

## Vanadium ${}_{73}\text{V}^{50.942}$

Vanadium was discovered in 1801 by A.M. del Rio at Mexico City, Mexico. Rediscovered in 1831 by N.G. Selfström at Falun, Sweden.

[Named after Vanadis, a Scandianavian goddess]

French: vanadium

German: Vanadium

Italian: vanadio

Spanish: vanadio



Atomic number	23
Density in g/cm <sup>3</sup>	6.11
Atomic radius in pm	171
Atomic weight	50.942
Melting point in °C	1890
Boiling point in °C	3378

**Description:** Vanadium is a shiny, silvery metal, which is soft when pure. It resists corrosion due to a protective film of oxide on the surface. Vanadium is attacked by concentrated acids, but not alkalis, not even when these are molten. The metal is used mainly as alloys, especially in steels.

### VANADIUM SINGLE CRYSTAL PROPERTIES

<b>State:</b>	single crystal
<b>Crystal structure:</b>	bcc
<b>Production method:</b>	Floating zone
<b>Standard size:</b>	diameter 12mm thickness 1-2mm
<b>Orientation:</b>	(100), (110) and (111)
<b>Orientation accuracy:</b>	<2°, <1°, <0.4° or <0.1°
<b>Polishing:</b>	as cut, one or two sides polished
<b>Roughness of surface:</b>	<0.03µm
<b>Purity:</b>	99.99%
<b>Typical analysis (ppm):</b>	C 3 H < 1 O 9 N < 5 Cu 1.60 Fe 1.80 Ni < 1 Pb 0.30 Si 0.30 Ga, Hf and Ta are below the detection limit
<b>Density:</b>	6.1 g/cm <sup>3</sup>
<b>Melting point:</b>	1886.85 °C / 2160 °K
<b>Boiling point:</b>	3376.85 °C / 3650 °K
<b>Molar volume:</b>	8.34 cm <sup>3</sup>

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<b>Thermal conductivity:</b>	30.7 [300 K] Wm <sup>-1</sup> K <sup>-1</sup>
<b>Coefficient of linear thermal expansion:</b>	8.3 x 10 <sup>-6</sup> K <sup>-1</sup>
<b>Electrical resistivity:</b>	24.8x 10 <sup>-8</sup> [293 K] Wm
<b>Mass magnetic susceptibility:</b>	+6.28 x 10 <sup>-8</sup> (s) kg <sup>-1</sup> m <sup>3</sup>
<b>Young's modulus:</b>	127.6 GPa
<b>Rigidity modulus:</b>	46.7 GPa
<b>Bulk modulus:</b>	158 GPa
<b>Poisson's ratio:</b>	0.365
<b>Radii:</b>	V5+ 59; V4+ 61; V3+ 65; V2+ 72; atomic 132
<b>Electronegativity:</b>	1.63 (Pauling); 1.45 (Allred); 3.6 eV (absolute)
<b>Effective nuclear charge:</b>	3.30 (Slater); 4.98 (Clementi); 6.65 (Froese-Fischer)
<b>Number of Isotopes (incl. nuclear isomers):</b>	11
<b>Isotope mass range:</b>	44 -> 55
<b>Crystal structure, (cell dimensions / pm), space group</b>	bcc
<b>X-ray diffraction: mass absorption coefficients:</b>	CuK $\alpha$ 233 ( $\mu$ /r) / cm <sup>2</sup> g <sup>-1</sup> MoK $\alpha$ 27.5 ( $\mu$ /r) / cm <sup>2</sup> g <sup>-1</sup>
<b>Neutron scattering length:</b>	-0.0382 b/10 <sup>-12</sup> cm
<b>Thermal neutron capture cross-section:</b>	5.08 sa / barns

