Abstract

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Investigation of structural and luminescence properties of borosilicate glass doped with Dy2O3

We manufactured a new series of borosilicate glass doped with Dy3+ ions using a glass-quenching technique. To achieve the unique luminescence properties of our prepared glass, rare earth (Dy2O3) was incorporated into the glass matrix. The photoluminescence spectrum revealed five intense emission bands allocated at wavelengths 483 nm, 575 nm, 665 nm, 712 nm, and 752 nm, attributed to the transition from 4F9/2 → 6H15/2, 4F9/2 → 6H13/2, 4F9/2 → 6H11/2, 4F9/2 → 6F3/2, and 4F9/2 → 6H9/2 respectively. From the emission results of prepared glass at excitation wavelength 350 nm, we used our glass as a new solid laser source for the production of white light. From radiative properties measurements, the luminescence performance of fabricated samples showed a strong transition, with limited transition life and high values of branching ratio. Additional physical parameters were evaluated, such as density, optical packing density, and molar volume. By X-ray diffraction, we observed that all the prepared samples were of the amorphous phase. Fourier Transform Infrared Spectroscopy demonstrated the effect of incorporating Dy2O3 on the structure of our prepared glass. From the spectrum of absorption transitions, optical band gap Eg, refractive index (n), and Urbach energy (?E) were obtained. To research glass bonding nature, Judd-Ofelt strength parameters (?? and ? = 2, 4, 6) were obtained these parameters were used to achieve the spectroscopic efficiency factor, branching ratios (?r), and lifetime (?). Moreover, the cross-sections of emission and absorption of our prepared glass was estimated. Finally, our cumulative study findings indicate that these manufactured samples may be used in luminescent display devices as a white light laser diode (W-LED).