

Synthesis of SrSnO₃:Cu by the polymeric precursor method

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Abstract – SrSnO₃ perovskite was synthesized by the polymeric precursor method and heat treated at 700, 800 and 900 °C for 4 h. Characterization was done by XRD, UV-visible and infrared spectroscopy. The results confirmed the formation of the perovskite structure after calcination at 700 °C, with lower amount of carbonate when a previous elimination of carbon is done. Cu addition also decreased the amount of carbonate and consequently, the amount of SnO₂.

Perovskite strontium stannate (SrSnO₃) has been widely studied due to the presence of mixed ionic and electronic conduction, leading to applications in many catalytic reactions, and also as membrane for gas separation. In perovskites doped with transition metals, especially Cu, Ni and Fe, the presence of mixed or intermediate valence states is critical for many of those properties [1]. The addition of Cu can promote the formation of a perfect perovskite crystal, which enhances the stability of catalysts. However, too much copper is not favorable for the enhancement of catalytic performance [2].

In this work, synthesis was done doping copper for strontium, in amounts of 1, 5 and 10 mol %, by the polymeric precursor method [3]. The polymeric precursor method presents advantages such as good homogeneity, good stoichiometric control and good control of the particle morphology, when carbon elimination is previously done. All polymeric resins were calcined at 350 °C for 2 h. After de-agglomeration, milling was done in an attritor mill with a rotation of 500 rpm. The material was calcined at 700, 800 and 900 °C for 4 h. The powders were characterized by X-ray diffraction (XRD), UV-vis and IR spectroscopy. The XRD patterns indicated the presence of the perovskite phase, and also peaks assigned to calcite (SrCO₃) and cassiterite (SnO₂). For samples without previous carbon elimination, a much higher amount of these phases was observed. The amount of secondary phase was also reduced with the increase in the Cu concentration. This is in agreement to the IR spectra, that presented bands related to metal-oxygen bond ~670 cm⁻¹ (Sn-O) and ~400 cm⁻¹ (Cu-O), besides bands related to strontium carbonate at ~860, ~1080 and ~1470 cm⁻¹. The intensity of the carbonate bands decrease with the Cu concentration, except for the bands at ~1080 indicating the presence of hydroxide groups on the surface of the materials.

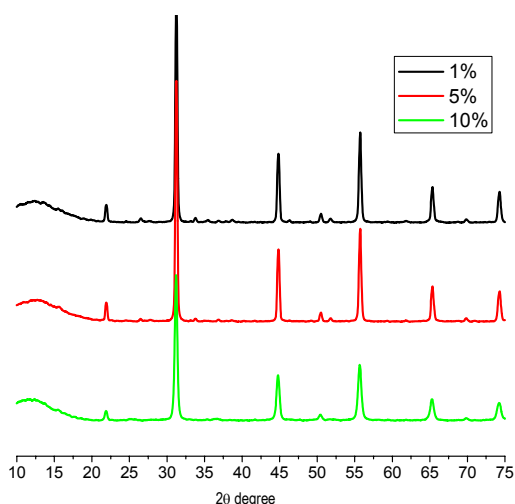


Figure 1: XRD patterns of the SrSnO₃:Cu calcined at 900 °C.

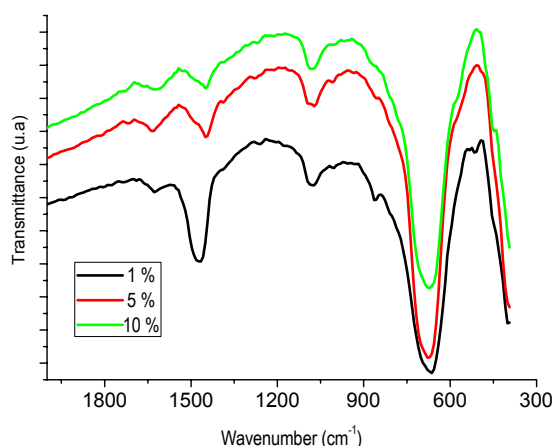


Figure 2: Infrared spectra of the SrSnO₃:Cu calcined at 900 °C

References

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