Influence of Dy^{3+} ions on the spectroscopic studies of thermally stable telluro-zinc-phosphate glasses for white light emitting devices

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Abstract

A transparent series of telluro-zinc-phosphate glasses along with varying Dy^{3+} ion concentrations (TZPD) have been synthesized via utilizing the melt-quenching procedure. The non-crystalline character of the as-prepared TZPD glass matrices has been demonstrated from the observed X-ray diffraction (XRD) profile. In order to recognize the proficient usage of the as-prepared TZPD glass matrices in the white light emitting devices, the spectroscopic characteristics such as optical absorption, photoluminescence excitation and emission, as well as temperature-dependent photoluminescence were conducted and investigated in detail. The optical absorption spectral studies were measured in the n-UV to NIR range for the as-prepared TZPD glasses and optical band gap energy was evaluated via utilizing the Tauc's plot. In the visible range, photoluminescence spectra exhibit three distinct emission peaks under different n-UV excitations, among which a strong emission peak around 575 nm is associated with the $^4F_{9/2} \rightarrow {}^6H_{13/2}$ transition in the as-prepared TZPD glasses. The color coordinates (*x*, *y*) for the as-prepared TZPD glasses have been situated in the white light region of the CIE graph and adjacent to the standard white light region (0.33, 0.33) [1-2]. Furthermore, temperature-dependent photoluminescence spectral studies suggest the excellent thermal stability of the as-prepared TZPD glass samples along with a high value of activation energy. In view of the above results, as-prepared TZPD glasses can be employed for the fabrication of thermally stable white light emitting devices.

References:

[1] M.K. Sahu, M. Jayasimhadri, *J. Am. Ceram.* 102 (2019) 6087-6099. DOI: https://doi.org/10.1111/jace.16479

[2] Vikas, M. Jayasimhadri, D. Haranath, *Int. J. Appl. Glass Sci.* 13 (2022) 645-654. DOI: https://doi.org/10.1111/ijag.16591