Examining the Impact of Samarium Doping on the Properties of Boro-Tellurite Glass for optical applications

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The glass composition (30-x)TeO_2 - 30B_2O_3 - 10ZnO - 20BaO - 5TiO_2 - 5GdF_3 : xSm_2O_3 represents a tailored blend designed to exhibit unique physical, structural, optical, and luminescence properties. This study explores the impact of varying concentrations of Sm_2O_3 (Samarium oxide) dopant (x) on the overall characteristics of the glass matrix. The base composition is composed of TeO_2, B_2O_3, ZnO, BaO, TiO_2, and GdF_3, carefully balanced to achieve desired attributes. The incorporation of Sm^{3+} introduces intriguing possibilities for optical applications due to its distinctive spectral properties. The investigation delves into the structural modifications, and luminescence behavior induced by Sm_2O_3 doping. The synergy of TeO_2, B_2O_3, ZnO, BaO, TiO_2, and GdF_3, combined with the introduction of Sm^{3+}, results in a glass matrix with tunable optical characteristics. The study employs a comprehensive set of analytical techniques, including X-ray diffraction, FTIR, and Judd-Ofelt, to elucidate the crystalline and amorphous phases, as well as the vibration bonding of the glass. Varying Samarium concentrations systematically affect the glass's luminescence in $^4G_{5/2} \rightarrow {}^6H_s$ transitions (s = 5/2, 7/2, 9/2, 11/2), with manifestations at 566 nm, 602 nm, 649 nm, and 708 nm, respectively. Understanding the interplay between the constituents in this glass system opens avenues for applications in lasers, optical amplifiers, and other photonics devices. The findings presented in this abstract contribute to the evolving field of glass science and its diverse applications, offering insights into the development of advanced materials for optical technologies.

Keywords: Glass, Luminescence, Optical, Sm^{3+} ions.

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