inc.	Marietta, OH	X	X					
Global Titanium Inc.	Detroit, MI					X		
Globe Metallurgical, Inc.	Beverly, OH			X				
AMG Vanadium, Inc.	Cambridge, OH						X	
RTI International Metals, Inc.	Canton, OH					X		
Northeast:								
Bear Metallurgical Co.	Butler, PA				X		X	
Reading Alloys Inc.	Robesonia, PA							X
Thompson Creek Metals Co. Inc.	Langeloth, PA				X			
South:								
CC Metals & Alloys, LLC	Calvert City, KY			X				
Evraz Stratcor, Inc.	Hot Springs, AR						X	
Felman Production, LLC	Letart, WV		X					
Globe Metallurgical, Inc.	Bridgeport, AL			X				
WVA Manufacturing, LLC	Alloy, WV			X				

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

TABLE 3
GOVERNMENT INVENTORY OF FERROALLOYS[1, 2]

(Metric tons, gross weight)

Alloy	Inventory
Ferrochromium:	
High-carbon	63,000
Low-carbon	32,600
Ferromanganese, high-carbon	280,000

[1]Data are rounded to no more than three significant digits.
[2]Inventory as of December 31, 2015.

Source: Defense Logistics Agency Strategic Materials.

TABLE 4
REPORTED U.S. CONSUMPTION OF BULK FERROALLOYS BY END USE[1, 2]

(Metric tons, gross weight)

End use	FeCr	FeMn	SiMn	FeSi
2014:				
Steel:				
Carbon and high-strength low-alloy	7,090 r	279,000	101,000	69,500
Stainless and heat-resisting	389,000 r	9,870	15,600	44,800
Unspecified and other steels	44,700 r	63,000	26,000	60,100
Total steel	441,000 r	351,000	142,000	174,000
Alloys and superalloys[r]	7,320	(3)	(3)	(3)
Cast irons	(3)	7,740	532	93,600
Miscellaneous and unspecified	5,280 r	571 r	2,760 r	3,070
Grand total	453,000 r	360,000	146,000 [4]	271,000
Consumer stocks, December 31	14,300 r	22,600 r, 5	9,700 r, 5	12,000
2015:				
Steel:				
Carbon and high-strength low-alloy	6,620	270,000	99,500	75,400
Stainless and heat-resisting	378,000	9,830	15,600	47,900
Unspecified and other steels	38,000	56,800	19,700	54,000
Total steel	423,000	336,000	135,000	177,000
Alloys and superalloys	7,280	(3)	(3)	(3)
Cast irons	(3)	6,890	230	81,200
Miscellaneous and unspecified	5,440	460	2,590	1,620
Grand total	436,000	344,000	138,000 [4]	260,000
Consumer stocks, December 31	13,700	21,100 [5]	20,800 [5]	11,200

[r]Revised.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]FeCr, ferrochromium, including chromium metal; FeMn, ferromanganese; SiMn, silicomanganese; and FeSi, ferrosilicon, silvery pig iron, silicon carbide, and inoculant alloys.
[3]All or part included with "Miscellaneous and unspecified."
[4]Internal evaluation indicates that silicomanganese consumption is understated.
[5]Consumer and producer stocks.

TABLE 5
REPORTED U.S. CONSUMPTION OF NOBLE FERROALLOYS BY END USE[1, 2]

End use	FeB (metric tons, gross weight)	FeMo (metric tons, Mo content)	FeNi (metric tons, Ni content)	FeNb (metric tons, Nb content)	FeP (metric tons, gross weight)	FeTi (metric tons, gross weight)	FeW (metric tons, W content)	FeV (metric tons, V content)
2014:								
Steel:								
Carbon	371	192	--	1,680	3,670	5,790	--	689
High-strength low-alloy	--	110	-- r	757	--	--	--	(3) r
Stainless and heat-resisting	207	715	13,300 r	918	(3) r	3,580	(3)	61
Unspecified and other steels	225	3,160	32 r	3,160	849	838	107	2,460
Total	803	4,180	13,300 r	6,510	4,520	10,200	107	3,210
Alloys and superalloys	36	112	195 r	1,700	(4) r	1,640	(3)	4
Cast irons	(4) r	346	--	--	432	11 r	--	(4)
Miscellaneous and unspecified	691	110	2,100 r	--	476	38	--	14
Grand total	1,530	4,750	15,600 r	8,220	5,420	11,900	107	3,230
Consumer stocks, December 31	147	374	W r	381	625	1,490	W	147
2015:								
Steel:								
Carbon	319	(3)	--	1,280	3,480	5,380	--	721
High-strength low-alloy	--	106	--	800	--	--	--	(3)
Stainless and heat-resisting	206	682	12,400	712	(3)	3,590	(3)	61
Unspecified and other steels	106	2,170	30	3,080	842	793	227	2,300
Total	631	2,960	12,400	5,870	4,320	9,770	227	3,080
Alloys and superalloys	61	(4)	137	1,640	(4)	1,710	(3)	6
Cast irons	(4)	330	--	--	390	8	--	(4)
Miscellaneous and unspecified	26	464	2,140	--	18	87	--	8
Grand total	718	3,760	14,700	7,510	4,730	11,600	227	3,090
Consumer stocks, December 31	170	357	W	344	489	851	35	148

rRevised. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

[2]FeB, ferroboron, including other boron materials; FeMo, ferromolybdenum, including calcium molybdate; FeNi, ferronickel; FeNb, ferroniobium, including nickel niobium; FeP, ferrophosphorus, including other phosphorus materials; FeTi, ferrotitanium, including titanium scrap and other titanium materials; FeW, ferrotungsten; and FeV, ferrovanadium, including other vanadium-carbon-iron ferroalloys.

[3]Withheld to avoid disclosing company proprietary data; included with "Steel, unspecified and other steels."

[4]Withheld to avoid disclosing company proprietary data; included with "Miscellaneous and unspecified."

TABLE 6
SELECTED DOMESTIC FERROALLOY PRICES

Alloy	Unit	2014			2015		
		High	Low	Average[1]	High	Low	Average[1]
Bulk ferroalloys:							
Chromium ferroalloys:							
0.05% carbon ferrochromium	Cents per pound, Cr content	XX	XX	227.12 r	XX	XX	228.33
0.10% carbon ferrochromium	do.	XX	XX	208.31 r	XX	XX	210.20
0.15% carbon ferrochromium	do.	XX	XX	201.40 r	XX	XX	207.82
Over 4% carbon ferrochromium:							
47–55% chromium	do.	XX	XX	106.89 r	XX	XX	105.77
60–70% chromium	do.	XX	XX	113.90 r	XX	XX	108.47
Manganese ferroalloys:							
85% medium-carbon ferromanganese	Cents per pound, Mn content	98.00	86.00	94.39	98.00	82.00	93.49
76% high-carbon ferromanganese	Dollars per long ton, Mn content	1,100.00 r	990.00	1,063.24	1,080.00	790.00	915.36
65% silicomanganese	Cents per pound, Mn content	54.00 r	53.00	58.72	58.00	36.00	49.60
Silicon ferroalloys:							
Ferrosilicon, 50%-grade	Cents per pound, Si content	104.23 r	100.98 r	102.61 r	109.85	105.79	107.82
Ferrosilicon, 75%-grade	do.	95.11 r	93.07 r	94.09 r	99.47	97.22	98.35
Noble ferroalloys:							
Molybdenum ferroalloys:							
Ferromolybdenum	Dollars per pound, Mo content	19.32 r	10.96 r	14.48 r	11.11	5.80	8.14
Molybdenum oxide	do.	14.75	9.54	11.72	4.50	9.57	6.85
Nickel metal, minimum 99.81% Ni	Dollars per metric ton	19,434.38 r	14,076.36 r	16,864.59 r	14,766.91	8,688.69	11,831.24
Ferrotitanium, 70%-grade	Dollars per pound, Ti content	2.80 r	2.75 r	2.78 r	3.10	2.90	3.00
Ferrotungsten	Dollars per kilogram*, W content	65.00	36.00	46.74	37.00	22.00	30.21
Ferrovanadium	Dollars per pound, V content	13.89 r	12.24 r	13.03 r	12.59	5.99	9.19

rRevised. XX Not applicable. do. Ditto.
[1]Arithmetic mean of high and low prices, weekly prices, or monthly prices.

Sources: London Metal Exchange, Platts Metals Week, and CRU Ryan's Notes.

*Correction posted on 6/22/2018.

TABLE 7
U.S. EXPORTS OF FERROALLOYS[1]

Alloy	2014 Gross weight (metric tons)	2014 Contained weight (metric tons)	2014 Value (thousands)	2015 Gross weight (metric tons)	2015 Contained weight (metric tons)	2015 Value (thousands)
Bulk ferroalloys:						
Chromium ferroalloys:						
Ferrochromium:						
More than 4% carbon	3,850	1,940	$6,250	723	354	$1,020
Not more than 4% carbon	839	339	1,770	279	154	717
Ferrochromium-silicon	36	13	43	73	26	85
Total, chromium ferroalloys	4,730	2,290	8,060	1,080	533	1,820
Manganese ferroalloys:						
Ferromanganese, all grades	5,530 r	4,370 r	8,580 r	5,140	4,060	5,630
Silicomanganese	3,320	1,940 r	3,820	1,220	721	1,340
Total, manganese ferroalloys	8,850 r	6,300 r	12,400	6,360	4,780	6,970
Silicon ferroalloys:						
Ferrosilicon, more than 55% silicon	7,870	4,980	14,400	5,760	3,580	11,800
Ferrosilicon, other	8,010	3,670	13,500	11,000	5,220	19,500
Total, silicon ferroalloys	15,900	8,650	27,900	16,800	8,800	31,400
Total, bulk ferroalloys	29,500	17,200	48,300	24,200	14,100	40,100
Noble ferroalloys:						
Ferromolybdenum	847 r	592 r	18,400	815	569	15,100
Ferronickel	186 r	110 r	3,070 r	198	118	3,270
Ferroniobium	1,620 r	XX	22,900	2,140	XX	26,300
Ferrophosphorus	544	XX	993	976	XX	1,760
Ferrotitanium and ferrosilicon-titanium	2,990	XX	12,400	2,140	XX	9,070
Ferrotungsten and ferrosilicon-tungsten	46 r	23 r	308 r	57	29	102
Ferrovanadium	352	253	7,510	163	122	3,190
Ferrozirconium	1,620 r	XX	3,980 r	973	XX	2,330
Ferroalloys, other	7,390	XX	15,700	3,380	XX	9,530
Total, noble ferroalloys	15,700 r	1,030 r	85,800	10,800	838	70,600
Grand total	45,100	18,300 r	134,000	35,100	15,000	111,000

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

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF FERROALLOYS[1]

Alloy	2014 Gross weight (metric tons)	2014 Contained weight (metric tons)	2014 Value (thousands)	2015 Gross weight (metric tons)	2015 Contained weight (metric tons)	2015 Value (thousands)
Bulk ferroalloys:						
Chromium ferroalloys:						
Ferrochromium:						
More than 4% carbon	579,000 r	316,000 r	$621,000 r	348,000	189,000	$356,000
More than 3% but not more than 4% carbon	3,040	1,470	3,060	2,590	1,320	2,180
More than 0.5% but not more than 3% carbon	14,500	10,000	37,400	3,960	2,660	9,650
Not more than 0.5% carbon	38,700 r	26,400 r	120,000 r	48,300	32,800	141,000
Ferrochromium-silicon	14,600 r	5,430 r	21,100 r	5,810	2,240	8,020
Total, chromium ferroalloys	650,000 r	359,000 r	803,000 r	408,000	228,000	517,000
Manganese ferroalloys:						
Ferromanganese:						
More than 4% carbon	266,000	202,000 r	245,000 r	175,000	132,000	153,000
More than 2% but not more than 4% carbon	2 r	1 r	6 r	608	479	1,470
More than 1% but not more than 2% carbon	61,800	49,600	86,000	65,100	52,000	100,000
Not more than 1% carbon	36,400	31,100	66,500	50,900	43,300	88,900
Silicomanganese	448,000 r	300,000 r	496,000 r	302,000	206,000	304,000
Total, manganese ferroalloys	812,000 r	583,000 r	894,000 r	594,000	433,000	647,000
Ferrosilicon:						
55%–80% silicon, more than 3% Ca	8,550	6,340	12,000	5,210	3,790	7,530
55%–80% silicon, other	215,000	163,000	324,000	188,000	142,000	260,000
Magnesium ferrosilicon	22,100	10,100 r	41,100	16,700	7,570	31,200
More than 80% ferrosilicon, other	23,500 r	6,410 r	20,700 r	27,000	7,290	21,700
Total, ferrosilicon	269,000 r	186,000	397,000 r	237,000	161,000	321,000
Total, bulk ferroalloys	1,730,000	1,130,000	2,090,000	1,240,000	822,000	1,480,000
Noble ferroalloys:						
Ferrocerium and other pyrophoric alloys	418 r	XX	8,350 r	401	XX	6,310
Ferromolybdenum	7,650	5,110	147,000	2,380	1,610	36,300
Ferronickel	69,800	20,500	313,000	42,600	11,100	139,000
Ferroniobium	12,500	XX	341,000	10,100	XX	271,000
Ferrophosphorus	8,060	XX	4,740	6,160	XX	3,450
Ferrotitanium and ferrosilicon-titanium	2,210	XX	9,290	1,730	XX	6,260
Ferrotungsten and ferrosilicon-tungsten	560	454	18,800	369	269	9,060
Ferrovanadium	4,210	3,230	94,700 r	2,680	1,980	64,100
Ferrozirconium	131	XX	774	158	XX	669
Ferroalloys, other	9,720 r	XX	32,400 r	10,100	XX	20,900
Total, noble ferroalloys	115,000 r	29,300	969,000 r	76,700	14,900	557,000
Grand total	1,850,000 r	1,160,000 r	3,060,000 r	1,320,000	837,000	2,040,000

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

Source: U.S. Census Bureau.

TABLE 9
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE, AND ALLOY TYPE[1]

(Metric tons, gross weight)

Country, furnace type, and alloy type[2]	2011	2012	2013	2014	2015[e]
Albania, electric furnace, ferrochromium	28,694	24,018	24,692	34,897	45,000
Argentina, electric furnace:[e]					
Ferrosilicon	18,000	14,000	15,000	17,000	12,700
Silicomanganese	11,000	11,000	13,000 r, 3	10,000 r, 3	8,000
Total	29,000	25,000	28,000 r	27,000 r	20,700
Armenia, electric furnace, ferromolybdenum	5,525	5,836	6,619	6,528	5,576 3
Australia, electric furnace:					
Ferromanganese	180,200 r	130,900 r	146,900 r	165,300 r	153,100 3
Silicomanganese	94,700 r	50,800	110,100	119,400	130,700 3
Total	274,900 r	181,700 r	257,000 r	284,700 r	283,800 3
Austria, electric furnace:[e]					
Ferronickel, including ferronickel ferromolybdenum	1,750 r	2,000 r	2,000 r	2,500 r	3,000
Other, including ferromolybdenum and ferrovanadium	739,000	698,000	698,000	698,000	698,000
Total	741,000	700,000	700,000	701,000 r	701,000
Bahrain, electric furnace:					
Ferromanganese	35,300	5,300 r	-- r	-- r	-- 3
Ferrosilicon	3,000	6,000 r	20,000 r	17,000 r	15,000 3
Total	38,300	11,300 r	20,000 r	17,000 r	15,000 3
Bhutan, electric furnace, ferrosilicon exports[e]	96,711 3	107,819 3	110,000	110,000	120,000
Bosnia and Herzegovina, electric furnace, ferrosilicon	(4)	(4)	(4)	(4)	(4)
Brazil, electric furnace:[e]					
Ferrochromium[5]	145,122 3	165,532 3	189,088 3	185,000 3	200,000
Ferrochromium silicon	8,378 3	9,556 3	10,200 3	10,000	10,000
Ferromanganese	82,000	94,000	93,000	96,000 r	73,000
Ferronickel	67,000 r	136,000 r	149,000 r	161,000 r, 3	131,000
Ferroniobium (ferrocolumbium)	82,062 3	77,788 3	71,623 3	73,846 3	78,500
Ferrosilicon	145,000	145,000	147,000	98,000	74,600
Silicomanganese	214,000	213,000	218,000	205,000 r	140,000
Other	34,462 3	33,449 3	33,500	33,500	34,000
Total	778,000 r	874,000 r	911,000 r	862,000 r	741,000
Burma, electric furnace, ferronickel[e]	--	--	4,771 r, 3	59,000	60,100
Canada, electric furnace:					
Ferroniobium (ferrocolumbium)	7,002 r	7,238 r	7,563 r	8,833 r	8,854 3
Ferrosilicon	31,039	31,979	38,871	32,000 r, e	38,000
Ferrovanadium[e]	900	800	800	800	800
Total[e]	38,900 r	40,000 r	47,200 r	41,600 r	47,700
Chile, electric furnace, ferromolybdenum	17,177	15,451	13,072	14,584	15,000
China, electric furnace:[e]					
Blast furnace, ferromanganese	350,000	300,000	300,000	300,000	300,000
Electric furnace:					
Ferrochromium	2,700,000	3,040,000	4,001,660 3	4,399,600 3	4,400,000
Ferromanganese	2,600,000	3,020,000	3,300,000	3,000,000	2,300,000
Ferrmolybdenum	53,000	180,000	200,000	200,000	200,000
Ferronickel and high nickel pig iron	1,430,000 r	1,590,000 r	2,160,000 r	2,120,000 r	1,730,000
Ferrosilicon	5,400,000	5,760,000	6,000,000	5,500,000	4,730,000
Ferrotitanium	5,000	--	--	--	--
Silicomanganese	6,700,000	7,400,000	7,700,000	7,900,000	5,600,000
Other	8,000,000	9,200,000	13,900,000	13,000,000	13,000,000
Total, blast and electric furnaces	27,200,000 r	30,500,000 r	37,600,000 r	36,400,000 r	32,300,000
Colombia, electric furnace, ferronickel[e]	103,400 r, 3	151,000 r	139,000	138,000 r	123,000
Dominican Republic, electric furnace, ferronickel[e]	34,700 r	38,900 r	24,100 r	--	--
Egypt, electric furnace:[e]					
Ferromanganese	30,000	30,000	30,000	12,000 r, 3	12,000 3
Ferrosilicon	55,500 r	55,300 r	50,800 r	61,500 r	61,700
Total	85,500 r	85,300 r	80,800 r	73,500 r	73,700
Finland, electric furnace, ferrochromium	231,405 r	228,744 r	433,677 r	441,292 r	460,000
France, electric furnace:[e]					
Ferromanganese	130,000 r	101,000	104,000	116,000 r	126,000

See footnotes at end of table.

TABLE 9—Continued
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE, AND ALLOY TYPE[1]

(Metric tons, gross weight)

Country, furnace type, and alloy type[2]	2011	2012	2013	2014	2015[e]
France, electric furnace—Continued:[e]					
Ferrosilicon	71,500	63,300	49,600	40,000 r	35,000
Silicomanganese	63,000 r	69,000 r	65,000 r	65,000 r	65,000
Other	60,000	60,000	60,000	60,000	60,000
Total	325,000	293,000	279,000	281,000 r	286,000
Georgia, electric furnace:					
Ferromanganese	195	--	--	--	--
Silicomanganese	242,746	261,075	253,361 r	256,677	210,700 p
Total	242,941	261,075	253,361 r	256,677	210,700 p
Germany, electric furnace:[e]					
Ferrochromium	18,500	17,800	17,800 r	17,800 r	17,800
Other	9,985 3	8,248 3	8,200	8,200	8,200
Total	28,500	26,000	26,000 r	26,000 r	26,000
Greece, electric furnace, ferronickel[e]	93,900 r	96,400 r	87,400 r	95,700 r	88,600
Iceland, electric furnace, ferrosilicon	120,076	131,818	125,204	110,000 r, e	115,000
India, electric furnace:[e, 6]					
Ferroaluminum	7,000	7,100	5,400	5,500	5,500
Ferroboron	98	95	26	21 3	20
Ferrochromium[5]	1,003,598 r, 3	943,000 r	944,000 r	944,000 r	950,000
Ferrochromium silicon	11,000	11,000	11,000	11,000	11,000
Ferromanganese[3]	436,100 r	419,200 r	455,400 r	533,300 r	476,300
Ferrmolybdenum	3,200	3,100	1,200	1,200	1,200
Ferronickel magnesium	255 r	272 r	478 r	478 r	478
Ferrosilicomagnesium	18,000	18,000	21,000	22,000	22,000
Ferrosilicon	86,000 r, 3	90,000 r, 3	92,013 r, 3	92,014 r, 3	92,000
Ferrosilicozirconium	170	180	--	2	10
Ferrotitanium	2,300	2,400	800	800	800
Ferrotungsten	225 3	--	--	--	--
Ferrovanadium	1,850	1,900	879 3	906 3	920
Silicomanganese[3]	1,433,600	1,693,100 r	1,917,000 r	1,786,000 r	1,691,300
Total	3,000,000 r	3,190,000 r	3,450,000 r	3,400,000 r	3,250,000
Indonesia, electric furnace:[e]					
Ferromanganese	-- r	-- r	-- r	-- r, 3	--
Ferronickel	98,200	91,500 r	90,900 r	82,600 r, 3	85,700
Silicomanganese	-- r	r	16,200 r	37,100 r, 3	20,700 3
Total	98,200 r	91,500 r	107,000 r	119,700 r, 3	106,000
Iran, electric furnace, ferrochromium[e]	15,600	15,600	15,600	10,600	10,600
Italy, electric furnace:[e]					
Ferromanganese	18,000	12,000 r	6,000 r	-- r	--
Silicomanganese	25,000 r	24,000 r	--	-- r	--
Other, excluding calcium-silicon	10,000	10,000	10,000	10,000	10,000
Total	53,000 r	46,000 r	16,000 r	10,000 r	10,000
Japan, electric furnace:					
Ferrochromium	17,217	19,392	21,671 r	22,000 r	22,000
Ferromanganese	456,798	436,171	460,936	463,345 r	465,952 3
Ferrmolybdenum	5,167	4,616	4,550	4,500 e	4,500
Ferronickel[e]	280,000 r	372,000 r	379,000 r	330,000 r	350,000
Ferrovanadium	3,980	4,403	4,433	4,400 e	4,400
Silicomanganese	49,798	52,287	24,741	26,500 r, e	22,700
Other	20,913	19,364	19,394	19,300 e	19,000
Total[e]	834,000 r	908,000 r	915,000 r	870,000 r	889,000
Kazakhstan, electric furnace:					
Ferrochromium	1,289,917	1,305,343 r	1,336,632 r	1,351,896 r	1,300,000
Ferrochromium silicon	143,296	164,853	165,195	158,826	160,000
Ferrosilicon	1,683	494	472	334 r	--
Silicomanganese	232,039	251,530	203,986	200,379 r	164,189 3
Other	1,754	1,845	81	3,470	3,500
Total	1,668,689	1,724,065 r	1,706,366 r	1,714,905 r	1,630,000

See footnotes at end of table.

TABLE 9—Continued
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE, AND ALLOY TYPE[1]

(Metric tons, gross weight)

Country, furnace type, and alloy type[2]	2011	2012	2013	2014	2015[e]
Korea, Republic of, electric furnace:					
Ferromanganese	355,047	364,800	330,000 [r]	360,000 [r, e]	300,000
Ferronickel	49,300 [r]	54,100 [r]	65,800 [r]	59,100 [r, e]	101,100
Silicomanganese	195,650	184,700	216,000 [r]	204,000 [r, e]	200,000
Total	599,997 [r]	603,600 [r]	611,800 [r]	623,000 [r, e]	601,000
Kosovo, electric furnace, ferronickel[e]	35,100 [r]	20,100 [r]	34,500 [r]	30,500 [r]	33,600
Macedonia, electric furnace:					
Ferronickel	75,200	83,700	84,000 [r]	75,800 [r, e]	74,300
Ferrosilicon	56,167	42,402	72,279	73,014	45,698 [3]
Silicomanganese	50,756	14,179	--	--	--
Total	182,123	140,281	156,279 [r]	149,000 [r, e]	120,000
Mexico, electric furnace:					
Ferromanganese	74,000 [r]	62,000 [r]	63,000 [r]	67,500	67,900 [3]
Silicomanganese	139,000 [r]	161,300 [r]	152,500 [r]	164,900	139,400 [3]
Total	213,000 [r]	223,300 [r]	215,500 [r]	232,400	207,300 [3]
New Caledonia, electric furnace, ferronickel[e]	132,000 [r]	184,000 [r]	175,000 [r]	238,000 [r]	245,000
Norway, electric furnace:					
Ferromanganese	337,900	325,900	306,700	295,400 [r]	309,200 [3]
Ferrosilicon	230,000	250,000 [e]	349,389 [r]	350,000 [r, e]	350,000
Silicomanganese	266,000 [e]	271,400	301,400	314,300	309,900 [3]
Total[e]	834,000	847,000	957,000 [r]	960,000 [r]	969,000
Oman, electric furnace, ferrochromium	--	--	20,625 [r]	44,063 [r]	63,750 [3]
Poland:[e]					
Blast furnace, ferromanganese	800	800	800 [r]	820 [r]	720
Electric furnace:					
Ferrosilicon	72,668 [3]	78,115 [3]	75,500	75,500	72,000
Silicomanganese	400	100 [r]	100 [r]	100 [r]	90
Other	300	300	280	300	300
Total, blast and electric furnaces	74,200	79,300 [r]	76,700	76,700 [r]	73,100
Romania, electric furnace, ferrosilicomanganese	31,000	17,000	--	-- [e]	--
Russia:					
Blast furnace:					
Ferromanganese	148,100	160,800	181,400	178,600 [r]	186,000 [3]
Ferrophosphorus[e]	3,600	3,600	3,600	3,600	3,600
Spiegeleisen[e]	6,000	6,000	6,000	6,000	6,000
Electric furnace:					
Ferrochromium	501,700 [r]	447,600 [r]	480,000 [r]	500,000	500,000
Ferrochromium silicon	49,740	57,450	58,130	58,000	58,000
Ferronickel, high-nickel[e]	19,900 [r]	11,500 [r]	--	--	--
Ferronickel, other[e, 7]	14,700	8,520	-- [r]	-- [r]	--
Ferroniobium (ferrocolumbium)	1,028 [r]	1,073 [r]	1,218 [r]	1,385 [r]	1,170
Ferrosilicon	1,026,170	1,036,930	1,012,740	1,026,190 [r]	1,059,000 [3]
Ferrotitanium[e]	7,000	7,500	8,000	8,000	8,000
Ferrovanadium[e]	13,500	12,500	12,500	12,500	12,500
Silicomanganese	149,850	164,350	169,160	179,000 [r]	172,800 [3]
Other[e]	9,000	8,000	8,500	8,500	8,500
Total, blast and electric furnaces[e]	1,950,000 [r]	1,930,000 [r]	1,940,000 [r]	1,980,000 [r]	2,020,000
Saudi Arabia, electric furnace:[e]					
Ferromanganese	-- [r]	-- [r]	-- [r]	-- [r]	--
Silicomanganese	96,000	80,000	80,000	60,000 [r]	63,000
Other	90,000	90,000	91,000	91,000	91,000
Total	186,000 [r]	170,000 [r]	171,000 [r]	151,000 [r]	154,000
Slovakia, electric furnace:					
Ferromanganese	18,180	12,862	2,119	20,600 [r, e]	25,376 [3]
Ferrosilicon	38,771	36,869	41,664	39,000	37,500
Silicomanganese	25,023	50,089	26,794	29,643	27,036 [3]
Total	81,974	99,820	70,577	89,200 [r, e]	89,900

See footnotes at end of table.

TABLE 9—Continued
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE, AND ALLOY TYPE[1]

(Metric tons, gross weight)

Country, furnace type, and alloy type[2]	2011	2012	2013	2014	2015[e]
South Africa, electric furnace:					
Ferrochromium	3,425,911	3,063,257	3,400,000	3,601,050	3,700,000
Ferromanganese	534,900	590,000 [r]	506,100 [r]	639,400 [r]	385,100 [3]
Ferronickel, high-nickel[e]	800 [r]	1,060 [r]	1,040 [r]	-- [r]	NA
Ferrosilicon	126,200	83,000	78,400	78,400 [e]	78,400
Ferrovanadium[e]	19,000	18,000	18,000	19,000	19,000
Silicomanganese	313,600	148,800	133,600	228,100	210,200 [3]
Total[e]	4,420,000	3,900,000 [r]	4,140,000 [r]	4,570,000 [r]	4,390,000
Spain, electric furnace:					
Ferromanganese	92,500 [r]	79,800 [r]	107,200 [r]	133,200 [r]	126,200 [3]
Ferrosilicon[e]	69,700	68,600	80,500	80,500	80,000
Silicomanganese	142,000 [r]	148,000 [r]	136,000 [r]	129,000 [r, e]	134,000 [3]
Total[e]	304,000	296,000 [r]	324,000	343,000 [r]	340,000
Sweden, electric furnace, ferrochromium	81,500	39,852 [r]	49,000	67,000	90,480 [3]
Turkey, electric furnace:					
Ferrochromium	75,950 [r]	69,550 [r]	132,603 [r]	86,025 [r]	82,560 [3]
Ferrosilicon[e]	2,000	2,000	2,000	--	--
Total[e]	78,000 [r]	71,600 [r]	135,000 [r]	86,025 [r, 3]	82,560 [3]
Ukraine, electric furnace:					
Ferromanganese	180,500	163,921	88,626	103,000 [e]	87,740 [3]
Ferronickel	96,400 [r]	119,000 [r]	127,000 [r]	111,000 [r, e]	93,900
Ferrosilicon	150,900	150,265 [r]	191,207 [r]	142,300 [r]	90,200 [3]
Silicomanganese	843,500	823,131	724,892	840,900	698,400 [3]
Other	28,500	22,115	15,908	16,000 [e]	16,000
Total	1,299,800 [r]	1,278,432 [r]	1,147,633 [r]	1,210,000 [r, e]	986,000
United States, electric furnace:[8]					
Bulk ferroalloys	461,000	564,000	552,000	517,000	424,000 [3]
Noble alloys[e, 9]	26,500	16,300	18,000	15,100	21,000 [3]
Total[e]	487,000	580,000	570,000	532,000	445,000 [3]
Venezuela, electric furnace:[e]					
Ferromanganese	12,000	9,000	9,000	8,000 [3]	8,000
Ferronickel	51,400 [r]	31,300	-- [r]	16,000 [r]	16,000
Ferrosilicon	70,000 [3]	72,300	74,300	74,300	74,300
Silicomanganese	24,000	58,000 [r]	63,000 [r]	39,000 [r, 3]	35,000 [3]
Total	157,000 [r]	171,000 [r]	146,000 [r]	137,000 [r]	133,000
Zimbabwe, electric furnace, ferrochromium	195,750 [r]	154,565 [r]	150,063 [r]	235,256 [r]	190,837 [3]
Grand total	47,600,000 [r]	50,600,000 [r]	58,400,000 [r]	57,900,000 [r]	52,800,000
Of which:					
Blast furnace:					
Ferromanganese	499,000	462,000	482,000	479,000 [r]	487,000
Spiegeleisen	6,000	6,000	6,000	6,000	6,000
Other, including ferrophosphorus	3,600	3,600	3,600	3,600	3,600
Total, blast furnace	509,000	471,000	492,000	489,000 [r]	496,000
Electric furnace:					
Ferrochromium	9,730,000 [r]	9,530,000 [r]	11,200,000 [r]	11,900,000 [r]	12,000,000
Ferrochromium silicon	212,000	243,000	245,000	238,000	239,000
Ferromanganese	5,570,000 [r]	5,860,000 [r]	6,010,000 [r]	6,010,000 [r]	4,920,000
Ferromolybdenum	84,100	209,000	225,000	227,000	226,000
Ferronickel[10]	2,580,000 [r]	2,990,000 [r]	3,520,000 [r]	3,520,000 [r]	3,140,000
Ferroniobium (ferrocolumbium)	90,100 [r]	86,100 [r]	80,400 [r]	84,100 [r]	88,500
Ferrosilicon	7,870,000 [r]	8,230,000 [r]	8,630,000 [r]	8,020,000 [r]	7,180,000
Ferrovanadium[e]	39,200	37,600	36,600	37,600	37,600
Silicomanganese	11,300,000 [r]	12,100,000 [r]	12,500,000 [r]	12,800,000 [r]	10,000,000
Other[e, 11]	9,530,000 [r]	10,800,000 [r]	15,500,000 [r]	14,500,000 [r]	14,400,000
Total, electric furnace	47,100,000 [r]	50,100,000 [r]	57,900,000 [r]	57,400,000 [r]	52,300,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available. -- Zero.

[1]Grand totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Includes data available through March 20, 2018.

[2]To the extent possible, ferroalloy production of each country shown has been separated according to the furnace from which production is obtained; production derived from metallothermic operation was included with electric furnace production. Ferroalloys may be produced in other countries, but production information was inadequate to make reliable estimates of output.

TABLE 9—Continued
FERROALLOYS: WORLD PRODUCTION, BY COUNTRY, FURNACE, AND ALLOY TYPE[1]

(Metric tons, gross weight)

[3]Reported figure.
[4]Country was a net importer of ferrosilicon.
[5]May include charge chrome, ferrochromium-silicon, or high- and low-carbon ferrochromium.
[6]Estimated or reported on a fiscal year basis, which is from April 1 to March 31.
[7]Includes ferronickel chromium and nickel-resist cast iron.
[8]Bulk ferroalloys include ferromanganese, ferrosilicon, and silicomanganese. Noble ferroalloys include ferromolybdenum, ferroniobium, ferrotitanium, and ferrovanadium.
[9]Calculated as consumption minus imports plus exports; only for noble ferroalloys with production in the United States.
[10]Includes ferronickel chromium, ferronickel magnesium, ferronickel molybdenum, high nickel pig iron, and nickel-resist cast iron.
[11]Includes ferroaluminum, ferroboron, ferrosilicomagnesium, ferrozirconium, ferrotitanium, ferrotungsten, bulk alloys, and noble alloys.