High-pressure / High-temperature Synthesis and Characterization of Boron-doped Diamond

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Bulk samples (with volumes up to ~ 7.5 mm^3) of boron-doped diamonds (BDD) were synthesized by means of direct reaction between boron carbide and graphite in a multianvil apparatus at high pressures and high temperatures (HPHT). X-ray diffraction data revealed the presence in BDD of a very small amount of a highly boron-enriched phase ($B_{50}C_2$) and traces of the $B_{13}C_2$ used as an initial material. The absence of $B_{50}C_2$ in the product of treatment of pure $B_{13}C_2$ under the same HPHT conditions suggests that boron-rich carbides exsolute from diamond on quenching leading to boron depletion of the diamond matrix. These observations imply that boron solubility in diamond increases at high pressure and high temperature. This result may have important implications for the understanding of the mechanism of boron incorporation into diamond at HPHT synthesis and for the interpretation of the data on superconductivity of polycrystalline BDD.

Key words: Boron-doped Diamond, High-pressure Synthesis, X-ray Diffraction