

Thermoluminescence responses of photon- and electron-irradiated lithium potassium borate co-doped with Cu+Mg or Ti+Mg

ABSTRACT

New glasses $\text{Li}_2\text{CO}_3\text{--K}_2\text{CO}_3\text{--H}_3\text{BO}_3$ (LKB) co-doped with CuO and MgO, or with TiO_2 and MgO, were synthesized by the chemical quenching technique. The thermoluminescence (TL) responses of LKB:Cu,Mg and LKB:Ti,Mg irradiated with 6 MV photons or 6 MeV electrons were compared in the dose range 0.5–4.0 Gy. The standard commercial dosimeter LiF:Mg,Ti (TLD-100) was used to calibrate the TL reader and as a reference in comparison of the TL properties of the new materials. The dependence of the responses of the new materials on ^{60}Co dose is linear in the range of 1–1000 Gy. The TL yields of both of the co-doped glasses and TLD-100 are greater for electron irradiation than for photon irradiation. The TL sensitivity of LKB:Ti,Mg is 1.3 times higher than the sensitivity of LKB:Cu,Mg and 12 times less than the sensitivity of TLD-100. The new TL dosimetric materials have low effective atomic numbers, good linearity of the dose responses, excellent signal reproducibility, and a simple glow curve structure. This combination of properties makes them suitable for radiation dosimetry.

Keyword: Thermoluminescence; Dosimetry; Lithium potassium borate; Copper; Titanium; Magnesium dopants