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P2.44: Relative dosimeter study of therapeutic radiation beam energy based on photochromic switching film and semiconductor oxide composite for evaluating the feasibility of radiation detection capability

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Current commercially available therapeutic radiation beam energy detection sensors have excellent signal detection efficiency, but have characteristics in which stability is deteriorated due to the occurrence of micro-cracks in the detection sensor according to the change in incident beam energy. In addition, noise generated by the drift of remaining electron-hole pairs for which signal collection has not been performed degrades the reproducibility and precision of the sensor, resulting in a problem in overall signal detection efficiency. In particular, as a major problem in commercial sensors, the energy dependence of the photon beam, directional dependence, thermal effect, and damage to the device due to incident radiation are being discussed as limitations of the silicon diode. This reduces the signal detection efficiency when used for a long period of time, making it impossible to detect signals stably. Therefore, this study aimed to develop a photochromic switching film and a sensor based on a photoconductor-metal oxide composite structure that can exhibit excellent signal detection efficiency in therapeutic radiation QA verification and excellent sensor precision and reproducibility. For measurements, 6 MV and 15 MV energies from LINAC systems (CLINACiX-S, Varian Inc., USA) were used. Electrometers (6517A, Keithley, USA) and oscilloscope (WaveSurfer 510, Teledyne LeCroy, USA) were connected to the manufactured dosimeter to obtain electrical signals from radiation. The sample-to-sample distance is set to 100 cm. The waveform and signal when irradiated with radiation were obtained using an oscilloscope. The obtained signal was calculated from the accumulated amount of charge using ACQ software (Biopac, Acq Knowledge 4.2, Canada).
As a result of plotting the transmission voltage (T-V) curve using a photodiode, the saturation voltage and threshold voltage according to the voltage are estimated to be about 2.54 V for 10% transmittance of the bias voltage and 10.25 V for 90% transmittance bias voltage. It became. Therefore, if the charge carriers generated in the photoconductor-metal-oxide composite set the sensor driving voltage within the dynamic range, the signal detection efficiency can be increased by increasing the linearity of transmission. The reproducibility results according to radiation irradiation. RSD measured values at 6 MV and 15 MV energies were 1.32c% and 1.24%, respectively. As a result of the reproducibility evaluation, evaluation criteria of 1.5% were satisfied at 6 MV and 15 MV energies. This indicates that the signal stability is suitable for use as a radiotherapy QA dosimeter. The linearity results according to dose changes. The R2 values according to linear regression analysis at 6MV and 15MV energies are 0.998. Hence, the evaluation criteria are satisfied, and the output signal is proportional to the dose change. This indicates that it is suitable for use as a radiation therapy QA dosimeter. These results suggest that the film-type perovskite dosimeter is suitable for a radiotherapy QA dosimeter.
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