

VANADIUM

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

Domestic Production and Use: Seven U.S. firms that comprise the majority of the domestic vanadium industry produced ferrovandium, 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 pig iron slag. Metallurgical use, primarily as an alloying agent for iron and steel, accounted for about 92% of the domestic vanadium consumption in 2008. Of the other uses for vanadium, the major nonmetallurgical use was in catalysts for the production of maleic anhydride and sulfuric acid.

Salient Statistics—United States:	2004	2005	2006	2007	2008^e
Production, mine, mill ¹	—	—	—	—	—
Imports for consumption:					
Ash, ore, residues, slag	2,350	1,690	1,000	920	720
Vanadium pentoxide, anhydride	1,040	1,370	1,920	2,390	4,100
Oxides and hydroxides, other	120	186	129	42	183
Aluminum-vanadium master alloys (gross weight)	19	1	102	1,110	547
Ferrovanadium	3,020	11,900	2,140	2,220	3,320
Exports:					
Vanadium pentoxide, anhydride	240	254	341	327	243
Oxides and hydroxides, other	584	899	832	626	953
Aluminum-vanadium master alloys (gross weight)	887	1,500	1,930	1,700	1,357
Ferrovanadium	285	504	389	154	265
Consumption, reported	4,050	3,910	4,030	4,130	5,190
Price, average, dollars per pound V ₂ O ₅	5.99	16.28	7.86	7.40	14.75
Stocks, consumer, yearend	336	371	330	295	340
Employment, mine and mill, number ¹	—	—	—	—	—
Net import reliance ² as a percentage of apparent consumption	100	100	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 consumed. The vanadium content of other recycled steels was lost to slag during processing and was not recovered.

Import Sources (2004-07): Ferrovandium: Czech Republic, 76%; Swaziland, 7%; Canada, 6%; Republic of Korea, 6%; and other, 5%. Vanadium pentoxide: South Africa, 59%; China, 20%; Russia, 18%; and other, 3%.

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

Item	Number	Normal Trade Relations <u>12-31-08</u>
Vanadium pentoxide anhydride	2825.30.0010	5.5% ad val.
Vanadium oxides and hydroxides, other	2825.30.0050	5.5% ad val.
Vanadates	2841.90.1000	5.5% 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 2008 increased about 24% from that of the previous year; however, that increase is partially attributable to expanded reporting by large consumers in 2008. Among the major uses for vanadium, production of carbon, full-alloy, and high-strength, low-alloy steels accounted for 16%, 40%, and 30% of domestic consumption, respectively. In 2008, U.S. steel production was expected to be about the same as that of 2007.

Vanadium pentoxide prices ranged from \$7.30 to \$18.40 per pound of V_2O_5 and averaged \$14.75 for the year, about 100% higher than that of 2007. Ferrovandium prices ranged from \$18.00 to \$46.00 per pound of ferrovanadium and averaged an estimated \$35.18 for the year, about 80% higher than that of 2007. The sharp rise in prices in 2008 occurred in the first quarter of the year when power shortages in South Africa and bad weather in China sharply reduced vanadium production. Supply disruption in a tight market, coupled with stable demand in the steel and aerospace industries, kept prices high for most of 2008.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ³	Reserve base ³
	<u>2007</u>	<u>2008^e</u>		
United States	—	—	45,000	4,000,000
China	19,000	20,000	5,000,000	14,000,000
Russia	14,500	16,000	5,000,000	7,000,000
South Africa	24,000	23,000	3,000,000	12,000,000
Other countries	<u>1,000</u>	<u>1,000</u>	NA	<u>1,000,000</u>
World total (rounded)	58,500	60,000	13,000,000	38,000,000

World Resources: World resources of vanadium exceed 63 million tons. Vanadium occurs in deposits of phosphate rock, titaniferous magnetite, 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 coal, crude oil, 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 and secondary recovery are adequate to supply a large portion of domestic needs, a substantial part of U.S. demand is currently met by foreign material because it is currently uneconomic to mine vanadium in the United States.

Substitutes: Steels containing various combinations of other alloying elements can be substituted for steels containing vanadium. Certain metals, such as manganese, molybdenum, niobium (columbium), 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.

^eEstimated. NA Not available. — Zero.

¹Domestic vanadium mine and mill production stopped in 1999.

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

³[See Appendix C for definitions.](#)