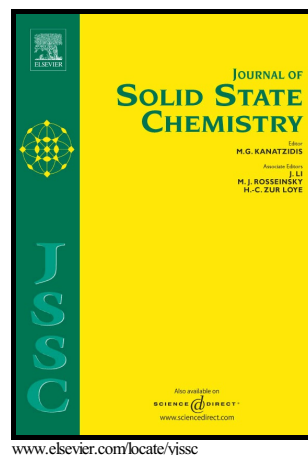


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Structural, Photoluminescence and Radioluminescence Properties of Eu^{3+} Doped $\text{La}_2\text{Hf}_2\text{O}_7$ Nanoparticles

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Abstract

This study presents the structural, optical, and radioluminescent characterization of newly synthesized europium-doped lanthanum hafnate ($\text{La}_2\text{Hf}_2\text{O}_7:\text{xmol}\%\text{Eu}^{3+}$, $\text{x} = 0$ to 35) nanoparticles (NPs) for use as phosphors and scintillation materials. Samples prepared through a combined co-precipitation and molten salt synthetic process were found to crystallize in the pyrochlore phase, a radiation tolerant structure related to the fluorite structure. These samples exhibit red luminescence under ultraviolet and X-ray excitation. Under these excitation wavelengths, the optical intensity and quantum yield of the $\text{La}_2\text{Hf}_2\text{O}_7:\text{xmol}\%\text{Eu}^{3+}$ NPs depend on the Eu^{3+} concentration and are maximized at 5%. It is proposed that there is a trade-off between the quenching due to defect states/cross-relaxation and a high dopant concentration. An optimal dopant concentration allows $\text{La}_2\text{Hf}_2\text{O}_7:5\text{mol}\%\text{Eu}^{3+}$ NPs to show the best luminescent properties of all the samples.

¹ Both authors contributed equally to this work.

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