

Red-Emitting Tellurite Glasses: A Combined Investigation of Physical, Structural, Optical and Luminescence Properties for Potential Red-Light Source and Scintillation Materials

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The (35-x)TeO₂: 30ZnO: 30B₂O₃ 5BaO: xEu₂O₃ (where x = 0.0, 0.1, 0.5, 1.0, 1.5, 2.0, and 3.0 mol%) glasses were prepared by melt-quenching technique. Their physical, structural optical, and luminescence properties were characterized by density, molar volume, refractive index, absorption spectra, Fourier transform infrared (FTIR), X-ray diffraction analysis (XRD), photoluminescence, Judd-Ofelt (JO) theory, and radioluminescence. The amorphous structure of the samples was confirmed by a Shimadzu XRD-6100 diffractometer. Absorption spectra were evaluated in the wavelength region between 350 - 2300 nm and found five peaks at 394, 465, 533, 2092, and 2207 which corresponded with the energy transitions of Eu³⁺ ion from the ground state of ⁵L₆, ⁵D₂, ⁷F₁, ⁷F₆ and ⁷F₁→⁷F₆ nm. In the photoluminescence of glass, it was found that glass exhibited the strongest luminescence intensity of Eu³⁺ ion at 613 nm (⁷F₂) under 394 nm excitation. The overall color of emission is reddish-orange in CIE 1931 chromaticity. The results obtained in photoluminescence properties showed that the glass could be a potential candidate for a red-light source medium in optical materials and scintillation materials.

Keywords: Glass material, Luminescence, Scintillator, Eu³⁺ ions.

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