

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 94% of the domestic vanadium consumption in 2009. 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:	2005	2006	2007	2008	2009^e
Production, mine, mill ¹	—	—	—	—	—
Imports for consumption:					
Ash, ore, residues, slag	1,690	1,000	920	920	890
Vanadium pentoxide, anhydride	1,370	1,920	2,390	3,700	1,420
Oxides and hydroxides, other	186	129	42	144	37
Aluminum-vanadium master alloys (gross weight)	1	102	1,110	618	390
Ferrovanadium	11,900	2,140	2,220	2,800	780
Exports:					
Vanadium pentoxide, anhydride	254	341	327	249	360
Oxides and hydroxides, other	899	832	626	1,040	270
Aluminum-vanadium master alloys (gross weight)	1,500	1,930	1,700	1,389	380
Ferrovanadium	504	389	154	281	740
Consumption:					
Apparent	11,910	1,270	4,210	5,420	1,910
Reported	3,910	4,030	4,970	5,090	5,000
Price, average, dollars per pound V ₂ O ₅	16.28	7.86	7.40	14.75	6.00
Stocks, consumer, yearend	371	330	323	310	320
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 (2005-08): Ferrovandium: Czech Republic, 70%; Republic of Korea, 15%; Canada, 8%; Austria, 4%; and other, 3%. Vanadium pentoxide: South Africa, 42%; Russia, 30%; China, 27%; and other, 1%.

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

Item	Number	Normal Trade Relations <u>12-31-09</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: U.S. vanadium consumption in 2009 decreased slightly from that of the previous year. Among the major uses for vanadium, production of carbon, full-alloy, and high-strength, low-alloy steels accounted for 13%, 41%, and 34% of domestic consumption, respectively. U.S. imports for consumption in 2009 were less than half that of the previous year. U.S. exports were approximately 40% less than that of the previous year. In 2009, U.S. steel production was expected to decrease from that of 2008.

Vanadium pentoxide (V_2O_5) prices continued to decrease to a low of \$3.60 per pound of V_2O_5 in April 2009 before slowly increasing in May. In April 2008, V_2O_5 prices averaged \$14.00 per lb of V_2O_5 , almost four times that of April 2009. Ferrovandium (FeV) prices followed a similar trend with a low of \$7.40 in April. In April 2008, prices averaged \$38.00 per pound of FeV, more than five times greater than that of the same month in 2009. The sharp decline in prices took place in the fourth quarter of 2008 and the first quarter of 2009 owing to the financial downturn and the decrease in demand from vanadium's dominant consumer, the steel industry.

World Mine Production and Reserves:

	Mine production		Reserves ³
	<u>2008</u>	<u>2009^e</u>	
United States	—	—	45,000
China	20,000	20,000	5,000,000
Russia	14,500	14,000	5,000,000
South Africa	20,000	19,000	3,000,000
Other countries	<u>1,000</u>	<u>1,000</u>	NA
World total (rounded)	55,500	54,000	13,000,000

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.

³See Appendix C for definitions. Reserve base estimates were discontinued in 2009; see [Introduction](#).