

SILICON

(Data in thousand metric tons of silicon content, unless otherwise noted)

Domestic Production and Use: Estimated value of silicon metal and alloys (excluding semiconductor-grade silicon) produced in the United States in 1997 was about \$650 million. Ferrosilicon was produced by five companies in six plants, and silicon metal was produced by five companies in eight plants. Two of the eight companies in the industry produced both products. Most of the ferrosilicon and silicon metal plants were east of the Mississippi River or in the Pacific Northwest. Most ferrosilicon was consumed in the ferrous foundry and steel industries, predominantly in the eastern one-half of the United States. The main consumers of silicon metal were aluminum producers and the chemical industry. The semiconductor industry, which manufactures chips for computers from high-purity silicon, accounted for only a few percent of silicon demand.

Salient Statistics—United States:	1993	1994	1995	1996	1997^e
Production	367	390	396	412	424
Imports for consumption	212	255	250	227	256
Exports	31	32	47	44	41
Consumption, apparent	557	616	609	594	637
Price, ¹ average, cents per pound Si:					
Ferrosilicon, 50% Si	40.8	43.9	57.9	64.0	55
Ferrosilicon, 75% Si	40.6	40.8	58.1	62.2	48
Silicon metal	66.4	64.1	69.5	89.7	82
Stocks, producer, yearend	48	45	35	35	37
Net import reliance ² as a percent of apparent consumption	34	37	35	31	34

Recycling: Insignificant.

Import Sources (1993-96): Norway, 24%; Russia, 15%; Brazil, 15%; Canada, 11%; and other, 35%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/97	Non-MFN³ 12/31/97
Ferrosilicon, 55%-80% Si:			
More than 3% Ca	7202.21.1000	1.1% ad val.	11.5% ad val.
Other	7202.21.5000	1.5% ad val.	11.5% ad val.
Ferrosilicon, 80%-90% Si	7202.21.7500	1.9% ad val.	9% ad val.
Ferrosilicon, more than 90% Si	7202.21.9000	5.8% ad val.	40% ad val.
Ferrosilicon, other:			
More than 2% Mg	7202.29.0010	Free	4.4¢/kg Si.
Other	7202.29.0050	Free	4.4¢/kg Si.
Silicon, more than 99.99% Si	2804.61.0000	1.5% ad val.	25% ad val.
Silicon, 99.00%-99.99% Si	2804.69.1000	5.3% ad val.	21% ad val.
Silicon, other	2804.69.5000	6.9% ad val.	45% ad val.

Depletion Allowance: Quartzite, 14% (Domestic and Foreign); gravel, 5% (Domestic and Foreign).

Government Stockpile: Information on silicon carbide in the National Defense Stockpile is discussed in the "Manufactured Abrasives" chapter.

Events, Trends, and Issues: Domestic apparent consumption of silicon for 1997 is projected as 7% greater than the average for 1993-96. Of the 1997 total, ferrosilicon is estimated to account for 54% and silicon metal 46%. Growth in demand for ferrosilicon is expected to be at an annual rate in the range of 1% to 2%, in line with trends in domestic steel production. Growth in demand for silicon metal is expected to be greater, with annual growth rates in demand expected to be about 3% from the aluminum industry and 8% from the chemical industry. The chemical industry, principally silicones, may soon overtake the aluminum industry as the largest user of metal.

In terms of contained silicon, domestic production, particularly for silicon metal, continued its upward trend in 1997. Indications were that domestic producers would be increasing their output of metal, possibly at some expense to ferrosilicon production. In the latter part of the year, a domestic producer announced its intention to invest in a Norwegian producer of silicon products, to include partial acquisition of ferrosilicon facilities.

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Prices for silicon materials in the U.S. market declined through at least the first three quarters of the year, especially for 75%-grade ferrosilicon. Prices decreased significantly for ferrosilicon in January; prices for metal began to fall in June. As of the end of September, dealer import prices, in cents per pound of contained silicon, were 53 to 56 for 50%-grade ferrosilicon, 46 to 48 for 75%-grade ferrosilicon, and 76 to 78 for silicon metal.

The domestic industry was operating in an environment whose uncertainties included the outcome of lawsuits and trade actions. The lawsuits were claiming damages from price fixing alleged to have occurred around 1990. Antidumping margins imposed in the 1990's on imported ferrosilicon and/or silicon from China and various Latin American countries and republics of the Former Soviet Union were still subject to review. Especially for silicon metal from Brazil, final determination of margins set by the U.S. Government were going through a complicated process of resolution for annual review periods going back to 1991-92.

World Production, Reserves, and Reserve Base:

	Production ^e		Reserves and reserve base ⁴
	1996	1997	
United States	412	424	The reserves and reserve base in most major producing countries are ample in relation to demand. Quantitative estimates are not available.
Australia	29	29	
Brazil	318	310	
Canada	58	66	
China	780	810	
Egypt	29	29	
France	140	140	
Iceland	47	47	
India	55	55	
Kazakstan	77	78	
Norway	408	420	
Poland	47	47	
Russia	267	260	
Slovakia	20	20	
South Africa	97	100	
Spain	24	31	
Ukraine	195	190	
Venezuela	32	32	
Other countries	130	140	
World total (rounded)	3,200	3,200	

Production quantities given above are combined totals of estimated content for ferrosilicon and silicon metal, as applicable. For the world, ferrosilicon accounts for about four-fifths of the total. The leading countries for ferrosilicon production were Brazil, China, Norway, Russia, Ukraine, and the United States, and for silicon metal Brazil, China, France, Norway, and the United States. China was by far the largest producer of ferrosilicon and may well have been the largest producer of silicon metal. China's production of silicon metal is not included in this tabulation because data are not available.

World Resources: World and domestic resources for making silicon metal and alloys are abundant, and, in most producing countries, adequate to supply requirements for many decades. The source of the silicon is silica in various natural forms such as quartzite.

Substitutes: Various metals and alloys, such as aluminum and silicomanganese, can be substituted for ferrosilicon in some applications. Germanium and gallium arsenide are the principal substitutes for silicon in semiconductor and infrared applications.

^eEstimated.

¹Based on U.S. dealer import price.

²Defined as imports - exports + adjustments for Government and industry stock changes.

³See Appendix B.

⁴See Appendix D for definitions.