

CENTRE D'ETUDES NUCLÉAIRES DE BORDEAUX-GRADIGNAN

Vendredi 02 Octobre 2015

à

11H

Un café sera servi à partir de 10h45

Michal POMORSKI*

CEA-LIST, Domaine : Matériau diamant et capteurs, Gif-sur-Yvette, France

Super-thin scCVD diamond membranes for radiation detection applications

Using Ar/O plasma etching technique self-supported few micrometres thick single crystal (sc) chemical vapour deposition (CVD) diamond membranes were fabricated of a size approaching initial size of the scCVD sample (commercially available crystals up to 8 mm x 8 mm). Membranes exhibit very good surface quality with no change in initial surface roughness after deep etch. Furthermore, due to the short drift path of the excess charge carriers in such structures, the use of a cheaper non-electronic grade (nitrogen content $5\text{ppb} < [N] < 5\text{ppm}$) diamond material as a radiation detector should be feasible. The membrane fabrication process includes, the deep plasma etching step, which requires preliminary samples screening (especially for membranes < 5 micrometres thick) regarding: surfaces quality (polishing defects), surfaces parallelism (wedge) and the bulk quality (absence of inclusions and voids). The effects of such defects on the membranes morphology will be addressed and methods of the samples pre-characterization will be discussed. Finally, the produced membranes are plated with metal or diamond-like carbon contacts and connected to the read-out electronics aiming at characterization of their electrical properties. Sensors properties are probed with 5.486 MeV α -particles as an ionization source in laboratory conditions. Despite nitrogen impurity scCVD membrane detectors exhibit: stable operation, charge collection efficiency close to 100%, with homogenous response, and extraordinary dielectric strength up to 30V/micron. Membrane scCVD detectors are perfect candidates for applications where transparency and/or radiation hardness are required. Several in-beam experiments were performed using membrane sensors including: X-ray beam monitors for tender X-rays at modern light sources, low energy heavy ion detection and vacuum window for living-cell irradiation studies. In all these measurements, scCVD membrane detectors exhibit perfect detection characteristics.

** Travail effectué en collaboration avec P. Bergonzo, K. Desjardins, V. Grilj, M. Jakšić, W. Kada, T. Makino, J. Morse, S. Onoda, S. Saada, N. Skukan, T. Ohshima, T. Kamiya*

Salle des Séminaires du CENBG

Le Haut Vigneau - BP 120 - F-33175 Gradignan Cedex