

## Photoluminescence in the SrSnO<sub>3</sub>:Nd<sup>3+</sup> perovskite

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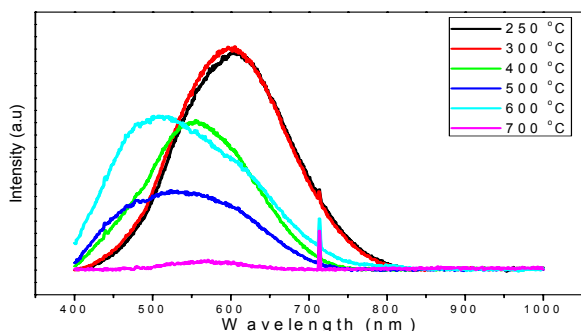
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**Abstract** – SrSnO<sub>3</sub>:Nd<sup>3+</sup> powders were synthesized by the polymeric precursor method and characterized in relation to the optical and structural properties. PL emissions at different regions were observed due to the presence of SnO<sub>5</sub>/SnO<sub>6</sub> polyhedra. For samples calcined at low temperatures, red and yellow emissions were observed as a consequence of the disorder in the modifier and former regions. For calcination at higher temperatures, green and green/yellow emissions were observed, being related to a higher short range order, which led to inclination among octahedra.

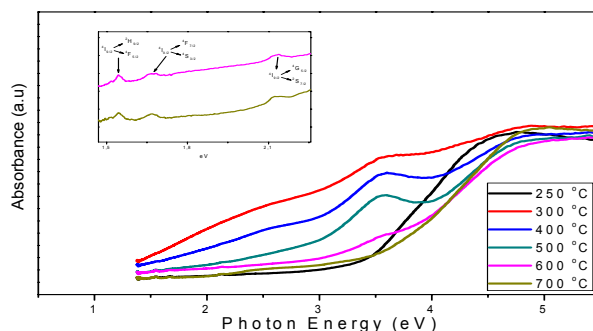
ABO<sub>3</sub> perovskites containing rare-earth elements are considered strategic materials due to their electronic, magnetic, optical, catalytic and other properties [1-2]. Stannate materials have been contributing to these researches due to their wide technological applications. The interest for Nd<sup>3+</sup> cation is due to its electronic configuration with the 4f level presenting transitions with high quantum efficiency and light emission at about 1060 nm assigned to the <sup>4</sup>F<sub>3/2</sub> → <sup>4</sup>I<sub>11/2</sub> transition.

In this work, SrSnO<sub>3</sub> powders were synthesized with 1 % of Nd<sup>3+</sup> doping by the polymeric precursor method with milling of the powder precursor, carbon elimination in O<sub>2</sub> atmosphere at 250 °C and calcination between 250 and 700 °C for 2 h. Samples were characterized in relation to the structural and optical properties, using infrared spectroscopy, Raman spectroscopy, UV-vis spectroscopy, X-ray diffraction and PL emission at room temperature.

Long range order was already observed after calcination at 250 °C, with the crystallization of the perovskite phase. The amount of carbonate decreased with temperature increase, as showed by IR spectra. In spite of this, a high short range disorder was observed for samples calcined below 600 °C, as indicated by the Urbach tail in the UV-vis spectra. Insert in Figure 2 showed three electronic transitions characteristic of Nd<sup>3+</sup>. Raman spectra showed the same behavior. After calcination at 250 °C, the lattice modifier region was not ordered, but a broad band was already observed in the former region, indicating that SnO<sub>6</sub> polyhedra were already formed. These polyhedra were probably bonded to each other, but without the characteristic inclination of the orthorhombic structure. In this case, PL emission was centered at about 600 nm. Above 500 °C, both lattice and former regions were already organized, leading to the inclination among polyhedra. As a consequence, PL emission was centered at lower wavelength (higher energy). We believe that both emissions were assigned to the presence of SnO<sub>5</sub> and SnO<sub>6</sub> polyhedra. At low temperatures, deep defects were present in the band gap, as a consequence of the high short range disorder, leading to red and yellow PL emissions. With temperature increase, a higher short range order was attained, leading to shallow defects in the band gap and PL emission in the green and yellow/green regions.



**Figure 1:** PL spectra of Sn<sub>0.990</sub>Nd<sub>0.010</sub>SrO<sub>3</sub> powders calcined at different temperatures ( $\lambda_{exc} = 350.7$  nm).



**Figure 2:** UV-Vis spectra of Sn<sub>0.990</sub>Nd<sub>0.010</sub>SrO<sub>3</sub> powders calcined at different temperatures. Insert shows Nd<sup>3+</sup> transitions.

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### References

- [1] M. Glerup, K. S. Knight, and F. W. Poulsen, Mater. Res. Bull. 40 (2005) 507.  
[2] I.R. Shein, V. L. Kozhevnikov and A. L. Ivanovskii, Solid State Sciences, 10 (2008) 217.