**Ultra-thin Diamond Detectors for On-Line Monitoring of Ion Microbeams**

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Studying the impact of ionizing radiation on living organisms is important both for radiation protection and radiation therapy applications. It requires to develop irradiation facilities that enable a precise control of the delivered dose and the localization of the irradiations. Charged-particle microbeams extracted in air are capable of irradiating living biological samples down to the micrometer scale. Unlike global irradiation, microbeam irradiation enables a specific cell or sub-cellular compartment to be targeted, with a small beam spot and a controlled number of particles. The ions available on the microbeam facilities at AIFIRA (LP2I Bordeaux, France) and MIRCOM (IRSN, Cadarache, France) are protons, alpha-particles or heavier ions like carbon with maximum energies ranging from 3 MeV to 8 MeV (carbon).

In order to deliver a precise and low number of ions per cell, it is necessary to develop dedicated detectors. Diamond detectors are suited to answer the problematic but face many technological challenges [1]. Indeed, as the ions stop in the biological samples, the detector must be placed as the extraction window and be very thin to limit the disturbance (in energy loss and deviation) of the beam. First prototypes have been previously tested successfully [2]. This work aims at developing thinner detectors (~1 µm) and improve their design.

Reactive Ion Etching (RIE) uses plasma bombarded onto the surface to etch diamond. Etch rate rise up to a few micrometers per hour. Starting from 50 µm bulk diamond, this technique has to be adapted for deep etching to achieve micrometer thickness. A good surface quality and thickness homogeneity of the etched diamond are necessary for efficient charge collection and accurate ion counting. Plasma composition and masking material are some of the parameters that can be optimized. We will present ongoing developments of etching techniques for the thinning of diamond.

**References**

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