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Characterization of Sr and Ba-doped $LaCrO_3$ Powders Synthesized by EDTA Method

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Lanthanum chromites are good candidates for electrode application in IT-SOFC. This paper reports the synthesis and characterization of lanthanum chromite powders, doped with strontium and barium, from nitrate precursors by the EDTA method. The samples were synthesized, calcined (800ºC/ 6h), pelletized and sintered at different temperatures. X-ray diffraction patterns showed formation of crystalline perovskite phase, with smaller quantities of secondary phases of $SrCrO_4$ and $BaCrO_4$. The crystallite size calculated using the Scherrer equation is in the range of 23-29 nm. Thermogravimetric analysis revealed that the weight loss is similar for all samples, with complete burn out of organics at 800°C. Scanning electron microscopy showed the presence of agglomerates, formed by particles with low porosity. The electrical conductivity of all samples is similar to the values in the literature.

Introduction

In recent years, solid oxide fuel cells (SOFC) have been identified as one of the most promising stationary energy conversion devices compared with the conventional power plants. However, the high temperature of operation limits the choice of the used materials, beyond its high cost. The challenge now is to develop materials with good performance at intermediate temperatures (600-800ºC) for IT-SOFCs, allowing it to reduce the cost of the cells, increasing the long-term stability. Among the studied materials for SOFC components, the perovskites have been largely used.

Perovskites are mixed oxides with ABO_3 type crystal structure where cations with a large ionic radius have 12 coordination to oxygen atoms and occupy A-sites, and cations with smaller ionic radius have 6 coordination and occupy B-sites (1). A and O form a cubic packing and B is contained in the octahedral voids in the packing. The perovskite structure may undergo atomic distortion leading to orthorhombic or rhombohedral unit cells (2). These materials are interesting for application in SOFCs due to chemical and thermal stability, mechanical strength and high electrical conductivity (2,3). The electrical conductivity of these materials can be enhanced by substituting a lower valence ion, such as Sr or Ba, on the La site. Sr-doped $LaCrO_3$ (LSC) is currently the preferred material for cathode in the IT-SOFC (3,4).

The EDTA (or EDTA-citrate) process is a polymerized complex method utilized to synthesize a wide variety of oxide materials. In this method, metal ions in a solution are chelated to form metal complexes and then these chelates undergo poly-esterification when heated to form a polymeric glass which has metal ions uniformly distributed throughout. The resultant powders have the nano-scaled particle size and compositional