substance: boron compounds with group V elements
property: properties of boron-vanadium compounds

Thermodynamic modelling of the V-B system (experimental and calculated phase diagrams, and phase equilibria data [81S]).

$V_{86}B_{14}$, $V_{84}B_{16}$, $V_{82}B_{18}$ (near-eutectic compositions)

activation energy of internal friction

E_A	1.62 eV		oxygen atmosphere	87D
	0.2 eV		nitrogen atmosphere	

Internal friction spectrum of $V_{84}B_{16}$ between 20 and 700 K in Fig. 1 [87D].

V_3B_2

Preparation [69S, 75S]

VB

Metallic; preparation [69S, 75S, 77L], crystalline structure [77L], electronic structure [79P]

Structure: orthorhombic

Space group: Cmcm

Single crystal preparation from aluminum-flux [94O].

lattice parameters
(in Å)

a	3.0595(8)	*T* = 300 K		94O
b	8.0503(12)			
c	2.9719(8)			
V	73.20(3) Å^3			

resistivity
(in Ωcm)

ρ	$0.36 \cdot 10^{-3}$	*T* = 300 K		94O
	$3.5 \cdot 10^{-3}$	*T* = 293 K		77C

density
(in g cm^{-3})

d	5.54(5)	*T* = 300 K	measured	94O
	5.603(2)		X-ray density	

microhardness

H_V	22.8(5) GPa	*T* = 300 K	(010)	94O

Low temperature electron heat capacity coefficient [86P] (see Fig. 2)

DTA and TG curves in the case of oxidation in [94O].

V_5B_6

Preparation [69S, 75S, 77L], crystalline structure [77L]

Structure: orthorhombic

Space group: Cmmm

Single crystal preparation from aluminium-flux [94O].

lattice parameters
(in Å)

a	3.063(1)	*T* = 300 K	94O
b	21.248(4)		
c	2.979(1)		
V	193.88(9) Å^3		

a	21.242(2)	*T* = 300 K	X-ray diffraction	90B
b	2.9773(2)			
c	3.0613(2)			
V	193.61 Å^3			

density

d	5.603(2) g cm^{-3}	*T* = 300 K	X-ray density	94O

V_3B_4

Preparation [69S, 75S, 77L], crystalline structure [77L]

Structure: orthorhombic

Space group: Cmcm

Single crystal preparation from aluminium-flux [94O].

lattice parameters
(in Å)

a	3.058(1)	*T* = 300 K		94O
b	13.224(2)			
c	2.980(1)			
V	120.51(2) Å^3			

resistivity

ρ	14.6·10^{-3} Ω cm	*T* = 300 K		94O

density
(in g cm^{-3})

d	5.35(4)	*T* = 300 K	measured	94O
	5.402(4)		X-ray density	

microhardness

H_V	21.9(5)GPa	*T* = 300 K	(010)	94O
	23.0 GPa			80S

DTA and TG curves in the case of oxidation in [94O].

Low temperature electron heat capacity [86P].

V_2B_3

Preparation [69S, 75S, 77L], crystalline structure [77L]

Structure: orthorhombic

Space group: Cmcm

Single crystal growth (aluminium solution method) [93O].

Single crystal preparation from aluminium-flux [94O].

lattice parameters
(in Å)

a	3.0595(3)	*T* = 300 K		94O
b	18.428(3)			
c	2.9836(8)			93O
V	168.23(5) Å^3			
a	3.0599(4)		X-ray diffraction	95Y2
b	18.429(2)			
c	2.9839(4)			

resistivity

ρ	2.129·10^{-1} Ω cm	*T* = 300 K		94O

density

(in g cm^{-3})

d	5.27(5)	*T* = 300 K	measured	94O
	5.303(2)	*T* = 300 K	X-ray density	93O

microhardness

H_V	23.2(5) GPa	*T* = 300 K	(010)	94O

DTA and TG curves in the case of oxidation in [94O].

$(V_{1-x}Nb_x)_2B_3$

Structure: orthorhombic,

Space group: Cmcm,4

Synthesis and structure investigation in [95Y1].

lattice parameters
(in Å)

a	3.1086(5)	*T* = 300 K	X-ray diffraction	95Y1
b	18.5817(9)			
c	3.0114(4)			
V	174.0 $Å^3$			

For dependence of lattice parameters on the chemical composition (V/Nb 3 – 1/3, Al/(V + Nb) = 0 and 28) see [95Y1].

VB_2

Metallic; preparation [69S, 75S, 77G], crystalline structure [77C, 77G, 81N], electronic structure [79P, 76S, 81N], electrical conductivity [79L], electronic transport, thermal properties [77C]

Structure: hexagonal

Space group: P6/mmm

Single crystal preparation from aluminium-flux [94O].

lattice parameters
(in Å)

a	2.9981(1)	*T* = 300 K		94O
c	3.0590(1)			
V	23.81(1) $Å^3$			

Defect structure in of VB_2 (and NbB_2) single crystals in [81N].

resistivity
(in Ω cm)

ρ	$2.270 \cdot 10^{-2}$	*T* = 300 K		94O
	$3.8 \cdot 10^{-2}$	*T* = 293 K		77C
	$7.08 \cdot 10^{-2}$	*T* = 1300 K		

density

(in g cm^{-3})

d	5.03(4)	*T* = 300 K	measured	94O
	5.061(1)	*T* = 300 K	X-ray density	

microhardness

H_V	2770...3100 kg mm^{-2}	*T* = 300 K	dep. on crystal orientation and load, Czochralski-grown single crystals	97B
	28.00(13) GPa		(0001)	94O
	27.5(1) GPa			80S

DTA and TG curves in the case of oxidation in [94O].

Low temperature electron heat capacity coefficient [86P] (see Fig. 2)

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Fig. 1.

$V_{84}B_{16}$. Internal friction vs. temperature. Q^{-1}(T) and $f^2/f_0{}^2$ [87D].

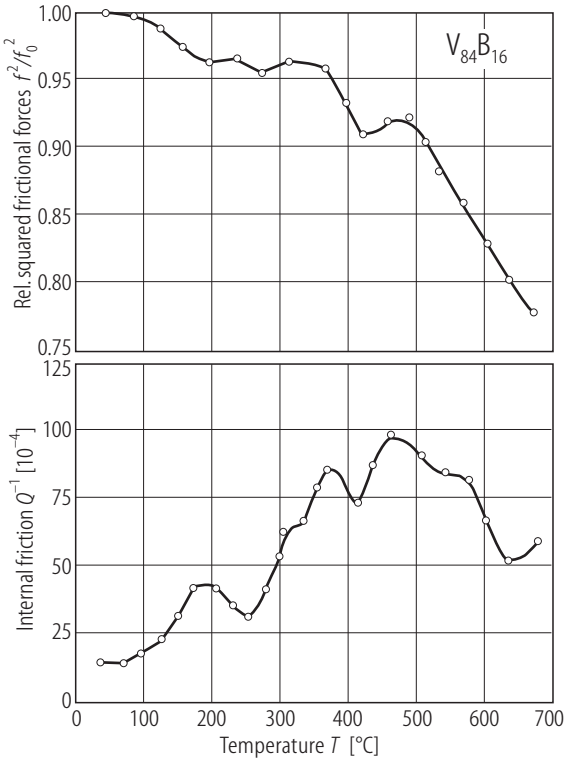

Fig. 2.

Lower vanadium borides. Low temperature electron heat capacity coefficient γ over the filling zone (Δ/Q = 1.4141; $\alpha = 12Q/k_B{}^2\pi^2$) vs. degree of band filling m [86P]. *Q*: Coulomb repulsion energy, *Δ:* halfwidth of the initial band (Hubbard model).