

Thermoluminescence studies of manganese doped calcium tetraborate (CaB₄O₇:Mn) nanocrystal synthesized by co-precipitation method

ABSTRACT

Manganese (Mn) doped bone-equivalent calcium tetraborate (CaB₄O₇) nanocrystals were synthesized using co-precipitation and thermal treatment techniques. The synthesized nanophosphors are found to possess the monoclinic structure and have the particle size about 9 nm. They showed good luminescence quantum efficiency and enough potential for radiation dose measurement in medical and industrial purposes. The variation of dopant concentrations was investigated from 0.1 to 2 mol% and it was found that the optimal concentration of 1.4 mol% Mn has the highest sensitivity among other concentrations. The results revealed that Mn enhance the thermoluminescence (TL) sensitivity about 80 times higher than the un-doped samples at 1 kGy and the TL response over a wide range of doses from 0.05 Gy to 2.0 kGy increased linearly with increasing the absorbed dose.

Keyword: Calcium borate; Nanocrystal; Thermoluminescence; Co-precipitation; Manganese; Radiation dose