

substance: boron compounds, general properties
property: structure group of $\text{AlB}_{10}/\text{C}_4\text{AlB}_{24}$ –26

[98M]

Room temperature phase: The existence of an orthorhombic AlB_{10} (space group Bbmm) was mentioned in [58K]. Based on theoretical considerations the substitution of Al for icosahedral B atoms was assumed [60L]. A preliminary orthorhombic structure model was proposed in [63W]. It was proved in [64M] and later on confirmed in [67A] that the AlB_{10} structure only develops in the presence of carbon, and the compound was denoted as $\text{B}_{24}\text{AlC}_4$. Nevertheless AlB_{10} and $\text{B}_{24}\text{AlC}_4$ were sometimes taken as different compounds [66W, 67W, 69W, 70W]. In [69P] the distorted h.c.p (space group Cmcm) of the compound $\text{B}_{51}\text{Al}_2\text{C}_8$ was reported. The most reliable structure determination of $\text{B}_{24}\text{AlC}_4$ is due to [90O].

High-temperature phase: Irreversible phase transitions into rhombohedral phases were reported for $\text{B}_{24}\text{AlC}_4$ (at about 2000°C) [65E, 66G] and for AlB_{10} (at 950°C) [66W]. An Al-containing boron carbide with the composition $\text{B}_{12}\text{AlC}_2$ was obtained by reaction at 1500°C [66L]. Single crystal fine structure analyses of $\text{B}_{40}\text{AlC}_4$ [70N] and HT- $\text{B}_{51}\text{Al}_2\text{C}_8$ [98M] led to the rhombohedral structure (space group $R\bar{3}m$). It can be attributed to the α -rhombohedral boron structure group and considered as an Al-doped boron carbide with some of the unit cells containing sideways shifted Al atoms instead of the central B atom of the three-atomic C-B-C or C-B-B chains.

Since in papers on physical properties the structures are not well defined in all cases, there it was sometimes uncertain, where the compounds are to be arranged, and therefore the data can probably be found at different places in this book.

For a detailed analysis of the structures attributed to this structure group, see [98M].

Representatives of the $\text{AlB}_{10}/\text{C}_4\text{AlB}_{24}$ structure group

Chemical formula	Structural formula (idealized)	
AlB_{10}	$(\text{B}_{12})_4\cdot\text{B}_4\text{Al}_{4.8}$	67W, 86H
$\text{AlC}_4\text{B}_{24}$	$(\text{B}_{12})_4\text{C}_8\text{B}_4\text{Al}_{2.1}$	69W, 86H
$\text{C}_4\text{AlB}_{26}$	$(\text{B}_{12})_4\text{C}_8(\text{Al B})_n$	69P
$\text{Al}_2\text{C}_9\text{B}_{51}$	originally denoted AlB_{10}	87L, 69P, 63W, 69W

References:

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