

Thermoluminescence characteristics of copper activated calcium borate nanocrystals (CaB₄O₇:Cu)

ABSTRACT

The copper activated calcium tetraborate (CaB₄O₇:Cu) nanophosphor was synthesized by a combination of facile co-precipitation and thermal treatment methods for the first time. Thermoluminescence and dosimetric characteristics of the gamma irradiated CaB₄O₇:Cu nanophosphor was reported. The glow curves shows two well resolved TL peaks centered at about 120 °C and 260 °C. The copper concentration was varied from 1 to 3 mol% and it was found that the nanocrystalline CaB₄O₇:Cu with a dopant concentration of 2 mol% has the highest sensitivity among the other dopant concentrations. The results demonstrated that copper can enhance TL efficiency to 2.26 times more than that of un-doped nanocrystalline samples. Moreover, the dose response of the dosimetric peak at 260 °C follows a good linearity up to 3 kGy whereas the linearity of lower temperature peak at 120 °C extended up to 30 Gy. The linearity characteristic of the present nanophosphor suggests it as a candidate towards dosimetric applications.

Keyword: Copper; Calcium tetraborate; Nanophosphor; Thermoluminescence; Co-precipitation; Radiation dose