LiF:Mg,Ti and $CaSO_4$:Dy TL responses to radiation therapy electron beans using lucite, RW3 solid water and water phantoms

M.G. Nunes, L.L. Campos

Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, Av. Prof. Lineu Prestes, 2242 Zip Code 05508-000, São Paulo / S.P., Brazil

The TL response to electron-radiation is known to be dependent on the electron energy [1] and the phantom material [2], justifying this study of LiF:Mg,Ti (TLD-100, Harshaw) and $CaSO_4$:Dy (developed and produced at the Thermoluminescent Materials Laboratory of the Radiation Metrology Center) TL responses to radiation therapy electron beans using lucite, RW3 solid water and water phantoms.

Dosimeters were previously divided in groups of 5 according to their individual sensitivities, that agree in 10% with the average sensitivity for each dosimetric material, to ^{60}Co gamma-radiation in air and electronic equilibrium conditions.

A Varian Clinac 2100C linear accelerator with the focus at 100 cm of the phantom surface was the electron source and a 10 x 10 cm^2 field was adopted for the irradiations up to 0.10 Gy and 25.0 Gy at the reference depths for 4, 6, 9, 12 and 15 MeV electron beans in lucite, RW3 solid water and water phantoms. The two first phantoms were constituted of 30 x 30 cm^2 and different thickness plates while the last one had the dimensions of 30 x 40 x 50 cm^3; to avoid water contact without the introduction of scattering, a special holder was designed for this phantom.

The TLD signal was always read in a Harshaw 3500 system between 36 h and 39 h after irradiation and each presented value is the average of 5 readings.

In comparison to LiF:Mg,Ti, $CaSO_4$:Dy TL has a higher sensitiveness, indicating that these dosimeters can be used as an alternative to the imported pellets for dosimetric purposes, in the studied energies and dose range, even considering that both dosimetric materials had their TL responses significantly altered by the phantom material and slightly changed by the electron-radiation energy.

The phantom shall be chosen according to the radiation-therapy service possibilities, justifying the further study of the differences in the TL responses for different phantom materials or dimensions, using other energies applied in radiation-therapy and outside the reference depth.

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References

[1] V. Robar, C. Zankowski, M. O. Pla and E. B. Podgorsak, Thermoluminescent dosimetry in electron beams: energy dependence, Med. Phys. 1996, 23, 667-673.

[2] P. Duscombr, P. McGhee and E. Lederer, Anthropomorphic phantom measurements for the validation of a treatment planning system, Phys. Med. Biol. 1996, 41, 399-411.

E-mail: maira_nunes@yahoo.com; mgnunes@ipen.br