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Spectroscopic Study of Eu^{3+} Ions Doped Potassium Lead Alumino Borate Glasses for Photonic Device Application

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Abstract : Quaternary potassium lead alumino borate (KPbAlB) glasses doped with different concentration of Eu^{3+} ions have been synthesized by melt quench technique and characterized by X-ray diffraction (XRD), Scanning electron microscope (SEM), Photoluminescence (PL), Time-resolved photoluminescence (TRPL) and CIE-chromaticity co-ordinates to study their luminescence behavior. A broad hump was observed in XRD spectrum confirms glassy nature of as-prepared glasses. By using Judd-Ofelt (J-O) theory, various radiative parameters for the prominent fluorescent levels of Eu^{3+} have been investigated. The intense emission peak was observed at 613 nm ($^5D_0 \rightarrow {}^7F_2$) under 393 nm excitation, matches well with the excitation of n-UV LED chips. The decay profiles observed for $^5D_0$ level were exponential for lower Eu^{3+} ion concentration while non-exponential for higher concentration, which may be due to efficient energy transfer between Eu^{3+}-Eu^{3+} through cross relaxation and subsequent quenching observed. From the emission cross-sections, branching ratios, quantum efficiency and CIE coordinates, it was concluded that 7 mol % of Eu^{3+} ion concentration (glass B) is optimum in KPbAlB glasses for photonic device application.

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