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Consolidation of nanocrystals of detonation diamonds at high-pressure high-temperature sintering

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Abstract

The process of consolidation of nanocrystals of detonation nanodiamond (DND) into polycrystalline aggregates during their annealing at high pressures and temperatures (HPHT) was studied. The experiments on HPHT annealing of DND powder were carried out using a high pressure apparatus BARS at 5 GPa and 1100, 1200 °C. It was established that after HPHT annealing the microhardness of sintered DND samples had a value of 14 GPa. It was proposed that HPHT annealing of DNDs leads to deep purification of nanoparticle surface, resulting in formation of strong nanodiamond polycrystalline aggregates. The observed growth can be a result of interaction of neighboring DND nanocrystals along the contact areas that are purified of impurities during the HPHT annealing.

Keywords: nanodiamond; high pressure high temperature; superhard materials

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