VANADIUM

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

Domestic Production and Use: Eight firms make up the U.S. vanadium industry. These firms process material such as ferrophosphorus slag, petroleum residues, spent catalysts, utility ash, and vanadium-bearing iron slag to produce ferrovanadium, vanadium pentoxide, vanadium metal, and vanadium-bearing chemicals or specialty alloys. Metallurgical use, primarily as an alloying agent for iron and steel, accounts for more than 95% of the vanadium consumed domestically. Of the other uses for vanadium, the major nonmetallurgical use was in catalysts for the production of maleic anhydride and sulfuric acid. With regard to total domestic consumption, major end-use distribution was as follows: carbon steel, 38%; high-strength low-alloy steel, 20%; full alloy steel, 19%; tool steel, 10%; and other, 13%.

Salient Statistics—United States:	1994	1995	1996	1997	1998[e]
Production:					
Mine, mill	W	W	W	W	W
Petroleum residues, recovered basis	2,830	1,990	3,730	NA	NA
Imports for consumption:					
Ash, ore, residues, slag	1,900	2,530	2,270	2,950	5,000
Vanadium pentoxide, anhydride	294	547	485	711	1,000
Oxides and hydroxides, other	3	36	11	126	60
Aluminum-vanadium master alloys (gross weight)	38	36	2	11	50
Ferrovanadium	1,910	1,950	1,880	1,840	1,700
Exports:					
Vanadium pentoxide, anhydride	335	229	241	614	400
Oxides and hydroxides, other	1,050	1,010	2,670	385	100
Aluminum-vanadium master alloys (gross weight)	1,030	660	310	974	1,400
Ferrovanadium	374	340	479	446	500
Shipments from Government stockpile	—	416	201	260	—
Consumption: Reported	4,280	4,650	4,630	4,730	4,700
Apparent	W	W	W	W	W
Price, average, dollars per pound V_2O_5	2.95	2.80	3.19	3.90	4.00
Stocks, producer and consumer, yearend	1,110	1,100	1,070	1,000	300
Employment, mine and mill, number	400	390	390	400	400
Net import reliance[1] as a percent of apparent consumption	W	W	W	W	W

Recycling: Some tool steel scrap was recycled primarily for its vanadium content, and vanadium was recycled from spent chemical process catalysts, but these two sources together accounted for only a very small percentage of total vanadium used.

Import Sources (1994-97): Ferrovanadium: Canada, 40%; Russia, 18%; China, 12%; Czech Republic, 11%; and other, 19%. Vanadium pentoxide: South Africa, 89%; China, 6%; Russia, 4%; and other, 1%.

Tariff: Ash, residues, slag, and waste and scrap enter duty-free.

Item	Number	Normal Trade Relations (NTR) 12/31/98	Non-NTR[2] 12/31/98
Vanadium pentoxide anhydride	2825.30.0010	12.8% ad val.	40% ad val.
Vanadium oxides and hydroxides, other	2825.30.0050	12.8% ad val.	40% ad val.
Vanadates	2841.90.1000	9.5% ad val.	40% ad val.
Ferrovanadium	7202.92.0000	4.2% ad val.	25% ad val.
Aluminum-vanadium master alloys	7601.20.9030	Free	10.5% ad val.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Prepared by **Robert G. Reese, Jr. [(703) 648-4981, rreese@usgs.gov, fax: (703) 648-7757]**

VANADIUM

Government Stockpile: None.

Events, Trends, and Issues: Vanadium consumption in the United States in 1998 was essentially unchanged from that in 1997. Although total consumption was essentially unchanged, preliminary data indicated the following changes among the major uses for vanadium during the first 6 months of 1998: carbon steel increased 7%; full alloy steel increased 14%; high-strength low-alloy steel increased 5%; and tool steel decreased 37%.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves[3]	Reserve base[3]
	1997	1998[e]		
United States	W	W	45,000	4,000,000
China	8,000	7,000	2,000,000	3,000,000
Russia	11,000	11,000	5,000,000	7,000,000
South Africa	17,000	16,000	3,000,000	12,000,000
Other countries	1,100	1,000	—	1,000,000
World total (may be rounded)	[4]37,100	[4]35,000	10,000,000	27,000,000

World Resources: World resources of vanadium exceed 63 million tons. Vanadium occurs in deposits of titaniferous magnetite, phosphate rock, and uraniferous sandstone and siltstone, in which it constitutes less than 2% of the host rock. Significant amounts are also present in bauxite and carboniferous materials, such as crude oil, coal, oil shale, and tar sands. Because vanadium is usually recovered as a byproduct or coproduct, demonstrated world resources of the element are not fully indicative of available supplies. While domestic resources are adequate to supply current domestic needs, a substantial part of U.S. demand is currently met by foreign material because of price advantages.

Substitutes: Steels containing various combinations of other alloying elements can be substituted for steels containing vanadium. Among various metals that are to some degree interchangeable with vanadium as alloying elements in steel are columbium, manganese, molybdenum, titanium, and tungsten. Platinum and nickel can replace vanadium compounds as catalysts in some chemical processes. There is currently no acceptable substitute for vanadium in aerospace titanium alloys.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]Defined as imports - exports + adjustments for Government and industry stock changes.

[2]See Appendix B.

[3]See Appendix D for definitions.

[4]Excludes U.S. mine production.