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 (6H15/2) to different excited states, 6H11/2, 6F11/2 + 6H9/2, 6F9/2 + 6H7/2, 6F7/2, 6F5/2, 6F3/2, 4F9/2, 4I15/2, 4F7/2 and 6P7/2, 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 4F9/2 → 6H15/2 and 4F9/2 → 6H13/2. 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