

Formation and characterization of ultrafine nanophosphors of lithium tetraborate (Li₂B₄O₇) for personnel and medical dosimetry

ABSTRACT

The present study demonstrates an innovative single-step thermal synthesis of nano-sized lithium tetraborate dosimeter and its characterization. The optimum calcination temperature and time for the synthesis of the nanoparticles material was 750 °C and 2 h, respectively. Characterization of the samples was carried out using X-ray diffractometry (XRD), Fourier transform infrared (FT-IR) spectroscopy, transmission electron microscopy (TEM), and thermoluminescence (TL). FT-IR, XRD and TEM results confirmed the formation of pure nano-crystalline lithium tetraborate. The product showed a linear response over a wide range of doses from 10⁻¹ to 1.5 × 10² Gy. Moreover, the samples illustrate non-energy dependence among a wide range energy interval from 24 keV up to 1250 keV and almost no fading during one month storage.

Keyword: Nanophosphors; Thermal treatment; Dosimeter; Thermoluminescence; Energy dependence