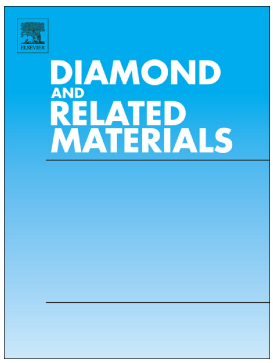

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Abstract

Highly oriented pyrolytic graphite (HOPG) is a unique source material for the synthesis of new types of diamond. It can transform to layered nano-polycrystalline diamond (NPD) under static high pressure and high temperature (HPHT) and to "amorphous diamond" by introducing structural defects by neutron irradiation followed by shock compression. Here, we investigated the structural change of the neutron-irradiated HOPG through a HPHT treatment at 2300 ˚C and 15GPa by Raman, XRD, TEM and XANES analyses. The recovered sample consists of randomly oriented nanodiamonds (50-100 nm), showing clearly a different microtexture from those of the layered NPD and "amorphous diamond" reported by the previous studies. This is likely as a result of competing effects of the introduction of irradiation-induced defects, which provided the preferential nucleation sites for cubic diamond, and their partial recovery upon annealing during the HPHT treatment. The present result suggests that NPDs with various crystalline structures can potentially be synthesized from neutron-irradiated HOPG by controlling the density and distribution of the defects introduced.

Key Word: nano-polycrystalline diamond, graphite, high pressure high temperature, irradiation induced defects

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