Surface modifications of nanodiamonds for higher surface reactivity

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Nanodiamonds (NDs) constitute excellent candidates for biomarkers, combining the ability to covalently graft biomolecules on their surface with the presence of stable coloured N-V centers. However, their surface chemistry presents a wide variety of oxidized groups as well as amorphous carbon. An initial surface treatment is thus required to ensure high grafting yield and reproducibility. Different strategies were previously reported in the literature [1-5].

We investigated two different ways to homogenize NDs surface terminations: hydrogenation and surface graphitisation. Our original approach combines *in situ* and *ex situ* experiments. First, surface modifications of NDs are monitored by electron spectroscopies without air exposure to better understand the involved mechanisms. Second, suitable conditions are used for *ex situ* treatment to modify larger quantities of NDs, usable for chemistry. Efficient surface hydrogenation of NDs using MPCVD will be first presented [6]. The MPCVD reactor is connected to a UHV system equipped with XPS and AES. Kinetics of oxygen removal were followed by surface analysis of hydrogen treated NDs. Their enhanced surface reactivity was then confirmed using photochemical reaction with alkenes and a spontaneous coupling of aryldiazonium salts. These results strongly suggest similar electronic surface properties between bulk and nanodiamond materials.

Surface graphitisation of NDs is also a promising way for chemistry. Prato reaction was recently reported on such modified surfaces [7]. Our *in situ* study of NDs using UHV annealing will be presented. The effects of the annealing parameters on the graphitization kinetics will be discussed. The best conditions were then used in an *ex situ* furnace allowing the preparation of stable colloid suspension of graphitised NDs characterised using DLS and Zeta potential measurements.

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