Abstract

Samir Y Marzouk

Structural and optical properties of TeO2-Li2O-ZnO-Nb2O5-Er2O3 glass system

Quinary tellurite glass system in the percentages of 75TeO2–5Li2O–10ZnO–(10–x) Nb2O5–xEr2O3 where (x = 0.0, 0.5, 1.0, 1.5, 2.0, and 2.8 mol%) have been prepared and characterized. Both Fourier-transform-infrared (FTIR) and Raman spectroscopies were performed to study the structural changes correlated with the glass network. The thermal characteristics of the system were specified which showed a higher thermal stability (> 100 °C) due to the formation of more bridging oxygen's (BO's) revealed by (FTIR) and Raman spectroscopies. The optical absorption spectra within near UV–visible regions were performed, and exhibited nine absorption bands centered around 1536, 977, 798, 653, 545, 524, 490, 450, and 443 nm corresponding to the 4 I15/2 ground state to the various excited states 4 I13/2, 4 I11/2, 4 I9/2, 4 F9/2, 4 S3/2, 2 H11/2, 4 F7/2, 4 F5/2, and 4 F3/2 respectively. The same measurement also showed increasing values of the optical band gap (Eg) form 2.70 to 2.90 (eV) and decreasing the refractive index (n) from 2.48 to 2.42. Both the extinction coefficient data and the complex dielectric functions of the glasses were estimated. The different optical parameters were distinctly affected by increasing the Er2O3 (mol %) and the structural changes. The radiative properties of the glass were calculated using J-O parameters. The Branching ratio (κ) of 4 I13/2 ? 4 I15/2 transition peaked at 1520.48 nm for Er3+ ions has the highest value (1.000) also, the radiative lifetime (τ) of the same transition changed from 1.4510 to 1.8483. The gain cross-section of the laser transition level from 4 G11/2 ? 4 I15/2 changed from 1.44 × 10^-20 to 1.92 × 10^-20 cm^2?1 in the existing glass system. The acquired results exhibited that the existent glass can be a good candidate in the fiber drawing and laser, non-linear optical applications.