Bio-Sensitization of Boron-Doped Diamond

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Polycrystalline layers of boron-doped diamond focus the interest of the electrochemical community for their specific properties, i.e., mechanical and chemical stability, large potential window for electrochemical reactions in water and transparency. In such a perspective, residual surface reactivity of the as-grown diamond film has to be carefully checked. As a matter of fact, little is presently known about surface chemistry of the diamond layer. Important questions as nature and amount of every oxygenated chemical function remain a matter of debate. Various pre-treatments of the diamond layers are found in literature, most of them being drastic oxidation, but the resulting surface states are not precisely defined. Recently, we observed that treatment of as-grown hydrogenated diamond layers by singlet oxygen afforded a greater amount of surface hydroxides than by electrochemical oxidation, as judged from the density of the obtained biotin grafting by heterogeneous esterification. Esterification of hydroxylated diamond surfaces appears a versatile tool for surface functionalization of boron-doped diamond. We so succeeded in grafting photoactive groups such as pyrene moieties. This surface sensitization induced measurable photocurrents in a photoelectrochemical configuration including oxygen-saturated aqueous electrolyte. Very accurate detection of pyrene monolayer was so achieved (figure 1).

Several developments of our current work aiming to bio-sensing with boron-doped diamond will be presented.

- Information about nature and amount of surface oxygenated species as deduced from derivatization methods and surface analysis.
- Grafting of biological functions and possible strategies for bio-sensing on boron-doped diamond.


Fig.1: (a) Photo-current distribution with energy measured on bare diamond and on grafted diamond with pyrene. (b) Comparison between a reference UV/visible spectrum of pyrene (1) and the difference between the two spectra measured in (a) corrected from the