Vereshchagin Institute for High Pressure Physics of the Russian Academy of Sciences (HPPI RAS)

Effect of boron on the structure of graphite formed at high pressure

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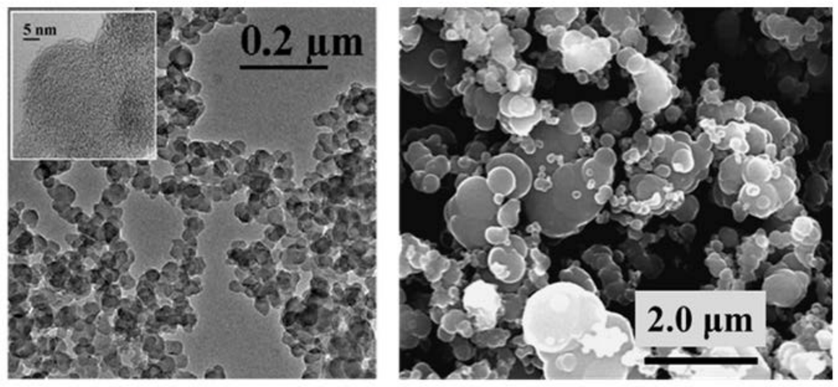
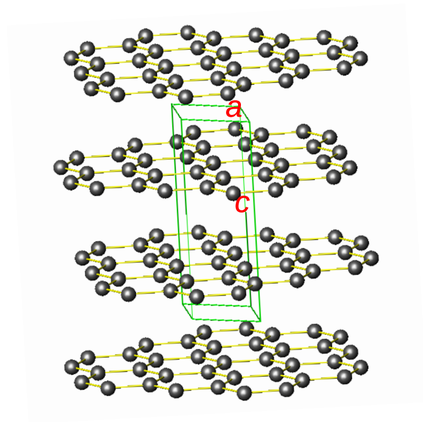
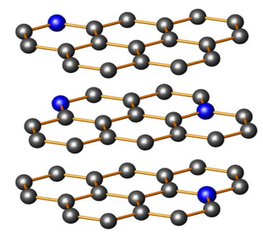
globular nanocarbon + boron





graphite: *a* - 2.462, *c* - 6.720



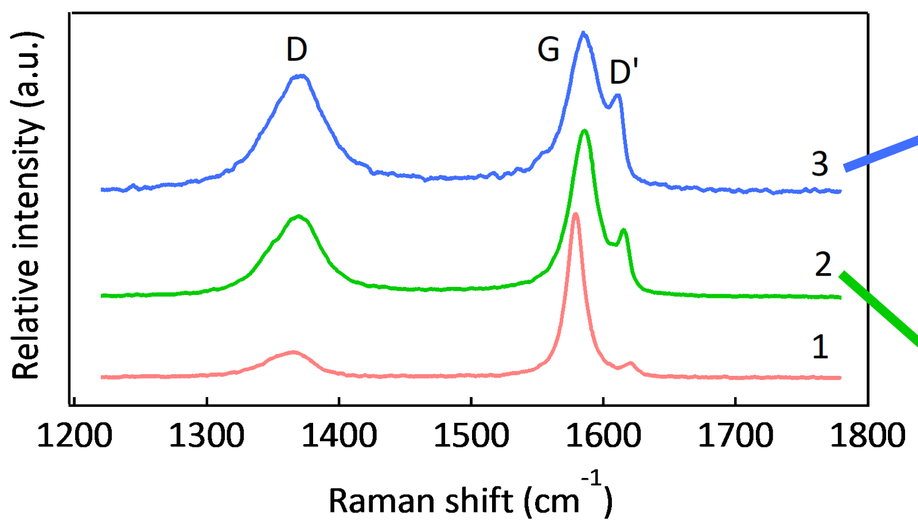
graphite with 2% boron:
a - 2.467, *c* - 6.704

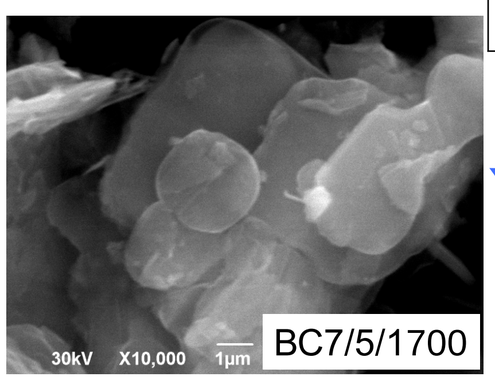
B/C = 1/7

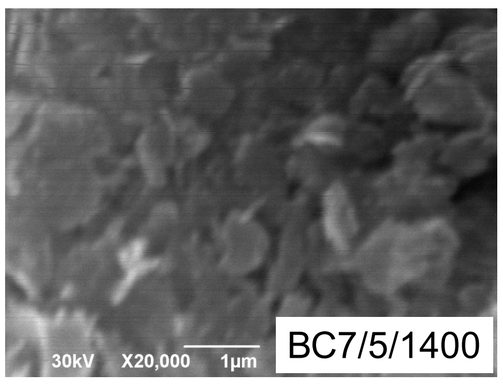
ethanol

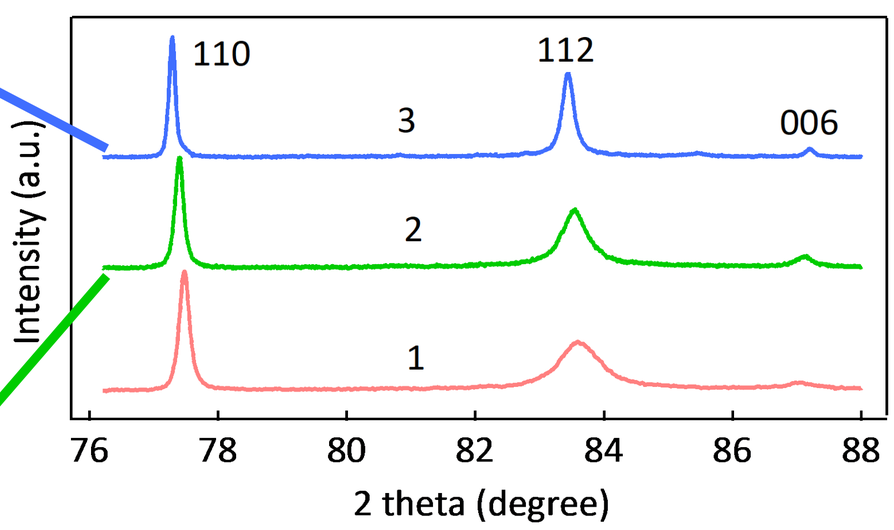
Influence of thermobaric treatment
on the parameters of the crystal lattice of the formed graphite

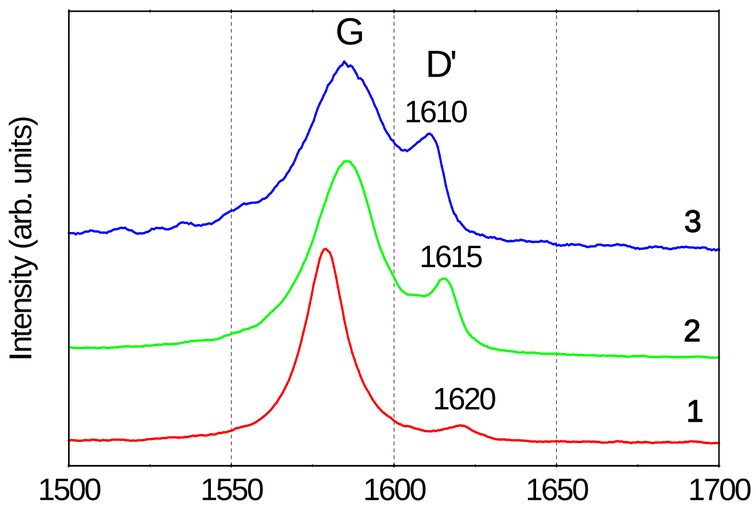
Sample number	Initial state	Processing parameters P, T, τ	a, Å	c, Å	B, at.%
1	Natural graphite	7.0ГПа, 1700°C, 60sec	2.4622(3)	6.7181(30)	-
2	BC7 mixture	5.0ГПа, 1400°C, 60sec	2.4644(1)	6.7055(6)	≈ 1
3	BC7 mixture	5.0ГПа, 1700°C, 60sec	2.4670(2)	6.7035(8)	≈ 2
4	BC7 mixture	7.0ГПа, 1700°C, 60sec	2.4663(2)	6.7043(13)	≈ 2
5	Globular nanocarbon	7.0ГПа, 1700°C, 60sec	2.4626(3)	6.7197(21)	-



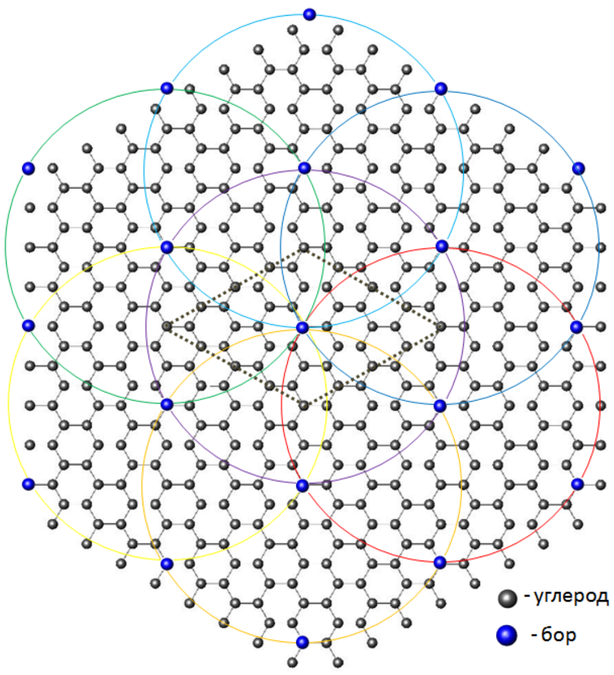




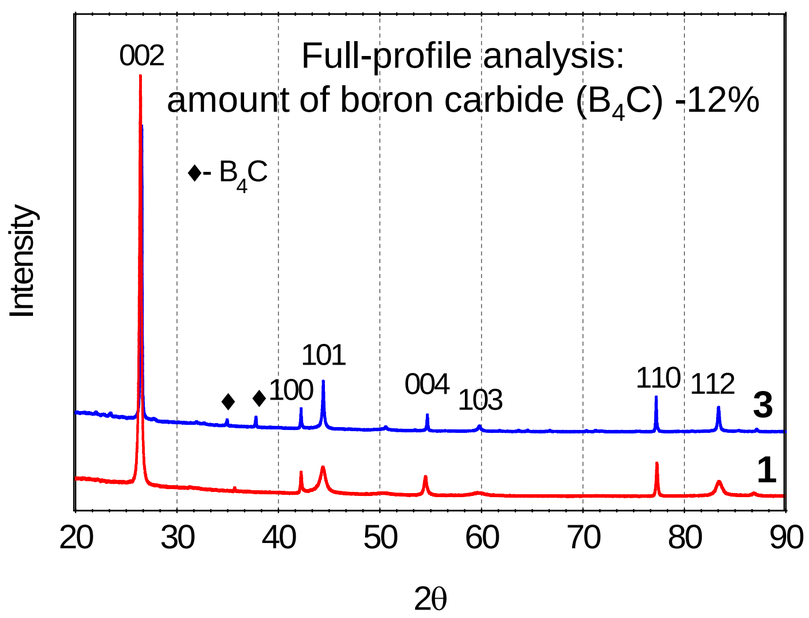




Raman spectra of boron-doped graphites show a significant structural imperfection. The width of G peak, intensity of D and D´ peaks increase with the graphitization temperature increase.

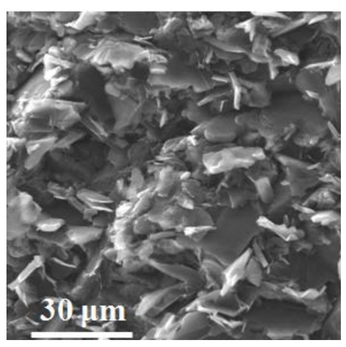


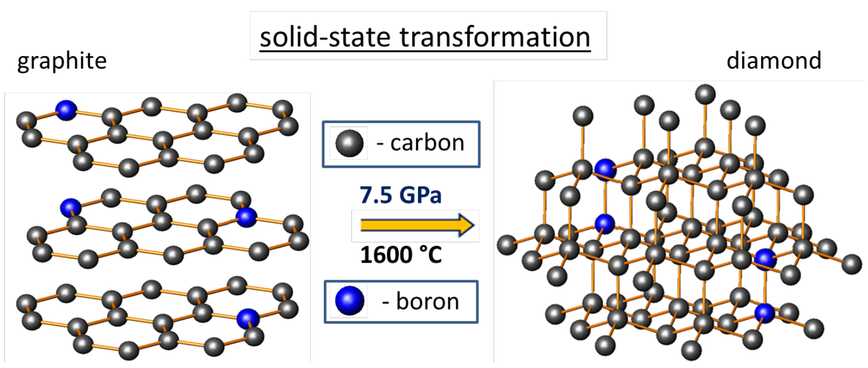
Perfect graphene layer
with 3% boron atoms

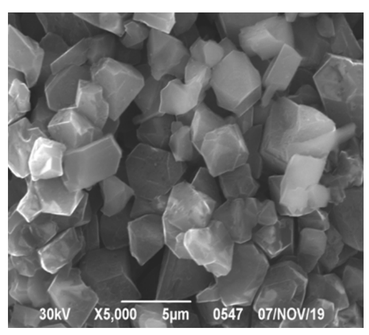


The peaks on the X-ray pattern of boron-doped graphite are not broadened, which reflects of a good periodicity of the structure. The apparent contradiction between X-ray and Raman data can be solved by assuming that boron atoms are located in layers periodically and do not disturb the three-dimensional ordering.

Solid-state conversion of heavily boron doped graphite into heavily boron doped diamond occurs at a record low pressures of 7.5-8.0 GPa and temperatures of 1600-1650°C.







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