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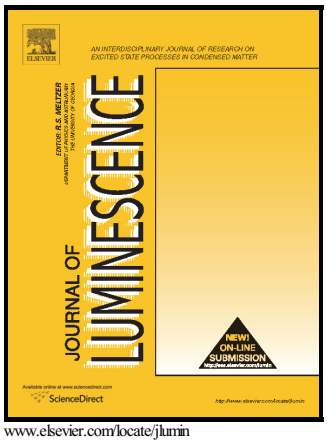

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Thermal and optical properties of Nd^{3+} ions in K-Ca-Al fluorophosphate glasses

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Abstract: Fluorophosphate glasses of composition (P_2O_5-K_2O-Al_2O_3-CaO-CaF_2)-doped with various Nd_2O_3 concentrations were prepared by melt quenching technique and their thermal, vibrational and optical properties were investigated. Thermal stability of the fluorophosphate glass has been determined from differential scanning calorimetric thermograph. The vibrational modes of the present glass composition, have been studied using Raman spectrum. The intensity parameters, Ω_λ (λ = 2, 4 and 6) as well as radiative properties for the $^4F_{3/2}$ level of Nd^{3+} ion have been evaluated from the absorption spectra of 1.0 mol% Nd_2O_3-doped glass using the Judd-Ofelt theory. Strong near infrared emission at 1056 nm attributed to $^4F_{3/2} \rightarrow {}^4I_{11/2}$ transition has been obtained for all the glasses upon 806 nm diode laser excitation. Decay analysis has been carried out and found that the lifetime for the $^4F_{3/2}$ level of Nd^{3+} ion was found to be higher compared to the other Nd^{3+}-doped glass host matrices. The quantum efficiency and saturation intensity have been determined to be 93% and 2.32 $\times 10^8$ W/m^2, respectively for 1.0 mol% Nd_2O_3-doped glass and compared to the other reported systems. The results indicate that the present glasses could be useful for 1.06 μm laser applications.

Keywords: Fluorophosphate glasses; Nd^{3+} ion; Judd-Ofelt parameters; Radiative properties; 1.06 μm emission; Stimulated emission cross-section; Lifetime.