

CaSnO₃:Ni²⁺ synthesized by the polymeric precursor method

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Abstract – Ca_{1-x}Ni_xSnO₃ powders (x = 0, 0.005, 0.05 and 0.10) were synthesized by the polymeric method and heat treated at 700 °C for 4 h. Characterization was done by XRD, UV-visible and infrared spectroscopy. The results confirmed that the perovskite phase was formed after calcination at 700 °C for 4 h. Carbonate bands were observed in the infrared spectra due to the high amount of organic material present in the polymeric precursor method. Nickel addition led to a decrease in the band gap value. Acknowledgements: The authors acknowledge CNPq/MCT and FINEP/MCT for the financial support of this work.

CaSnO₃ is an alkaline-earth stanate, displaying perovskite structure. This material has been investigated for its attractive dielectric properties, finding applications as thermally stable capacitors in electronic industries, as well as sensors, battery electrode materials, catalysts, etc [1]. Several methods were used for the synthesis of CaSnO₃, such as sol-gel, polymeric precursor, peroxide precursors, solid state reaction, etc [1,2].

In this work, CaSnO₃ was synthesized by the polymeric precursor method, with 0.5, 5 and 10 mol % of nickel doping. The resins were heat treated at 300 °C/2 h, leading to the formation of the powder precursor. Further calcinations were done at 700 °C for 4 h. Characterization of the material was done by X-ray diffraction (XRD), Infrared spectroscopy and UV-vis spectroscopy.

The infrared spectra of CaSnO₃ (Fig. 1a) presented bands at about 1500-1400, 1100 and 875 cm⁻¹, assigned to calcium carbonate [1]. Bands at about 666 and 484 cm⁻¹ were also observed, being assigned to metal-oxygen bond. These bands were well defined indicating that a high short range order was already obtained after calcination at 700 °C. The UV-vis spectra showed a certain decrease in the band gap value when nickel was added to the system indicating that defects were formed inside the band gap (Fig. 1b). Transitions assigned to Ni²⁺ were also observed. The XRD patterns of pure CaSnO₃ (Fig. 1c) presented well-defined peaks at 22.4°, 31.9°, 45.8°, 51.7°, 57.24° and 66.7°, assigned to the perovskite phase. Small peaks related to SnO₂ at about 26.6°, 33.9°, 38.0°, 51.8°, 54.8° and 62.0° were also observed.

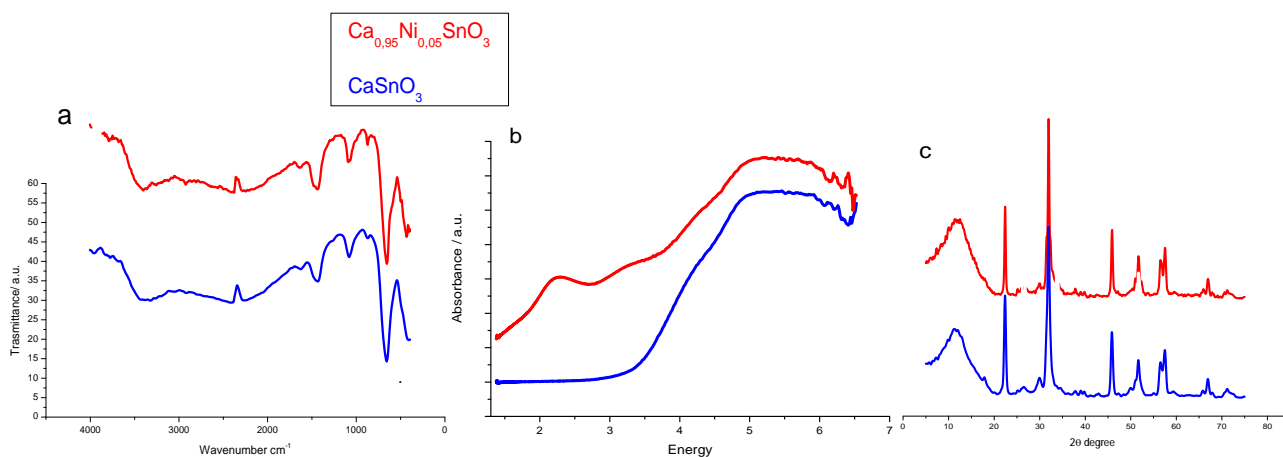


Figure 1. Characterization of CaSnO₃ after calcination at 700 °C for 4 h. a) IR spectra; b) UV-vis spectra; c) XRD patterns.

References:

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