World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Photoluminescence and Energy Transfer Studies of Dy3+ Ions Doped Lithium Lead Alumino Borate Glasses for W-LED and Laser Applications

Authors : Nisha Deopa, A. S. Rao

Abstract : Lithium Lead Alumino Borate (LiPbAlB) glasses doped with different Dy3+ ions concentration were synthesized to investigate their viability in solid state lighting (SSL) technology by melt quenching techniques. From the absorption spectra, bonding parameters (ð) were investigated to study the nature of bonding between Dy3+ ions and its surrounding ligands. Judd-Ofelt (J-O) intensity parameters (Ω = 2, 4, 6), estimated from the experimental oscillator strengths (fex) of the absorption spectral features were used to evaluate the radiative parameters of different transition levels. From the decay curves, experimental lifetime (τex) were measured and coupled with the radiative lifetime to evaluate the quantum efficiency of the as-prepared glasses. As Dy3+ ions concentration increases, decay profile changes from exponential to non-exponential through energy transfer mechanism (ETM) in turn decreasing experimental lifetime. In order to investigate the nature of ETM, non-exponential decay curves were fitted to Inkuti–Hirayama (I-H) model which further confirms dipole-dipole interaction. Among all the emission transition, 4F9/2 □ 6H15/2 transition (483 nm) is best suitable for lasing potentialities. By exciting titled glasses in n-UV to blue regions, CIE chromaticity coordinates and Correlated Color Temperature (CCT) were calculated to understand their capability in cool white light generation. From the evaluated radiative parameters, CIE co-ordinates, quantum efficiency and confocal images it was observed that glass B (0.5 mol%) is a potential candidate for developing w-LEDs and lasers.

Keywords : energy transfer, glasses, J-O parameters, photoluminescence
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020