Abstract

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Influence of Sm2O3 addition on Judd-Ofelt parameters, thermal and optical properties of the TeO2-Li2O-ZnO-Nb2O5 glass system

A series of transparent and light yellow color samples composed of Sm2O3 doped tellurium oxide glasses with chemical composition 75TeO2-5Li2O-10ZnO-(10-X) Nb2O5-XSm2O3 was prepared by conventional melt-quenching technique. Rare earth (Sm2O3) was added to improve all glass properties. From obtained radiative properties, the samples which prepared with above composition can be considered as a prospect application for laser design due to higher branching ratio. The physical properties including sample density, molar volume, and OPD were measured. The glassy nature is approved by XRD analysis. The structural modification of glass forming units with introducing Sm2O3 was studied by FTIR and Raman spectra. The intensity ratio of TeO4/TeO3 was measured to determine the ratio of bridging/non-bridging oxygen exists in glass network. Glass thermal stability, glass transition temperature, and melting temperature were obtained from DSC plots. The UV–vis-NIR absorption spectra display 9 peaks. Optical parameters including optical band gap EOpt, Urbach energy $\gamma_E$ and refractive index $n$ were determined. From absorption spectra, Judd-Ofelt intensity parameters ($\Omega$ and $\Omega=2, 4, 6$) have been derived to study bonding nature. A spectroscopic quality factor was calculated. Branching ratio ($\beta_r$) and lifetime ($\tau$) have been calculated using JO parameters. Absorption and emission cross-sections were determined to measure the probability of an absorption emission process. Finally, we propose that these prepared samples can be used in optical devices and other applications.