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Evaluation of Energy Characteristics of Glass Dosimeter using Synchrotron Radiation

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Introduction

Radiophotoluminescence glass dosimeter (GD) is used for the measurement of absorbed dose in radiotherapy and used for personal monitoring of low energy photons[1,2]. A sensitivity of the glass element varies with absorbed energy. The characteristics were examined in high and low energy regions using γ-rays and X-rays, respectively. The X-rays show continuous spectra generally. In the energy regions which sensitivity varies, accurate sensitivity is not always provided, and only sensivity for effective energy is obtained. Therefore monochromatic X-rays taken out from the syncrotron radiation at KEK were used for an investigation of energy characteristics of radiophotoluminescence glass dosimeter (GD-301). The linearity between the exposure and the dose obtained from the GD was identified beforehand.

Method

An angle of crystal of Si is changed to shift energy of monochromatic X-rays for irradiation. Therefore a beam center axis deviates from a former one. A beam center axis is matched with the center of the irradiation field whenever the energy is changed. Using films, It is confirmed that center of the beam is equivalent to center of the irradiation field. A beam shape is rectangular, the long side is 10mm - 15mm and the short side is 5mm - 10mm. The radiophotoluminescence glass dosimeter (GD-301) is made by Asahi Techno Glass Corporation and glass element without holder is Φ1.5 x 8.5 mm. Three-five GDs were arranged along a short side direction of a beam. Then GDs were fixed so that the gap between GDs became about 2cm. While the GD moved to a short side direction of the slit with fixed speed, one was irradiated. The exposure was regulated by changing speed of the GD. The GDs were fixed to the polystyrene with size of 1cmx10cmx30cm. The groove at right angles to slit was made on foam polystyrene in a neighborhood of both ends of a slit. Both ends of the glass element were fitted in the groove to fix one. A diameter of the GD was 1.5mm, and the GD element was settled in 10mm - 15mm of a long side of the beam configuration. A glass element without a holder and one within a holder were irradiated by monochromatic X-rays.

Results and Consideration

Relations between exposure by monochromatic X-rays with 10 keV taken out from the syncrotron radiation and measured value by the glass element of GD-301 without the holder are shown in figure 1, and the linearity is sufficient. Relative responses of the glass element in the region of 8 to 40 keV are shown in figure 2 and change greatly.

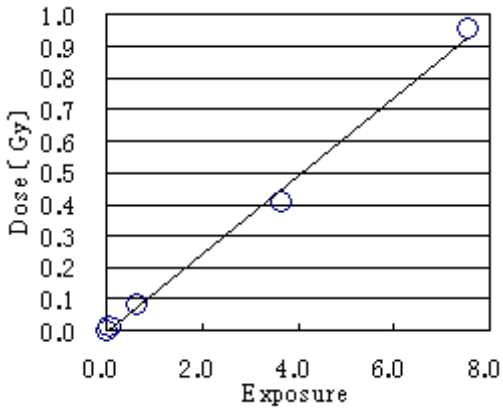

Figure 1. Linearity (10keV)

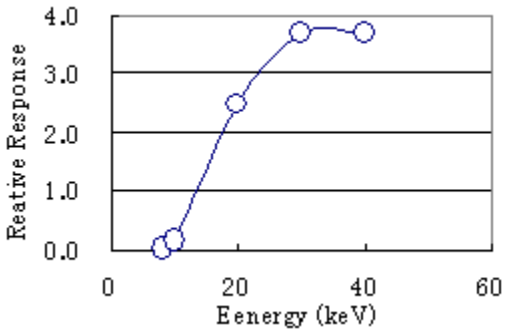

Figure 2. Energy Response

References

[1] E.Piesch et al., Radioprotection 29, 39(1994)
[2] T.Shimosato et al., Jpn.J.Med.Phys. 20, 151(2000)