substance: boron compounds, general properties
property: structural properties of compounds with other boride structures

Lower borides

In metal-rich borides the triangular prism is by far the most common coordination polyhedron of the boron atoms. There are only few compounds with octahedrally coordinated boron atoms [97E].

General discussion of the electronic properties of lower borides in [77S].

Transition metal diborides (AlB_2 (hP3) structure)

Systematic consideration of the thermodynamic data in [91G].

Phase stability in [91G].

The (negative) enthalpy of formation in [91G].

Borocarbides (boride carbides)

The ternary rare-earth borocarbides are divided into two parts [91B]:

1. Borides and carboborides. The structures consist of boron and carbon atoms, which form three- or two-dimensional, covalently bonded frameworks and metal atoms, which are located in interstitial positions.

2. Carbides and borocarbides. The frameworks of the structures are formed by the metal atoms with the nonmetal atoms on interstices.

Ternary M-B-C borocarbide systems

Detailed review on ternary M-B-C borocarbide systems in [96G] (with 240 references). Further monographs in [84H, 89A, 90K].

Quaternary M_1-M_2-B-C borocarbide systems

Quaternary borocarbides, new and exciting magnetic superconductors [97G].

Borocarbides of Group III transition metals

In particular scandium, yttrium and all the lanthanides (except for Pm) form ternary borocarbides of the formula MB_2C_2.

Structure: tetragonal

Space group: $P\bar{4}2c$

The unit cell (Fig. 1) [96G]) with a statistical distribution of the atoms is doubled along the *c* axis, i.e. $a = a_0$ and $c = 2c_0$. The metal atoms occupy the 2(e) sites, the four boron atoms occupy the 4(i) sites with $y = 0.232$ and the four carbon atoms are at the 4(h) sites with $x = 0.168$ [71B].

Electronic structure of the new rare earth borocarbide Sc_2BC_2 [90H].

Physical properties of a layered scandium boron carbide $Sc_3B_{0.75}C_3$ [99M].

Electronic structure and geometrical arrangement of the rare earth metal boron carbide $Gd_3B_4C_2$ [99K].

Borocarbides of Group IV transition metals

Compounds have been found in the Ti-B-C phase diagram, the Zr-B-C phase diagram, the Th-B-C phase diagram, see [96G] and references therein.

Borocarbides of Group V-VIII transition metals

No ternary borocarbides of group V transition metals were detected in the M^V-B-C systems. Chromium, molybdenum and uranium form borocarbides, whereas in the W-B-C system no ternary compounds have been found [96G].

In the V-B-C and the Nb-B-C systems all the carbides and borides are in equilibria with one another (for B-B-C: V_2C_y – V_3B_2, V_2C_y – VB, VC_y – VB, VC_y – V_3B_4, VC_y – VB_2, VB_2 – C) [71M, 96G].

The Ta-B-C system (unlike V-B-C and Nb-B-C) has one additional pseudobinary equilibrium: Ta_2C' – Ta_2B [96G].

Cr-B-C system: Chromium carbides, in contrast to carbides of other transition metals, can dissolve substantial quantities of boron because of the significant differences between the crystal structures. Apart from these solid solutions the compound Cr_7BC_4 exists ([96G] and references therein). Structure of Cr_7BC_4 in [96G].

In the Mo-B-C and the W-B-C systems six pseudobinary phase interactions exist [71M, 83S, 96G].

In the U-B-C system the compounds UBC, UB_2C and $U_5B_2C_7$ have become known [96G].

Ternary boronitride systems

Six pseudobinary equilibria are possible in the Ti-B-N system, five in the Zr-B-N system, at least three in the Hf-B-N system, eight in the V-B-N system, three ternary compounds (e.g. Nb_2BN) were found in the Nb-B-N system, eight pseudobinary equilibria were found in the Cr-B-N system. In the Ta-B-N and the Fe-B-N systems no ternary coumpounds seem possible [96G].

Quaternary M-M'-B-C borocarbide systems

On structure, chemical and physical properties (in particular a review and new results on superconducting and nonsuperconducting Y-Pd-B-C compounds) of quaternary borocarbides [97G].

On superconductivity (T > 20 K) [97F, 97Y, 97S].

Specific compounds: $LaPt_2B_2C$ [94S], $LaPd_2B_2C$ [95J2], YNi_2B_2C, $LuNi_2BC$, $LaPt_{1.5}Au_{0.5}B_2C$, $LaNiB_2C$ [95M].

Chemical and superconducting properties of the quaternary borocarbides Ln-M-B-C (Ln = rare earths, Y; M = Ni, Pd) [99T].

High resolution transmission electron microscope studies on a superconductor $YPd_2B_2C_x$ compound [94I].

Influence of some metal substitutions on the superconducting behavior of molybdenum borocarbide [81L].

Microwave properties of borocarbide superconductors RNi_2B_2C (R = Y, Er, Tm, Ho) [95J1].

Superconductivity at 23 K in yttrium palladium boride carbide [94C].

Amorphous borides

Amorphous transition metal borides [87M].

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Fig. 1.

Borocarbides MB_2C_2. Structure; projection along the [001] axis of the ordered crystal structure. Only one half of the unit cell is shown; for z = ¾, the B-C network is rotated by 90° [96G].