Nanodiamond seeding for nucleation and growth of CVD diamond films

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Very high nucleation density (>10^{10} cm^{-2}) must be achieved when deposition of thin conformal diamond films on flat or finely patterned substrate surface is required. The nanocrystalline CVD diamond layer produced at the first stage of the deposition process is the prerequisite of fabrication of a precise replica of the substrate pattern using a molding technique [1]. The nanodiamond particles produced by a detonation technique are effectively used for seeding the substrates with a complex shape by an ultrasonic pretreatment.

In this talk the evolution of the seeds upon diamond film growth on different materials by DC plasma and microwave plasma CVD is studied. The surface morphology and some physico-chemical properties (wettability, surface energy, impurities abundance, thermal conductivity) of nucleation side of the thick, hundreds microns, free-standing films obtained by removal the substrate are experimentally examined. The surface roughness less than 10 nm is measured with AFM for the fine-grained nucleation side in case of the deposition on mirror-polished substrates. Examples of micron-scale and macro-scale diamond components grown on Si molds for optical and electronic applications will be given.

[1] V. Ralchenko, Nano- and microstructral features in CVD diamond growth, in Nanostructured Carbon for Advanced Applications, G. Benedek, et al. (eds), Kluwer, Dordrecht, 2001, pp. 27-52.