

VANADIUM

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

Domestic Production and Use: Seven U.S. firms that comprise most of the domestic vanadium industry produced 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 pig iron slag. Metallurgical use, primarily as an alloying agent for iron and steel, accounted for about 97% 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:	2006	2007	2008	2009	2010^e
Production, mine, mill ¹	—	—	W	W	W
Imports for consumption:					
Ferrovanadium	685	1,440	2,720	353	1,080
Vanadium pentoxide, anhydride	1,920	2,390	3,700	1,120	2,500
Oxides and hydroxides, other	129	42	144	25	12
Aluminum-vanadium master alloys (gross weight)	405	1,110	618	282	900
Ash, ore, residues, slag	637	1,000	1,040	791	490
Sulfates	—	80	2	16	25
Vanadates	115	211	187	214	90
Vanadium metal, including waste and scrap	73	84	45	216	10
Exports:					
Ferrovanadium	389	154	281	672	460
Vanadium pentoxide, anhydride	341	327	249	401	180
Oxides and hydroxides, other	832	626	1,040	506	810
Aluminum-vanadium master alloys (gross weight)	1,700	1,700	1,390	447	830
Vanadium metal, including waste and scrap	491	49	57	23	8
Consumption:					
Apparent	256	3,520	5,960	1,220	4,100
Reported	4,030	4,970	5,170	5,000	5,100
Price, average, dollars per pound V ₂ O ₅	7.86	7.40	12.92	5.43	6.40
Stocks, consumer, yearend	330	323	334	314	300
Net import reliance ² as a percentage of apparent consumption	100	100	91	81	69

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 (2006–09): Ferrovanadium: Republic of Korea, 38%; Czech Republic, 30%; Canada, 20%; Austria, 9%; and other, 3%. Vanadium pentoxide: South Africa, 39%; Russia, 32%; China, 28%; and other, 1%.

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

Item	Number	Normal Trade Relations <u>12-31-10</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. apparent consumption of vanadium recovered in 2010 from its relatively low level in 2009; apparent consumption of vanadium declined dramatically in 2009 from that of 2008 owing to the global economic downturn in 2009. Among the major uses for vanadium, production of carbon, full-alloy, and high-strength, low-alloy steels accounted for 14%, 41%, and 33% of domestic consumption, respectively. U.S. imports for consumption in 2010 were 69% more than that of the previous year. U.S. exports were approximately 12% more than those of the previous year. In 2010, U.S. steel production was expected to increase from that of 2009. Given the increase in steel demand, the vanadium industry was expected to continue to slowly recover.

Vanadium pentoxide (V_2O_5) prices continued to slowly increase to a high of \$7.50 per pound of V_2O_5 in May 2010 before decreasing again in June. In May 2009, V_2O_5 prices averaged \$4.13 per pound of V_2O_5 , 45% less than average V_2O_5 prices in May 2010. Ferrovandium (FeV) prices followed a similar trend with a high of \$16.76 per pound of FeV in May 2010. In May 2009, FeV prices averaged \$8.56 per pound of FeV, almost 50% less than average FeV prices in May 2010.

World Mine Production and Reserves:

	Mine production		Reserves ³ (thousand metric tons)
	<u>2009</u>	<u>2010^e</u>	
United States	W	W	45
China	21,000	23,000	5,100
Russia	14,500	14,000	5,000
South Africa	17,000	18,000	3,500
Other countries	<u>1,000</u>	<u>1,000</u>	<u>NA</u>
World total (rounded)	53,500	56,000	13,600

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.

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. W Withheld to avoid disclosing company proprietary data. — Zero.

¹Domestic vanadium mine and mill production did not take place from 1999–2007. In 2008, production commenced.

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

³[See Appendix C for resource/reserve definitions and information concerning data sources.](#)