

Impact of Dy₂O₃ substitution on the physical, structural and optical properties of lithium–aluminium–borate glass system

ABSTRACT

In this study, a series of Li₂O-Al₂O₃-B₂O₃ glasses doped with various concentrations of Dy₂O₃ (where $x = 0.0, 0.2, 0.4, 0.6, 0.8,$ and 1.0 mol%) were prepared by using a conventional melt-quenching technique. The structural, physical and optical properties of the glasses were examined by utilising a variety of techniques instance, X-ray diffraction (XRD), UV–Vis-NIR spectrometer, Fourier transform infrared (FTIR) and photoluminescence (PL). The XRD spectra demonstrate the amorphous phase of all glasses. Furthermore, the UV-vis-NIR spectrometers have registered optical absorption spectra a numbers of peaks which exist at 1703, 1271, 1095, 902, 841, 802, 669, 458, 393 and 352 nm congruous to the transitions from the ground of state (6H_{15/2}) to different excited states, 6H_{11/2}, 6F_{11/2} + 6H_{9/2}, 6F_{9/2} + 6H_{7/2}, 6F_{7/2}, 6F_{5/2}, 6F_{3/2}, 4F_{9/2}, 4I_{15/2}, 4F_{7/2} and 6P_{7/2}, respectively. The spectra of emission exhibit two strong emanation bands at 481 nm and 575 nm in the visible region, which correspond to the transitions 4F_{9/2} → 6H_{15/2} and 4F_{9/2} → 6H_{13/2}. All prepared glass samples doped with Dy₂O₃ show an increase in the emission intensity with an increase in the concentration of Dy³⁺. Based on the obtained results, the aforementioned glass samples may have possible applications, such as optical sensor and laser applications.

Keyword: Borate glass; Dy₂O₃; UV-VIS-NIR; Photoluminescence