ECS Transactions, 25 (2) 2327-2334 (2009)
10.1149/1.3205784 ©The Electrochemical Society

Structural Characterization of Sr-doped $LaMnO_3$ and $LaCrO_3$ Powders Synthesized by Combustion Method

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Lanthanum strontium manganite (LSM) and chromite (LSC) are good candidates for cathode and interconnect application in SOFC, respectively. This paper reports the synthesis of LSM and LSC powders from nitrate precursors by the combustion method, using two different fuels (urea and glycine). The ignition of the reagent mixture with urea takes a longer time and the maximum temperature is higher than using glycine. However, the adiabatic flame temperatures using urea are lower. X-ray diffraction patterns showed formation of only perovskite phase for the samples synthesized with urea, whereas secondary phases were also found for the samples prepared from glycine. The crystallite size calculated using the Scherrer equation is in the range of 23-31 nm. Thermogravimetric analysis revealed that the weight loss is much higher for manganites, with complete burn out of organics at 850-900^{o}C. Scanning electron microscopy showed the presence of agglomerates, formed by fine particles of different shapes.

Introduction

Perovskites like lanthanum manganite and chromite are interesting materials for application in solid oxide fuel cells (SOFC) due to chemical and thermal stability, mechanical strength and high electrical conductivity (1,2). The electrical conductivity of these materials can be enhanced by substituting a lower valence ion, such as Sr, on the La site. Sr-doped $LaMnO_3$ (LSM) and $LaCrO_3$ (LSC) are currently the preferred materials for cathode and interconnect in the SOFC (2,3). Different synthesis methods have been developed for the production of perovskite powders, like solid-state reaction, sol-gel technique, hydrothermal synthesis, co-precipitation, and combustion (4-7). Combustion synthesis is characterized by fast heating rates, high temperatures and short reaction times (8). It is a straightforward preparation process to produce homogeneous, very fine, crystalline and non-agglomerated multicomponent oxide powders, without intermediate decomposition steps (9). In the solution combustion synthesis, an aqueous solution of the desired metal salts is heated together with a suitable organic fuel, until the mixture ignites and a fast combustion reaction takes off (10).

Various fuels have been used in the combustion synthesis of perovskites, like urea, glycine, oxalyl-hydrazine, citric acid and sucrose (7, 11-13). All these fuels serve two purposes: (i) they are the source of C and H, the reducing elements, which form CO_2 and H_2O on combustion and liberate heat; (ii) they form complexes with the metal ions