VANADIUM

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

<u>Domestic Production and Use</u>: 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, or 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 33%; full alloy steel 21%; high-strength low-alloy steel 22%; tool steel 11%; and other 3%.

Salient Statistics—United States:	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u> °
Production:					
Mine, recoverable basis	W	W	W	W	W
Mill, recovered basis ¹	W	W	W	W	W
Petroleum residues, recovered basis	2,870	2,830	1,990	3,730	NA
Imports for consumption:					
Ash, residues, slag,	1,450	1,900	2,530	2,270	2,200
Vanadium pentoxide, anhydride	70	294	547	485	700
Oxides and hydroxides, other	19	3	36	11	200
Aluminum-vanadium master alloys (gross weight)	19	38	36	2	
Ferrovanadium	1,630	1,910	1,950	1,880	1,800
Exports:					
Vanadium pentoxide, anhydride	126	335	229	241	800
Oxides and hydroxides, other	895	1,050	1,010	2,670	400
Aluminum-vanadium master alloys (gross weight)	866	1,030	660	310	700
Other compounds	989	· —			
Ferrovanadium	219	374	340	479	400
Shipments from Government stockpile			416	201	260
Consumption: Reported	3,970	4,280	4,650	4,650	4,500
Apparent	. W	. W	. W	. W	. W
Price, average, dollars per pound V ₂ O ₅	1.45	2.95	2.80	3.19	3.90
Stocks, producer and consumer, yearend	900	1,110	1,100	1,070	1,000
Employment, mine and mill, number	430	400	390	390	400
Net import reliance ² as a percent of					
apparent consumption	W	W	W	W	W
apparent consumption	٧V	٧V	٧V	٧V	۷V

Recycling: Vanadium was recycled as a minor component of scrap iron and steel alloys, which were recycled principally for their iron content. 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.

<u>Import Sources (1993-96)</u>: Ferrovanadium: Russia, 36%; Canada, 32%; Belgium, 7%; Austria, 6%; and other, 19%. Vanadium pentoxide: South Africa, 79%; China 10%; Russia, 9%; and other, 2%.

Tariff: Aluminum-vanadium master alloys (except from non-most-favored nations), ash, residues, slag, and waste and scrap enter duty-free.

Item	Number	Most favored nation (MFN) 12/31/97	Non-MFN ³ 12/31/97	
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).

VANADIUM

Government Stockpile:

Stockpile Status—9-30-97⁴

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 1997	Disposals FY 1997
Vanadium pentoxide (Gross weight)	_	180	_	_	372

Events, Trends, and Issues: In 1994, the Defense Department decided that vanadium pentoxide was no longer needed in the National Defense Stockpile (NDS), and authorized the disposal of its entire holdings, with sales beginning in fiscal year 1995. At yearend 1994, the NDS held 651 tons of vanadium pentoxide. On September 30, 1997, the Defense Logistics Agency (DLA), which has operational control of the NDS, completed the disposal of the vanadium pentoxide held in the NDS.

Vanadium consumption in the United States in 1997 was essentially unchanged from that in 1996. Although total consumption was essentially unchanged, preliminary data indicated the following changes among the major uses for vanadium during the first 8 months of 1997: carbon steel decreased 15%; full alloy steel decreased 17%; high-strength low-alloy steel increased 10%; and tool steel increased 36%.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ⁵	Reserve base⁵
	<u>1996</u>	<u>1997°</u>		
United States	W	W	45,000	4,000,000
China	7,000	7,000	2,000,000	3,000,000
Russia	11,000	11,000	5,000,000	7,000,000
South Africa	16,000	16,000	3,000,000	12,000,000
Other countries	1,100	<u>1,000</u>		1,000,000
World total (may be rounded)	⁶ 35,100	⁶ 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.

<u>Substitutes</u>: 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.

eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Produced from domestic materials.

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

³See Appendix B.

⁴See Appendix C for definitions.

⁵See Appendix D for definitions.

⁶Excludes U.S. mine production.