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Spectroscopic Investigations of Nd^{3+} Doped Lithium Lead Alumino Borate Glasses for 1.06μM Laser Applications

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Abstract : Neodymium doped lithium lead alumino borate glasses were synthesized with the molar composition $10Li_2O$ – $10PbO$ – $(10\text{-}x)$ Al_2O_3 – $70B_2O_3$ – xNd_2O_3 (where, x = 0.1, 0.5, 1.0, 1.5, 2.0 and 2.5 mol %) via conventional melt quenching technique to understand their lasing potentiality. From the absorption spectra, Judd-Ofelt intensity parameters along with various spectroscopic parameters have been estimated. The emission spectra recorded for the as-prepared glasses under investigation exhibit two emission transitions, $^4F_{3/2} \rightarrow {}^4I_{11/2}$ (1063 nm) and $^4F_{3/2} \rightarrow {}^4I_{9/2}$ (1350 nm) for which radiative parameters have been evaluated. The emission intensity increases with increase in Nd^{3+} ion concentration up to 1 mol %, and beyond concentration quenching took place. The decay profile shows single exponential nature for lower Nd^{3+} ions concentration and non-exponential for higher concentration. To elucidate the nature of energy transfer process, non-exponential decay curves were well fitted to Inokuti-Hirayama model. The relatively high values of emission cross-section, branching ratio, lifetimes and quantum efficiency suggest that 1.0 mol% of Nd^{3+} in LiPbAlB glasses is aptly suitable to generate lasing action in NIR region at 1063 nm.

Keywords : energy transfer, glasses, J-O parameters, photoluminescence
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