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RESEARCH ARTICLE

Optical, emission, and excitation dynamics of Eu^{3+}-doped bismuth-based phosphate glass for visible display laser applications

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Abstract

Eu^{3+}-doped-bismuth-based phosphate glasses with chemical equation $(60 - x)P_2O_5$–$20Bi_2O_3$–$10Na_2CO_3$–$10SrF_2$–xEu_2O_3 (PBNSEu), (where x = 0, 0.1, 0.5, 1.0, 1.5 and 2 mol%) were fabricated using the melt-quenching method. Obtain X-ray diffraction (XRD), energy-dispersive X-ray (EDAX), and Fourier transform infrared (FTIR) spectra were used to characterize the structure of the prepared PBNSEu glass. The J–O (Judd–Ofelt) intensity parameters (Ω_2, Ω_4) were estimated using photoluminescence emission spectra. When excited with a xenon lamp at λ_{exc} = 394 nm, the most intense red-emission transition occurred at ~612 nm ($^5D_0 \rightarrow {}^7F_2$). J–O intensity parameters were used to calculate radiative properties, whereas the radiative branching ratio (β_R), radiative transition probability (A_R), radiative lifetime (τ_R), and total radiative transition rate (A_T) were calculated for the transitions $^5D_0 \rightarrow {}^7F_J$ (where J = 0–4) and were obtained in the emission spectra for europium ion-doped in the current glass. Using the CIE1931 chromaticity coordinates axes, the colours of various concentrations of Eu^{3+} ion-doped PBNS glass were evaluated using the emission spectra. Temperature-dependent luminescence spectra were recorded for the optimized PBNSEu20 glass to calculate the activation energy. These results strongly suggested red components in w-LEDs and visible display laser applications.

DATA AVAILABILITY STATEMENT

The authors state that they have no known competing financial interests or personal relationships that may have influenced the work presented in this study.

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