

## Structural, thermal, optical and dielectric studies of Dy<sup>3+</sup>: B<sub>2</sub>O<sub>3</sub>-ZnO-PbO-Na<sub>2</sub>O-CaO glasses for white LEDs application

### ABSTRACT

Dy<sup>3+</sup>-doped borate glasses with nominal composition (60-x) B<sub>2</sub>O<sub>3</sub>-10 ZnO-10 PbO-10 Na<sub>2</sub>O-10 CaO-(x) Dy<sub>2</sub>O<sub>3</sub> (x = 0, 0.1, 0.2, 0.5, 0.75, 1.0, 1.5 and 2.0 mol%) were prepared by the melt quenching technique. The XRD and SEM confirm the amorphous nature of the glasses and through EDAX, all the related elements were found in the synthesized glasses. The vibrations of metal cations such as Pb<sup>2+</sup> and Zn<sup>2+</sup>, B–O–B bond bending vibrations from pentaborate groups, bending vibrations of BO<sub>3</sub> triangles, and stretching vibrations of tetrahedral BO<sub>4</sub><sup>-</sup> units etc. are identified from the respective FTIR and Raman spectra including the non-hygroscopic nature of the synthesized glasses. The TGA and DSC measurements were performed to study thermal properties, where  $\Delta T > 100$  °C ( $\Delta T = T_x - T_g$ ) for all the glasses. Among all the Dy<sup>3+</sup>-doped glasses, the 0.75 mol% Dy<sup>3+</sup>-doped glass shows the highest PL intensity with four emissions, where the two transitions corresponding to 4F<sub>9/2</sub> → 6H<sub>15/2</sub> (blue) and 4F<sub>9/2</sub> → 6H<sub>13/2</sub> (yellow) are observed more intense than the others. The CIE chromaticity (x,y) coordinates for BZPNCDy 0.1 mol% glass are (0.398, 0.430), close to the white light region in the CIE 1931 chromaticity diagram. The dielectric properties of the 0.75 mol% Dy<sup>3+</sup>-doped glass such as dielectric constant, dielectric loss and AC conductivity were studied in the various frequencies and temperature.

**Keyword:** Borate glasses; Fourier transform infrared spectroscopy; Raman spectroscopy; Thermal analysis; Luminescence properties; Dielectric properties

