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Photoluminescence in the $SrTi_{1-x}Nd_xO_3$ System

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Abstract – Strontium titanate is a good candidate for optical materials. In this work photoluminescence of undoped and Nd^{3+} doped $SrTiO_3$ was verified. $SrTi_{1-x}Nd_xO_3$ (x = 0.00; 0.01; 0.02; 0.04) powders were synthesized by polymeric precursor method. Evaluation of PL spectra indicated that the main emission region is the yellow one, dislocating to the green one (higher energy) with temperature increase. This result indicates that a higher ordering is taking place. Besides this, Nd^{3+} also leads to a higher short-range order, with dislocation of the PL emission band to higher energies. Acknowledgements: The authors acknowledge the financial support of CNPq/MCT and FINEP/MCT.

Strontium titanate is considered a good candidate for optical materials [1]. In this work the photoluminescent (PL) emission of the undoped $SrTiO_3$ and the influence of Nd^{3+} addition was verified. $SrTi_{1-x}Nd_xO_3$ (x = 0,00; 0,01; 0,02; 0,04) powders were synthesized by polymeric precursor method [2]. The polymeric resins were calcined at 300 °C for 1 h. After this first calcination, the powder precursors were submitted to a milling process in an alcoholic medium using an attritor mill. A second calcination was performed in an oxygen atmosphere at 300 °C for 12 h. These precursors were heat treated in air between 400 and 700 °C for 2 h. The samples were analyzed by micro-Raman spectroscopy, UV-Vis spectroscopy, PL spectroscopy and X-ray diffraction (XRD).

PL emission spectra of samples heat treated at 300 and 400 °C showed one broad band in the whole visible spectrum, from ~488 to 850 nm. The main PL emission region was the yellow one, dislocating to the green one (of higher energy) with temperature increase, indicating that the short-range ordering of the system was taking place. After calcination at 500 °C, samples with higher amount of Nd^{3+} ($SrTi_{0,98}Nd_{0,02}O_3$ and $SrTi_{0,96}Nd_{0,04}O_3$) showed a division in the PL emission band in two bands, the first one was centered at about 560 nm and the second one at about 610 nm. Nd^{3+} doping also dislocated the PL emission peaks to highest energy regions, indicating that a higher ordering of the system was taking place. This behavior was confirmed by IR spectra and XRD patterns, which showed a higher short and long order in doped samples.

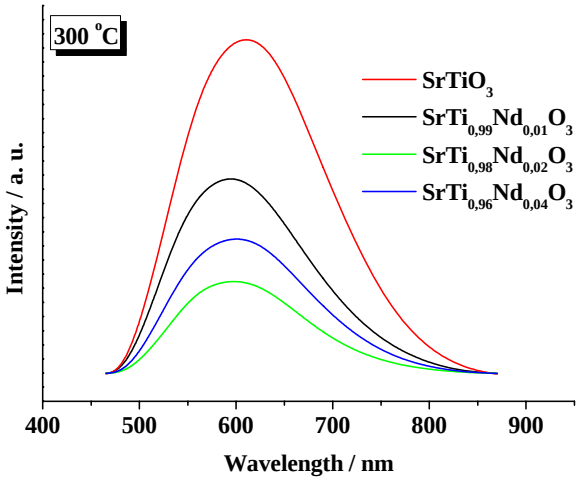

Figure 1: PL emission spectra of pure and Nd^{3+} doped $SrTiO_3$, after calcination at 300 °C

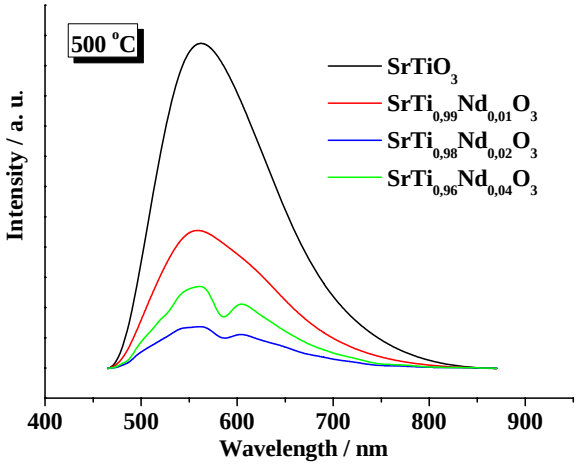

Figure 2: PL emission spectra of pure and Nd^{3+} doped $SrTiO_3$, after calcination at 500 °C

References

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