substance: boron compounds with group IV elements: B-C compounds
property:properties of special B-C compounds

BC_3

Structural and electronic properties of the layered compound [95I]. Electronic band structure calculation in [90L].

B_2C

Preparation of crystalline material by CVD [86K].

Preparation of boron-carbon compounds, including crystalline B_2C material, by chemical vapor deposition [87S].

B-C compounds, prepared by CVD: B_8C, $B_{50}C_2$ ($B_{25}C$), $B_{51}C$

B_8C

Structure: orthorhombic

Structure formula $(B_{48}C_6)_8$

Primitive structural elements in the unit cell: $32B_{12}$ + 48C

lattice parameters
(in Å)

a	35.909	*T* = 300K	X-ray diffraction	74P1
b	17.653			
c	5.094			

Preparation by CVD at 900...950°C [74P1, 74P2, 65M].

IR lattice vibration spectra of B_8C, $B_{50}C_2$, $B_{51}C$ [99W].

IR absorption and reflectivity spectrum in Fig. 1a, b [99W] (see also [88W]); for phonon resonance frequencies, see below.

density

d	2.42 g cm^{-3}	*T* = 300 K	$B_{192}C_{24}$ (experimental)	74P1, 77B,
	2.430 g cm^{-3}		calculated	77N

$B_{50}C_2$ ($B_{25}C$)

Structure: tetragonal

Space group: $P4_2/nnm$

Structure formula $(B_{12})_4B_2C_2$

Primitive structural elements in the unit cell: $4\ B_{12}$ + 2B + 2C

lattice parameters

a	8.722 Å	*T*=300 K	X-ray diffraction	74P1,
c	5.080 Å			77M1,

Preparation by CVD under normal pressure at substrate temperatures between 1150 and 1200 °C [74P1].

Discussion of the structure in [77B, 77M1, 77M2].

For slightly differing lattice parameters of needle-like crystals, compact crystals and powder, see [77B].

IR lattice vibration spectra of B_8C, $B_{50}C_2$, $B_{51}C$ [99W].

IR absorption and reflectivity spectrum in Fig. 2a, b [99W] [88W]; for phonon resonance frequencies, see below.

density

d	2.43 g cm^{-3}	*T* = 300 K	$B_{50}C_{1.9}$ (experimental)	74P1, 77B

	2.426 g cm^{-3}		calculated	77N

$B_{51}C$

Structure: tetragonal

Space group: $P4_2/nnm$

Structure formula $B_{48}B_2(BC)$

Primitive structural elements in the unit cell: 4 B_{12} + 2B + (1B + 1C)

lattice parameters

a	8.761 Å	*T* = 300 K	X-ray diffraction	87H,
c	5.059 Å			88W

Preparation by CVD under normal pressure at substrate temperatures between 1150 and 1200 °C [74P1].

number of IR-active phonons (group theoretically determined)

B_2	23	degeneracy 1	87H
E	38	degeneracy 2	
E	(1)	rotation, degeneracy2	

IR absorption and reflectivity spectrum in Fig. 1a, b [99W], see also [87H, 88W].

IR lattice vibration spectra of B_8C, $B_{50}C_2$, $B_{51}C$ [99W].

density

d	2.39 g cm^{-3}	*T* = 300 K	$B_{48}B_2(BC)$ (experimental)	74P1,
				77B
	2.408 g cm^{-3}		calculated	77N

resonance frequencies of phonons of tetragonal B-C compounds
(obtained from the spectra in Fig. 1b and 2b) [99W]
equal or similar resonance frequencies of the different compounds are arranged in one row each, uncertain data in parentheses

$B_{25}C$	$B_{50}C_2$	B_8C	$B_{51}C$	
ν/c [cm^{-1}]	ν/c [cm^{-1}]	ν/c [cm^{-1}]	ν/c [cm^{-1}]	
87	82	72	71	99W
103	106	101		
139	141	135	136	
170	165			
226	226	(226)	(224)	
		261	(263)	
314	311	308	307	
	381	390		
393	400			
411	418	410	(417)	
444	439	449	443	
467	471	471	460	
		(507)	508	
546	545	542	(554)	
	581	575	576	
	615	620	616	
632	633	635		
		651	646	
668	669	673	681	
684	684	700		
712	712		712	
756	756		740	
			775	
		801	(798)	
(833)	(832)	845	(859)	
873	874	874	875	
924	924	921	923	
986	985	968	988	
		1064	1068	
1239	(1238)	(1248)	1234	
1424	1428	1441	1435	
1528	1528			

References:

65M Matkovich, V.I., Giese, R.F.: Z. Kristallogr. 122 (1965) 108.

74P1 Ploog, K.: J. Cryst. Growth 24/25 (1974) 197.

74P2 Ploog, K., Druminski, M.: Krist. Techn. 9 (1974) 25.

77B Becher, H.J., Mattes, R.: in Boron and Refractory Borides, V.I. Matkovich ed., Springer: Berlin, Heidelberg, New York, 1977, p. 107.

77M1 Matkovich, V.I., Economy, J.: in: Boron and Refractory Borides, V.I. Matkovich ed., Springer: Berlin, 1977, p. 78.

77M2 Matkovich, V.I., Economy, J.: in: Boron and Refractory Borides, V.I. Matkovich ed., Springer: Berlin, Heidelberg, New York, 1977, p. 96.

77N Naslain, R., Etourneau, J., Hagenmuller, P.: in: Boron and Refractory Borides, V.I. Matkovich ed., Springer: Berlin, Heidelberg, New York, 1977, p. 262.

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87H Haupt, H., Werheit, H., Siejak, V., Gurin, V.N., Korsukova, M.M.: in: Proc. 9th Int. Symp. Boron, Borides and Rel. Compounds, University of Duisburg, Germany, Sept. 21 - 25, 1987, H. Werheit ed., University of Duisburg: Duisburg, 1987, p. 387.

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88W Werheit, H., Kuhlmann, U., Tanaka, T.: (unpublished results).

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95I Itoh, S., Nozaki, H.: in: 22nd Int. Conf. Phys. Semiconductors, Vancouver, BC, Canada, 1994, Lockwood, D.J. ed., World Scientific: Singapore, 1995, p. 145.

99W Werheit, H., Au, T.: (to be published).

Fig. 1.

B_8C, $B_{51}C$. **(a)** Reflectivity, **(b)** absorption index vs. wavenumber [99W]. (See also [88W]).

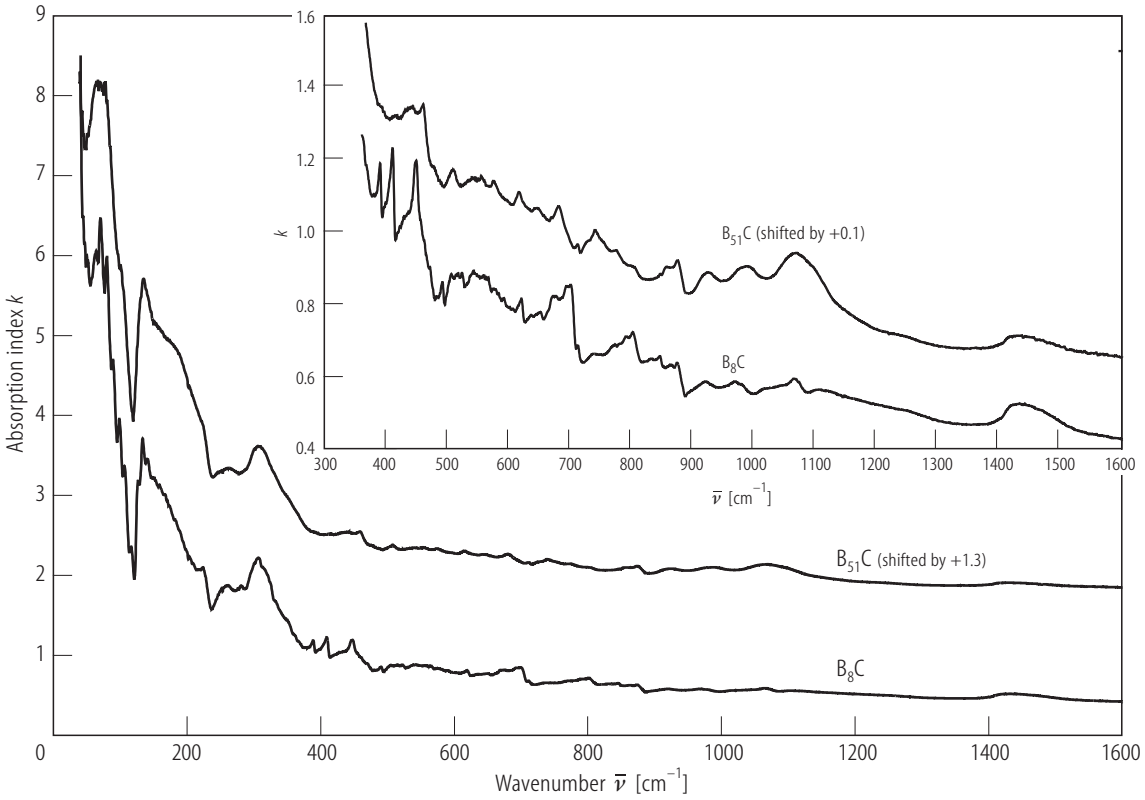

Fig. 2.

$B_{50}C_2$ ($B_{25}C$). **(a)** Reflectivity, **(b)** absorption index vs. wavenumber [99W]. (see also. [87H, 88W]). The spectra were obtained on two samples, denominated as $B_{50}C_2$ and $B_{25}C$ respectively. The spectra confirm that the structures do not essentially differ from one another.