

Linear and nonlinear optical properties of erbium doped zinc borotellurite glass system

ABSTRACT

A glass series of erbium doped zinc borotellurite glass system was prepared by using the melt-quenching method. The absorption spectra revealed several bands at visible range which correspond to the following transitions (from the ground state); $4G_{11/2} + 2H_{9/2} + 4F_{5/2} + 4F_{7/2} + 2H_{11/2} + 4S_{3/2} + 4F_{9/2} + 4I_{9/2} + 4I_{11/2}$. From the Judd-Ofelt analysis, it is found that the trend of σ_{21} values is a non-linear variation along with erbium concentrations. Meanwhile, the value of σ_{6} decreases as the erbium concentration increases. The photoluminescence analysis shows green emission which are attributed to the $4S_{3/2}$ level to the ground state at $4I_{15/2}$. Meanwhile, the upconversion analysis revealed several emission bands at 376 nm, 424 nm, 470 nm and 558 nm which correspond to $4G_{11/2} \rightarrow 4I_{15/2}$, $4F_{3/2} \rightarrow 4I_{15/2}$, $4F_{7/2} \rightarrow 4I_{15/2}$ and $4S_{3/2} \rightarrow 4I_{15/2}$ transitions respectively. The non-linear refractive index spectra show self-defocusing behavior and negative nonlinear refraction ($n_2 < 0$) under laser excitation at 532 nm of wavelength. The obtained values of nonlinear absorption and nonlinear susceptibility revealed nonlinear variations.

Keyword: Borotellurite glass; Luminescence; Upconversion; Nonlinear optical properties