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Lanthanum Strontium Chromites: Synthesis and Characterization

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Abstract – Lanthanum strontium chromites (LSC) were synthesized by combustion (utilizing urea and glycine as fuel agent) and modified-citrate methods. The XRD patterns of calcined samples show the presence of secondary phases for glycine-combustion and citrate samples. The combustion samples present high porosity, with a spongy aspect, whereas the citrate sample presented an agglomerated structure, due to the polymerization of the precursor reagents.

Lanthanum strontium chromites (LSC) have been largely employed as interconnect materials in solid oxide fuel cells (SOFC) because of the chemical and thermal stability, mechanical strength and high electrical conductivity [1]. In this work $La_{0.7}Sr_{0.3}CrO_3$ powders were synthesized by two methods, combustion and modified-citrate, and their structural and morphological properties were evaluated. In combustion method, the metal nitrates were dissolved with the fuel agent (urea or glycine) in distilled water, heated at 80ºC, until the formation of a gel. The gel was then introduced in a muffle, previously heated at 600ºC, where the combustion reaction took place. The fuel: metal nitrates molar ratio was held at 2:1. In modified-citrate method, the nitrate precursors were dissolved in an aqueous citric acid solution (with citric acid: nitrate precursors molar ratio of 1:1). The water was removed by heating at 90ºC, with a formation of gel. The gel formed was heated at 110ºC for 20 h, then at 200ºC for 2 h. The samples, prepared by both methods, were calcined at 800ºC, under air flow, for 6 h.

X-ray diffraction patterns (Fig. 1) of the powders synthesized by combustion showed formation of only LSC phase for the sample synthesized with urea, whereas $SrCrO_4$ phase was also found for the sample prepared from glycine. This additional phase occurs due to incomplete combustion reactions. For the citrate synthesized sample, secondary phases of $SrCrO_4$ can also be observed. The samples synthesized by combustion method with urea presented smaller crystallite sizes indicating the influence of the synthesis method in the structural parameters. The doped samples presented a structural change compared with non-doped ones (orthorhombic to hexagonal), which has already been described in the literature [2]. All the uncalcined samples presented a lot of secondary phases or non-crystallinity, showing the need of calcination. The SEM micrographs of the powder samples (Fig. 2) presented a spongy aspect, with primary particles linked together in agglomerates of different sizes and shapes. The samples prepared with urea have higher porosity compared with glycine. The combustion reaction with urea presents a great evolution of gases, resulting in porous structures with smaller particle size. The citrate sample presented formation of aggregates, with smaller porosity. The citrate reaction forms a ceramic material with low porosity, since the method involves a polymerization of the precursor reagents [3].

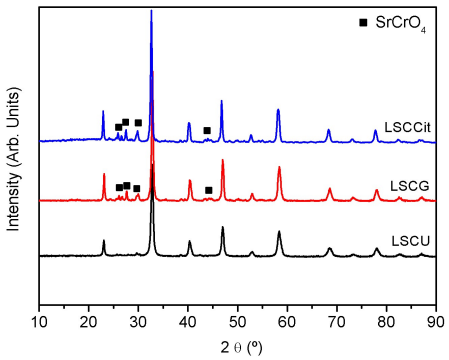

Figure 1: XRD of LSC samples synthesized by combustion (LSCU and LSCG) and citrate (LSCCit) methods, after calcination.

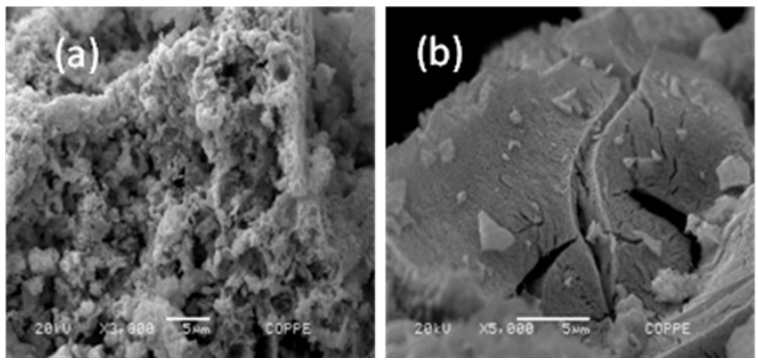

Figure 2: SEM micrographs of LSC samples after calcination: (a) LSCU; (b) LSCCit.

References

[1] S.C. Singhal, K. Kendall, High Temperature Solid Oxide Fuel Cells: Fundamentals, Design and Applications, Elsevier Ltda., 2004.
[2] J.H. Kuo, H.U. Anderson, S.A. Howard, Journal of Solid State Chemistry, 87 (1990), 55 – 63.
[3] A. Worayingyong, P. Kangvansura, S. Ausadasuk, P. Praserthdam, Colloids and Surfaces A: Physicochem. Eng. Aspects, 315 (2008), 217 – 225.