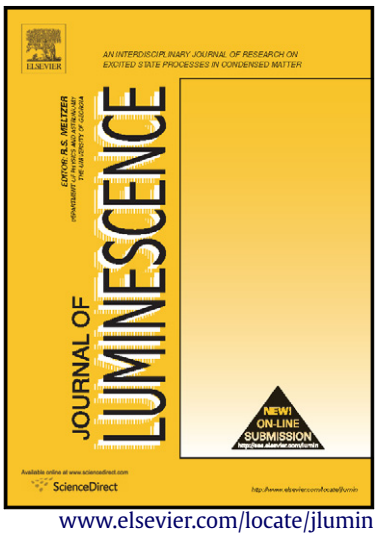

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Thermoluminescence of gamma rays irradiated LiF nanocubes doped with different elements

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Abstract

Lithium fluoride (LiF) doped with proper activator is a highly sensitive phosphor, widely used as a dosimeter for ionizing radiations. This work reports on the thermoluminesence (TL) response of LiF nanocubes doped with different impurities. These nanocubes were synthesized by the co-precipitation method and characterized by different techniques. The dopants used in this study are Eu, Tb, Dy, Cu and Ag. The gamma radiation induced TL glow peaks are located in the temperature range 120-125 ^{0}C. These samples have different TL sensitivity, where Eu doped one is found to be the most TL sensitive. Further irradiations in the dose range of 10Gy-30kGy were performed to LiF:Eu and the obtained result is explained using a proposed multilevel TL model. According to this model, Eu dopant (in Eu^{3+} ionic form) could induce shallow and deep electron traps in the host of LiF nanocubes. These traps differ in their response according to the doses. The optimum concentration of Eu ions in LiF host is found to be 0.2 mole%. It is also found that LiF nanocubes are thermally stable in the range of 30-400 ^{0}C with a single phase. This property along with the good sensitivity of Eu doped one make this tissue equivalent nanomaterial a proper candidate for heavy dose measurement like swift heavy ions used in radiotherapy.

Keywords:

Thermoluminesence; Nanomaterials; LiF nanocubes; Impurities; Gamma radiation.