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## Photoluminescence and Judd-Ofelt analysis of Er<sup>3+</sup> doped CdO-V<sub>2</sub>O<sub>5</sub>-ZnO-B<sub>2</sub>O<sub>3</sub> inverted glasses.

Er-doped CdO-V<sub>2</sub>O<sub>5</sub>-ZnO-B<sub>2</sub>O<sub>3</sub> inverted glasses were synthesized by the melt-quenching method, using proportions of 80-5.0-2.5-12.5 mol% of CdO-V<sub>2</sub>O<sub>5</sub>-ZnO-B<sub>2</sub>O<sub>3</sub>, respectively, which were doped with different mol% of Er. The structural analysis, carried out by X-Ray diffraction patterns recording, showed an amorphous structure in all Er doping range. This fact was also verified by the line shape of Raman spectra, which revealed vibrational modes associated with borate, Zn<sub>2</sub>V<sub>2</sub>O<sub>7</sub> and Cd<sub>2</sub>V<sub>2</sub>O<sub>7</sub> in amorphous phases. By using optical absorption and the Tauc model, the direct optical band gap ( $E_g^d$ ) values were found around 2.74 eV, without tendency with Er mol% concentrations. The down-shifting emission spectra recorded under laser excitation at 980 nm exhibited the featured near infrared Er emission band centered at 1534 nm, which grows up to 2 mol% and remained oscillate for larger Er doping contents. The upconverting (UC) emission spectra registered under laser excitation of 980 nm, displayed the well-known green and red emission bands, related to relaxations of 2H<sub>11/2</sub>, 4S<sub>3/2</sub> and 4F<sub>9/2</sub> excited states to the 4I<sub>15/2</sub> ground state, respectively. Such process is dominated by a linear decay mechanism, as revealed the dependence of the intensity versus the excitation laser power. The Judd-Ofelt (JO) parameters obtained by least-square method from the experimental and theoretical oscillator strengths, were found as  $\Omega_2 = 6.43 \times 10^{-20}$ ,  $\Omega_4 = 0.96 \times 10^{-20}$  and  $\Omega_6 = 1.53 \times 10^{-20}$  cm<sup>2</sup> for the CVZB glass activated with 2.8 mol% of Er. Moreover, the emissions arisen by transitions from 4I<sub>13/2</sub>, 4I<sub>11/2</sub>, 4F<sub>9/2</sub>, 4S<sub>3/2</sub>, 2H<sub>11/2</sub>, 4F<sub>7/2</sub> states to 4I<sub>15/2</sub> ground state, present radiative branching ratio ( $\beta_R$ ) values higher than 0.6, and total radiative transfer probabilities  $A_T$  (4I<sub>13/2</sub> → 4I<sub>15/2</sub>) = 782.46 s<sup>-1</sup> and  $A_T$  (4S<sub>3/2</sub> → 4I<sub>15/2</sub>) = 10248.56 s<sup>-1</sup>. Finally, for the 1533 nm emission, the stimulated emission cross section had a value of  $\sigma_{em}(\lambda) = 1.57 \times 10^{-20}$  cm<sup>2</sup>, and an effective bandwidth  $\Delta\lambda_{em} = 60.52$  nm.

### Keywords

Luminescence, Inverted glasses, Judd-Ofelt, Laser, Upconversion

### Reference

Soriano-Romero, O., et al. "Spectroscopic evaluation a new and novel Nd<sup>3+</sup>/Yb<sup>3+</sup> co-doped CdO-V<sub>2</sub>O<sub>5</sub> glass system for 1  $\mu$ m laser application." *Journal of Alloys and Compounds* 777 (2019): 886-893.

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### Author approval

I confirm

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