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Synthesis and study of thermoluminescence and photoluminescence properties of dysprosium -doped alumina nanoparticles under gamma irradiation

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Abstract

This study investigates the dosimetric properties of alumina-based phosphor doped with dysprosium impurity, evaluating its potential as highly sensitive thermoluminescent material for high-dose applications. All samples were synthesized using the sol-gel method. The highest sensitivity to gamma radiation from a ^{60}Co source was observed in the sample with 0.5 mol% dysprosium doping. The structural and morphological properties of the particles were examined using X-ray diffraction (XRD) and scanning electron microscopy (SEM), while elemental analysis of the α -alumina sample was analyzed using energy-dispersive X-ray spectroscopy (EDS). The kinetic parameters of the thermoluminescence (TL) glow curve were extracted through computer-based curve fitting. The TL glow curve exhibited two overlapping peaks at approximately 394 K and 449 K. Additional analyses of the glow curve characteristics, fading characteristics, and dose-response linearity demonstrated the strong potential of this nanophosphor as a high-sensitivity TL dosimeter suitable for high-dose radiation measurements.

Keywords: TL, α - Al_2O_3 , Kinetic parameters, Dysprosium, Thermoluminescence glow curve.

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