Abstract

CVD diamonds as dosimeter for radiotherapy - An assessment

Detectors based on polycrystalline Diamond grown by Chemical Vapour Deposition (CVD) are being studied for use in Radiotherapy Dosimetry. The tissue equivalence of diamond allows the measurement to be directly used for patient dosimetry and a single diamond detector to be used for both photon and electron dosimetry. The principal problem in using diamond detectors is the dose dependence of its response, known as ‘ Priming‘.

The electrical contacts were made using the thermal evaporation of Gold/Chromium and the leakage current measured using a Keithley Source Measure Unit, varied from pico amperes to nano amperes depending upon the sample and applied voltage.

The radiation sensitivity of the diamond samples was measured in an Orthovoltage x-ray beam. The maximum amplification of the signal after subtracting the background was 1400, demonstrating a good radiation sensitivity of around 7nC/cGy. The samples were tested for dose dependent effects by irradiating them to a maximum dose of 48Gy in steps of 8Gy at a dose rate of 90cGy/min. For each 8Gy step,the diamond took around 4 minutes to stabilise but the long time level was stable after 16Gy. This is possibly due to traps of various depths filling and emptying. The current also increased with time and stabilised after about 4 minutes. The current was measured as a function of dose rate and $\sigma \alpha D^{0.9}$ was obtained, also indicating the presence of traps.