

**substance: boron compounds, general properties****property: structural properties of tetraborides with B<sub>6</sub> octahedra**

The boron covalent sublattice is formed by chains of B<sub>6</sub> octahedra, developing along the *c* axis, and by B<sub>2</sub> pairs bonding the octahedra in the *xOy* plane (Fig. 1) [77E, 81W, 86W]. The resulting three-dimensional skeleton contains tunnels parallel to the *c* axis that are filled by metal atoms [53Z].

Representatives of this structure group: CdB<sub>4</sub>, YB<sub>4</sub>, LaB<sub>4</sub>, CeB<sub>4</sub>, PrB<sub>4</sub>, NdB<sub>4</sub>, PmB<sub>4</sub>, SmB<sub>4</sub>, GdB<sub>4</sub>, TbB<sub>4</sub>, DyB<sub>4</sub>, HoB<sub>4</sub>, ErB<sub>4</sub>, TmB<sub>4</sub>, YbB<sub>4</sub>, EuB<sub>4</sub>, ThB<sub>4</sub>, UB<sub>4</sub> (for preparation, form of growth and microhardness anisotropy, see [96S]).

The NdB<sub>4</sub>, SmB<sub>4</sub>, GdB<sub>4</sub>, TbB<sub>4</sub>, DyB<sub>4</sub>, HoB<sub>4</sub> and TmB<sub>4</sub> phases are antiferromagnetic at low temperatures. PrB<sub>4</sub> is ferromagnetic [72B].

Electrical and thermal conductivity in [74S].

**Resistivity of tetraborides**

Metal	$\rho$ [ $\mu\Omega$ cm] [74S]	$\rho$ [ $\mu\Omega$ cm] [75P]	
Y	34.85	35.3	$T = 300$ K
Pr		40.3	
Nd		39.2	
Gd	31.1	31.1	
Tb	32.0	32.0	
Dy	35.2	35.2	
Ho	30.0	30.0	
Er	49.4	49.5	
Tm	34.7	34.7	

**Hall coefficient, electron density, mobility at 300 K**

Metal	$R_H$ [ $10^{-10}$ m <sup>3</sup> /C]	$n$ [ $10^{22}$ cm <sup>-3</sup> ]	$\mu$ [cm <sup>2</sup> V <sup>-1</sup> s <sup>-1</sup> ]	
Y	-7.02	0.9	20.0	75P
Pr	-3.91	1.6	9.7	
Nd	-5.80	1.1	14.8	
Gd	-8.41	0.8	27.0	
Tb	-6.60	1.0	20.0	
Dy	-4.37	1.5	12.4	
Ho	-5.19	1.2	17.3	
Er	-5.71	1.1	11.5	
Tm	-4.06	1.5	12.1	

For temperature dependence of thermoelectric power, Hall coefficient and magnetic susceptibility in TbB<sub>4</sub> see [75P].

**Thermal conductivity of tetraborides**

Metal	$\kappa$ [W mol <sup>-1</sup> K <sup>-1</sup> ]		
Y	29.16	$T = 300$ K	74S
Gd	148.65		
Tb	126.44		
Dy	118.25		
Ho	27.69		
Er	—		
Tm	158.22		

**Characteristic temperatures (according to [36M]) of metal tetraborides**

Metal	$\Theta$ [K]		
Y	670	$T = 300$ K	74S
Gd	632		
Tb	661		
Dy	698		

Ho	517
Er	543
Tm	657

Electrophysical properties in [75P].

Magnetic properties in [74P].

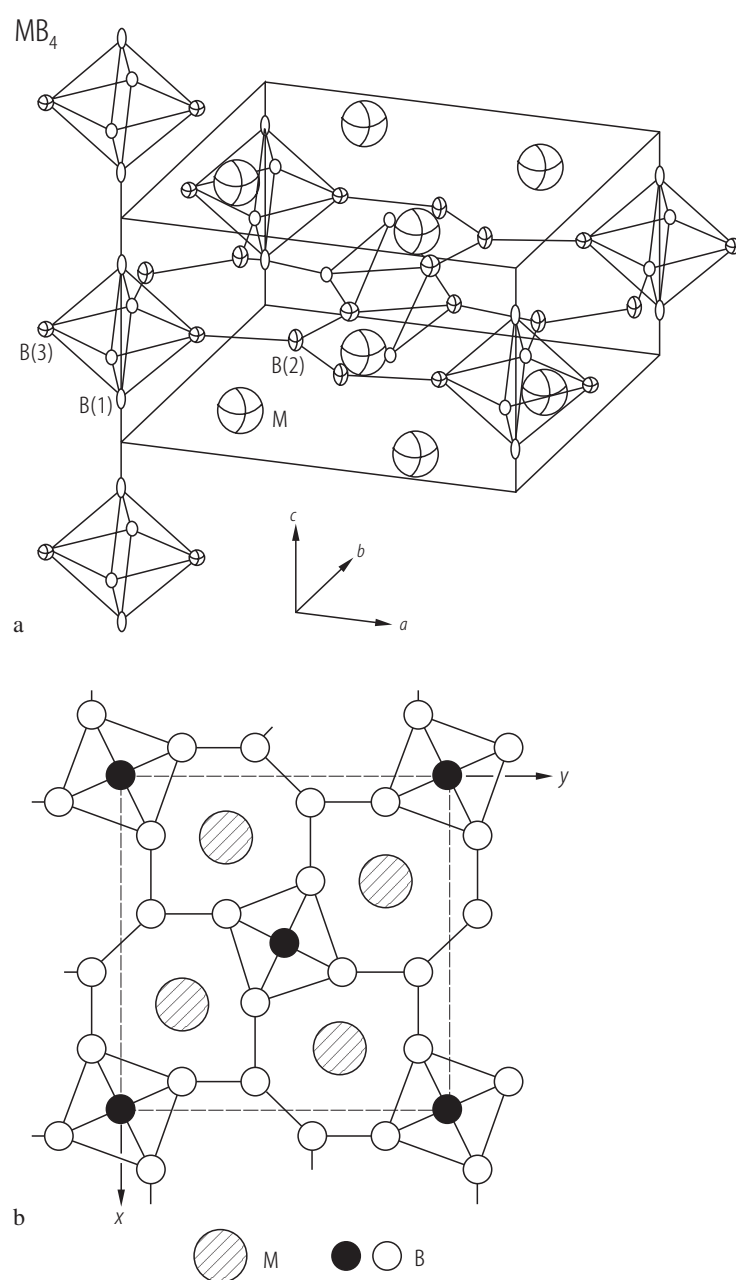
Magnetic susceptibility of  $\text{GdB}_4$ ,  $\text{HoB}_4$ ,  $\text{ErB}_4$  in Fig. 2 [74P].

## References:

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**Fig. 1.**

Metal tetraborides. Crystal structure; **(a)** unit cell; **(b)**  $x0y$  plane [77E, 81W, 86W].



**Fig. 2.**

Metal tetraborides ( $\text{GdB}_4$ ,  $\text{HoB}_4$ ,  $\text{ErB}_4$ ). Reciprocal magnetic susceptibility vs.  $T$  [74P].

