

## VANADIUM<sup>1</sup>

(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 produce ferrovanadium, vanadium pentoxide, vanadium metal, and vanadium-bearing chemicals or specialty alloys by processing materials such as petroleum residues, spent catalysts, utility ash, and vanadium-bearing iron slag. Metallurgical use, primarily as an alloying agent for iron and steel, accounts for about 90% 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.

<b>Salient Statistics—United States:</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002<sup>e</sup></b>
Production, mine, mill	W	W	—	—	—
Imports for consumption:					
Ash, ore, residues, slag	2,400	1,650	1,890	1,670	2,000
Vanadium pentoxide, anhydride	847	208	902	600	400
Oxides and hydroxides, other	33	—	14	1,080	100
Aluminum-vanadium master alloys (gross weight)	298	1,210	16	10	100
Ferrovanadium	1,620	1,930	2,510	2,550	2,600
Exports:					
Vanadium pentoxide, anhydride	681	747	653	71	60
Oxides and hydroxides, other	232	70	100	63	200
Aluminum-vanadium master alloys (gross weight)	856	514	677	363	600
Ferrovanadium	579	213	172	70	100
Consumption, reported	4,380	3,620	3,520	3,210	3,300
Price, average, dollars per pound V <sub>2</sub> O <sub>5</sub>	5.47	1.99	1.82	1.37	1.40
Stocks, consumer, yearend	336	348	303	246	300
Employment, mine and mill, number	400	400	400	400	400
Net import reliance <sup>2</sup> as a percentage of reported consumption	78	76	100	100	100

**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 (1998-2001):** Ferrovanadium: South Africa, 29%; Canada, 24%; China, 20%; Czech Republic, 11%; and other, 16%. Vanadium pentoxide: South Africa, 98%; and other, 2%.

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

Item	Number	Normal Trade Relations <u>12/31/02</u>
Vanadium pentoxide anhydride	2825.30.0010	7.6% ad val.
Vanadium oxides and hydroxides, other	2825.30.0050	7.6% ad val.
Vanadates	2841.90.1000	6.6% ad val.
Ferrovanadium	7202.92.0000	4.2% ad val.
Aluminum-vanadium master alloys	7601.20.9030	Free.

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

**Government Stockpile:** None.

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**Events, Trends, and Issues:** Preliminary data indicate that U.S. vanadium consumption in 2002 was essentially unchanged from the previous year. Among the major uses for vanadium, production of carbon and full alloy steels accounted for 27% and 23% of domestic consumption, respectively.

Both ferrovanadium and vanadium pentoxide prices remained low during 2002. Articles in various industry-related publications attributed the low prices primarily to an increased supply of material.

**World Mine Production, Reserves, and Reserve Base:** Reserves and reserve base estimates for China have been significantly increased based on new information from that country.

	Mine production		Reserves <sup>3</sup>	Reserve base <sup>3</sup>
	2001	2002 <sup>e</sup>		
United States	—	—	45,000	4,000,000
China	30,000	39,000	5,000,000	14,000,000
Russia	9,000	9,000	5,000,000	7,000,000
South Africa	18,000	18,000	3,000,000	12,000,000
Other countries	1,000	1,000	NA	1,000,000
World total (may be rounded)	58,000	67,000	13,000,000	38,000,000

**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. Metals, such as columbium (niobium), manganese, molybdenum, titanium, and tungsten, are to some degree interchangeable with vanadium as alloying elements in steel. 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.

<sup>e</sup>Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

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<sup>2</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>3</sup>See Appendix C for definitions.