High density nanodiamond monolayer obtained by an electrophoretic process

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Electrophoretic deposition is an efficient method to deposit colloidal particles on an electrode by using an electrical field. This technique has already been used for the deposition of nanoparticles [1] or nanodiamonds [2] and was here applied to detonation ultra-nanocrystalline diamonds (D-UNCD). To obtain ultrathin D-UNCD deposit, the use of suspension containing individual nanodiamonds is crucial.

The D-UNCD used in this study were synthesized and purified at the ISL [3]. The D-UNCD particles surface is mainly covered by carboxylic groups [4] resulting in a negative surface charge when suspended in water. A mechanical treatment was applied to the D-UNCD to obtain suspension containing separated nanodiamonds with an average size of 3-5 nm. An electrical field was applied to this colloidal suspension to deposit the D-UNCD on a Highly Oriented Pyrolitic Graphite electrode. The obtained deposits were characterised by Atomic Force Microscopy (AFM). The deposits topography is 5 nm, corresponding to a monolayer deposition of D-UNCD (Figure 1). The deposits density obtained with this technique is estimated to be over 10^{12} particles/cm^2. Due to the proximity of the nanodiamonds particles, an AFM tip with a radius of 2 nm wasn't able to discern them. To our knowledge such a density has never been obtained before.

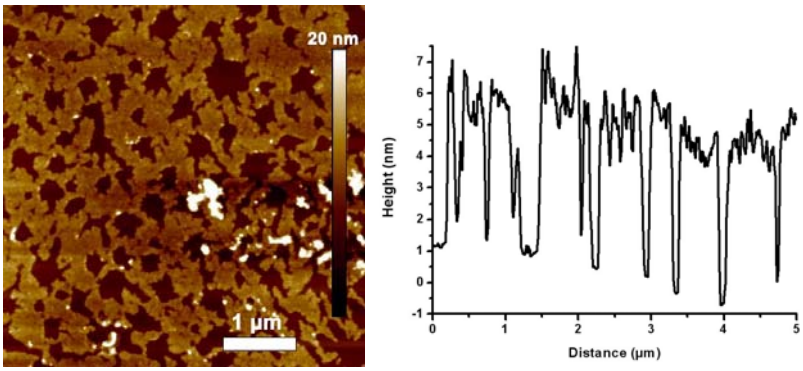

Figure 1. AFM image of an electrophoretic deposit of a D-UNCD monolayer

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