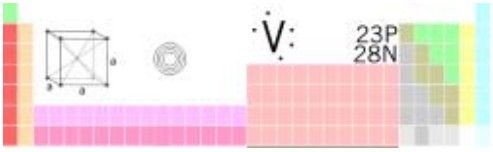
Vanadium



Vanadium (IPA: /və□neɪdiəm/) is a chemical element that has the symbol **V** and atomic number 23. A soft and ductile element, vanadium naturally occurs in about 65 different minerals and is used mainly to produce certain alloys. It is one of the 26 elements found in most living organisms.

Notable characteristics

Vanadium is a soft and ductile, silver-grey metal. It has good resistance to corrosion by alkalis, sulfuric and hydrochloric acid. It oxidizes readily at about 933 K (660 C). Vanadium has good structural strength and a low fission neutron cross section, making it useful in nuclear applications. Although a metal, it shares with chromium and manganese the property of having valency oxides with acid properties.

Common oxidation states of vanadium include +2, +3, +4 and +5. A popular experiment with ammonium vanadate NH_4VO_3, reducing the compound with zinc metal, can demonstrate colorimetrically all four of these vanadium oxidation states. An oxidation state of +1 is rarely seen.

Applications

Approximately 80% of vanadium produced is used as ferrovanadium or as a steel additive. Other uses:

- In such alloys as
  - specialty stainless steel, e.g. for use in surgical instruments and tools.
  - rust resistant and high speed tool steels.
  - mixed with aluminium in titanium alloys used in jet engines and high-speed airframes
- Vanadium steel alloys are used in axles, crankshafts, gears, and other critical components.
- It is an important carbide stabilizer in making steels.
- Because of its low fission neutron cross section, vanadium has nuclear applications.
- Vanadium foil is used in cladding titanium to steel.
- Vanadium-gallium tape is used in superconducting magnets (175,000 gauss).
- Vanadium pentoxide V_2O_5 is used as a catalyst in manufacturing sulfuric acid (via the contact process) and maleic anhydride. It is also used in making ceramics and glass manufacturing.
- Glass coated with vanadium dioxide VO_2 can block infrared radiation (and not visible light) at a specific temperature.
- Electrical fuel cells and storage batteries such as vanadium redox batteries.
- Added to corundum to make simulated alexandrite jewelry.
- Vanadate electrochemical conversion coatings for protecting steel against rust and corrosion
- Lithium vanadium oxide is proposed for use as a high energy density anode for lithium ion batteries, at 745Wh/l when paired with a lithium cobalt oxide cathode.[2]
- Used to make lacrosse shafts
- Possibly used to make Wootz steel and Damascus steel.