Self-assembling of n-diamond Nanocrystals into Supercrystals and Strategies for Fabrication of Diamond Microcomponents

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In this communication we present recent efforts from our group to construct single-crystal architectures using nanodiamond as building blocks and to find out microfabrication processes for the shaping of free standing diamond tips, whiskers and nanorods .

The starting material for these experiments was detonation nanodiamond manufactured by R&P Centre ALTAI. HRTEM and SAED characterizations have been performed on small pieces of the deposits obtained on a glass plate by drying drops of the pale-grey colloidal suspension in acqueous medium. The HRTEM images and the electron diffraction pattern indicated the presence of a single-crystalline material resulting from a 3D ordered aggregation of diamond nanograins with sizes of few nm and moreover with the structural features of a fcc crystal lattice. The correspondence with the plane indexing suggestes the presence of the so-called n-diamond, already found as a by-product of several diamond synthesis techniques [1-3]. In the case of detonation nanodiamond, self-assembling mechanisms lead to selective aggregation of monodisperse n-diamond grains into highly ordered close-packed crystals.

The possibility to coat the net-shaped 3D specimen, obtained by self-assembled nanodiamond deposits, by layers of CVD-grown polycrystalline diamond allows one to modulate the shape of the final diamond components and represents a viable alternative for easy and low-cost manufacturing of diamond micro-components for MEMS or of tip arrays for electronic devices.

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