

Group 5 / VB; Vanadium Group

Basics

- Vanadium (V), Niobium (Nb) and tantalum (Ta) are important metals that are not all that rare.
- Tantalum has been seen as critical since it was linked to the ongoing war in the Congo, a source of the mineral group known as "coltan". Wrongly, tantalum was and is described as crucial for silicon microchip technology. It is actually important for so-called tantalum (or better tantalum oxide) capacitors, which are indeed crucial for electronics but not related to silicon technology.
- Vanadium, Niob und Tantal sind wichtige und relativ häufig vorkommende Elemente; Hahnium ist künstlich erzeugt. Alle Elemente sind technisch wichtig ("Tantalkondensator), insbesondere als Legierungsbestandteile. **Nb** war (und wahrscheinlich ist) ein Hauptbestandteil von technisch eingesetzten Supraleitern.
- Niobium and vanadium are important alloy elements for steel. Vanadium is also held responsible for the "water pattern" in wootz steel.

Table of Basic Data

Name <i>(German)</i>	Vandium <i>Vandium</i>	Niob <i>Niobium</i>	Tantal <i>Tantalum</i>
Atomic number	23	41	73
Atomic mass [u]	50,9415	92,90638	180,9479
Melting point [K]	2163	2741	3269
Melting point [°C]	1890	2468	2996
Melting point [°F]	3434	4474	5425
Boiling point [K]	3653	5200	5698
Density [g/cm ³]	6,09	8,58	16,68
Ionization energy [eV]	6,74	6,88	7,89
Electro-negativity	1,5	1,2	1,4
Atomic radius [pm]	132,1	142,9	143
Ionic radius [pm]	59	69	64
Oxidation numbers	5 bis -3	5 bis -1	5 bis -1
Lattice typ Transformation temp. [°C]	bcc -	bcc -	bcc -
Therm. expansion coefficient α Lattice constant [Å] (a or c)	3,03	3,30	3,30
Young's - Modul us [GPa]	127	104	175
[10 ⁻⁶ K ⁻¹]	7,8	7,1	3,6

- In case of doubt all numbers are for room temperatures
- fcc = [face centered cubic](#); lattice const. = a
- bcc = [body centered cubic](#)

sc = [simple cubic](#)
hp = simple [hexagonal](#)
hcp = [hexagonal close packed](#); lattice constants a and c.
op = [simple orthorhombic](#), [monoclinic](#), [triclinic](#)
tp = [simple tetragonal](#)
dia = [diamond structure](#)
r = [trigonal](#) or rhomboedral trigonal