Effects of Heating Rate and Dose on T rapping Parameters of TLD-100 Crystals

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Abstract

The characteristics of the thermoluminescence glow curve and dosimetric peak of LiF:Mg,Ti (TLD-100) crystalsare studied, with emphasis on the evaluation of the influence of the irradiation dose and heating rate on the dosimetric peak (peak 5) trapping parameters. These parameters were obtained using a computerized deconvolution routine that assumed first-order kinetics for each peak composing the glow curve. This routine was able to fit accurately (1.2% < FOM < 3.4%) all measured glow curves. It was found that for the evaluated range ofphoton doses (0.2 to 20 cGy) and heating rates (7 to 25 K/s), the behavior of the dosimetric peak was consistent with the predictions of the Randall-Wilkins first-order kinetic model. In particular, it was confirmed that the activation energy of the dosimetric peak is independent of the heating rate and irradiation dose, as expected from this model. The mean activation energy obtained for peak 5 was 2.27 ± 0.08 eV. The area under the experimental glow curves for the same dose remained stable regardless of the heating rate used, indicating that the thermal quenching effect did not have a significant influence within the studied range. By fixing the heating rate and varying the dose, it was found that the integral was proportional to the irradiation dose, as expected.