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SYNTHESIS, DOPING AND CHARACTERIZATION OF $CaTiO_3$: Er/Yb BY SOLID-STATE REACTION

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ABSTRACT

Perovskites of general formula $MTiO_3$ (M = Ca or Sr) have attracted considerable attention as an important class of mixed oxides and as potential candidates for optoelectronic devices due to many applications related to their physical properties (Marí, B. et al. 2013). Particularly, calcium titanate ceramics are good candidates for use as dielectric resonators in the wireless communication system due to their high dielectric constant, high quality factor and low insertion loss (Mazzo, T.M. et al, 2010). The main goal of this work is to synthesize and to characterize a perovskite ceramic-based $CaTiO_3$ (CTO) co-doped with the rare earths elements Er and Yb. The starting materials used in this sense to synthesize CTO were $Ca(OH)_2$ and TiO_2, while the ones used for the doping were Er_2O_3 and Yb_2O_3. Such oxides were thoroughly mixed by mechanical milling in a high-energy ball mill and afterwards submitted to a common solid-state reaction.

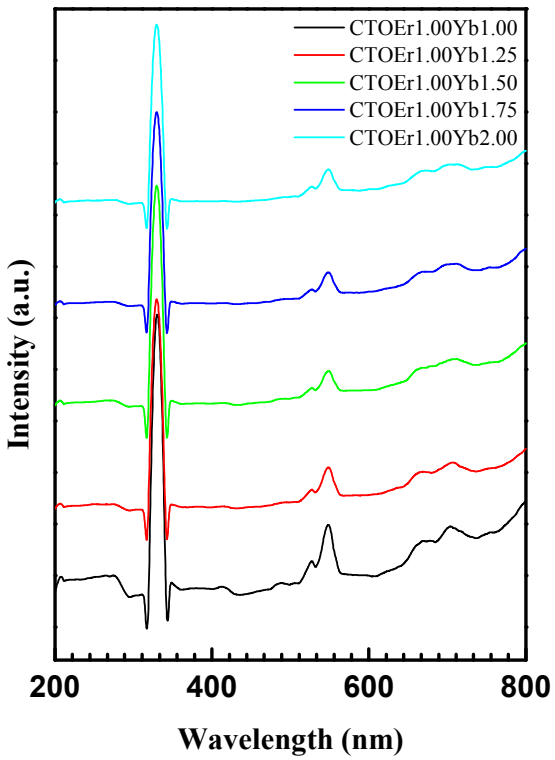

Fig. 1 - Luminescence spectra co-doped $CaTiO_3$

The powders were characterized by X-ray diffraction, Raman scattering and photoluminescence spectroscopy. The unit cell parameters presented by pure $CaTiO_3$ were *a = 5.378 Å, b = 5.441 Å* and *c = 7.640 Å* and $\alpha = \beta = \gamma = 90°$, and the diffraction pattern was assigned to the space group *Pbnm* (#62 or D_{2h}^{16}), with four formulas per unit cell (*Z*=4). The factor group analysis in orthorhombic $CaTiO_3$ permitted to foresee 24 Raman modes, besides to 25 infrared modes and 8 silent ones. The luminescence spectra of CTO co-doped samples showed typical bands of green and red light, which correspond to the transitions $^4H_{11/2} \rightarrow {}^4I_{15/2}$ and $^4F_{9/2} \rightarrow {}^4I_{15/2}$ (figure 1). Finally, the results obtained for the ceramic systems were satisfactory regarding the synthesis method (solid-state reaction), since it presents low cost as compared with another common processes in the literature.

REFERENCES

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