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Solid-state Synthesis of $La_{0.7}Sr_{0.3}MnO_3$ Powders Using Different Grinding Times

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Sr-doped lanthanum manganites (LSM) have been studied as promising materials for cathodes in solid oxide fuel cells (SOFC). In the present work $La_{0.7}Sr_{0.3}MnO_3$ powders were synthesized by solid-state method evaluating the influence of dry or wet (using isopropanol) routes and different grinding times on the morphological and microstructural properties of LSM. The results of the synthesis of LSM powders pointed out that the use of solvent during homogenization results in poor crystallinity and only 6 hours of grinding at low speed in the ball mill is enough to obtain nano-sized crystalline phase by dry route. Scanning electron micrographs showed formation of agglomerates of fine primary particles. The electrical conductivity of the sintered LSM ($La_{1-x}Sr_xMnO_3$, x= 0.2, 0.3 and 0.4) pellets with about 35% of porosity was measured by the two probe technique, showing a slight increase in the conductivity with strontium content.

Introduction

Solid oxide fuel cells (SOFCs) are efficient, energy-saving, and environment-friendly energy conversion devices that generate electricity and heat (1-2). The performance of SOFCs can be improved by better control of the morphology and electrochemical properties of the electrodes. This instigates research in the area of preparation methods of ceramic powders used as cathode materials in SOFC.

Sr-doped $LaMnO_3$ (lanthanum strontium manganite- LSM) attracts substantial interest as a promising material for cathode in SOFCs. This material presents good properties such as chemical and thermal stabilities, high catalytic activity for the oxygen reduction, thermal expansion coefficient reasonably similar to that of solid electrolyte (yttria stabilized zirconia-YSZ) and high electrical conductivity (3). LSM has been mainly synthesized by solid-state reaction and chemical solution methods (4). The solid-state reaction is a conventional method of ceramic processing, which usually involves high temperatures and leads to large particle size and limited degree of chemical homogeneity (5). However, by proper choice of the rotating speed of the mill and the grinding time, it is possible to produce fine homogeneous powders. In this context, the present work is aimed to contribute to the synthesis of LSM ($La_{1-x}Sr_xMnO_3$, x = 0.3) nanostructured powders by solid-state method for application as SOFC cathodes. The objective is to study the influence of dry or wet route and different grinding times on the structural and