CHARACTERIZATION OF 14 MEV NEUTRON DETECTORS MADE WITH POLYCRYSTALLINE CVD DIAMOND FILMS

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Polycrystalline chemical vapor deposited (CVD) diamond detectors are of great interest in harsh environments due to their capability to operate even at high temperature and to withstand great neutron fluencies. Their use is of interest in many fields including the nuclear fusion reactors.

In this paper the successful characterization of polycrystalline CVD diamond detectors as 14 MeV neutron monitors is reported.

Two polycrystalline CVD diamond detectors of 96 μm and 126 μm thickness respectively were used. The detectors' count rate versus neutron flux was studied for various applied electric fields (from 0.25 V/μm up to 1 V/μm), showing that these detectors have a linear behavior in the flux range investigated (from 5.0×10^6 $n*cm^{-2}s^{-1}$ up to 3.0×10^8 $n*cm^{-2}s^{-1}$). The detector efficiency was also derived resulting in almost stable behavior vs. the neutron flux, for each electric field used. However the counting efficiency decreases as the electric field decreases.

The time dependent neutron emission from the 14 MeV Frascati Neutron Generator (FNG) was also recorded with CVD diamond detectors. The data for diamonds were compared with that recorded by the standard monitors available at FNG (Silicon surface barrier detector and NE-213 scintillator) showing good agreement.

Good stability and capability to operate (with negligible dead time and pile-up effect) with neutron flux up to 3×10^8 n cm^{-2} s^{-1} was observed. This neutron flux level is comparable with that expected in the neutron camera of ITER**.**

Following this characterization one of the two diamond detector (the 126 μm) was installed at JET and successfully operated during the trace tritium experiment campaign as a flux monitor of the 14 MeV neutron emission from JET.