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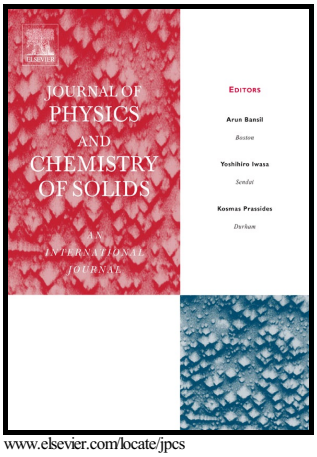

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Boron-doped diamond synthesized at high-pressure and high-temperature with metal catalyst

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Abstract

The boron-doped diamond (BDD) powder consists of 40-100 μm particles was synthesized at 5 GPa and 1500–1600 °C from a mixture of 50wt% graphite and 50wt% Ni–Mn catalyst with an addition of 1wt% or 5wt% boron powder. The size of crystal domains of doped and non-doped diamond was evaluated as a coherent scattering region by X-ray diffraction (XRD) and using small-angle neutron scattering (SANS), being ≥ 180 nm (XRD) and ~100 nm (SANS). Magnetic impurities of $NiMn_x$ originating from the catalyst in the synthesis, which prevent superconductivity, were detected by magnetization measurements at 2-300 K. X-ray photoelectron spectroscopy, the temperature dependence of the resistivity, XRD, and Raman spectroscopy reveal that the concentration of electrically active boron is as high as $(2 \pm 1) \times 10^{20}$ cm^{-3} (0.1 at.%). To the best of our knowledge, this is the highest boron content for BDD synthesized in high-pressure high-temperature process with metal catalysts.

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