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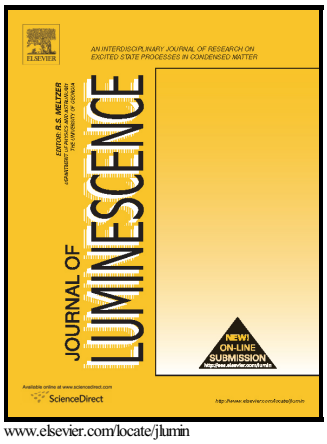

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Concentration effect on the spectroscopic behavior of Tb^{3+} ions in zinc phosphate glasses

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Abstract

Zinc phosphate glasses (PZABPTb) in the compositional system: P_2O_5 - ZnO -Al_2O_3 - BaO - PbO) doped with variable Tb^{3+} concentrations (1-5 wt% Tb_2O_3) were prepared and characterized through absorption, excitation, emission and intensity decay rate measurements. The Judd-Ofelt model has been adopted to evaluate the radiative properties of the $^5D_4 \rightarrow {}^7F_{6\text{-}3}$ emission transitions. The effect of Tb^{3+} ion concentration on the emissions from the $^5D_{3,4}$ excited levels is discussed in detail. Analysis of the intensity decay curves corresponding to blue and green emissions from levels $^5D_3$ and $^5D_4$, respectively, allowed determination of effective lifetimes, which confirmed the Tb^{3+} ion concentration quenching of the blue emission in these glasses. The decay curves for the $^5D_3$ level are found to be non-exponential in nature for all the studied concentrations due to ion-ion energy transfer through cross-relaxation. In an attempt to identify the origin of the energy transfer mechanism, the decay curves were well fitted to Inokuti-Hirayama model for S = 6, which indicates that the energy transfer process is of dipole-dipole type. The optical band gap energy (E_{opt}) has been evaluated taking into account the ultraviolet edge of absorption spectra.

Keywords: Zinc phosphate glasses; Tb^{3+} ion; Judd-Ofelt theory; Luminescence; Decay time.

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