

Fabrication of Silicon Photodiode Detector and its Characteristics for Dosimetry

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INTRODUCTION

Silicon photodiode detectors have been used in high energy photon and electron beam dosimetry, because they have many advantages in comparison with conventional ionization chambers in relative and absolute dosimetry, as well as in direct patient dosimetry. The sensitivity of silicon photodiode relative to the same volume is about 18,000 times higher than that of an air-filled ionization chamber. They are small, stable, sensitive, independent of pressure variations and require no bias voltage. We have fabricated small size diode detectors for dosimetry using p-n junction diode, CsI(Tl) scintillator and photodiodes, and measured the linearity, the directional dependence and field disturbance profiles.

METHOD

In order to select appropriate diodes for the fabrication of high energy radiation detector, typically used several kinds of silicon diodes, such as p-n junction diodes, zener diodes and photodiodes have been tested for the physical characteristics. Selected diodes were used to fabricate the radiation detectors using an epoxy and coaxial cable after shaping process.

For the detection of diagnostic x-rays, CsI(Tl) scintillator which has the thickness of 5mm was mounted on the surface of photodiode to fabricate a detector. The linearity, the directional dependence of silicon diode detector and flatness between diode detector and ionization chamber have been measured. Dosimetry system which consists of the electrometer(Capintec 192) and the water phantom was used for measuring small field size scanning.

RESULTS

Detectors have the size of 6 mm diameter and 6 mm length of cylinder type. The results for the variation of radiation dose of Co-60 gamma-ray and linear accelerator x-ray showed good linearity within 1%. The differences of percent depth dose between the values of silicon diode and ionization chamber were negligible in large field size. The outputs of detector when irradiated Co-60 Gamma-ray have been measured 0.01 ± 1.2 nC/cGy in the case of PN junction diode a

nd 11.0 nC/cGy in the case of CsI(Tl) photodiode detector.

CONCLUSION

Fabricated silicon diode Detectors have a good linearity, a high sensitivity, as well as a small size, rugged, waterproof, so they can be used to diagnostic and therapeutic radiation detection for dosimetry.