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Preparation of LSM/SDC films by Spin Coating

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Abstract

$LaMnO_3$ doped with Sr (LSM) is an attractive cathode material for high temperature solid oxide fuel cells due to its catalytic and electric properties. In this work, LSM/SDC films were prepared by spin coating technique. Ethyl cellulose was used as pore former. The films were characterized morphologically and structurally.

At present, several techniques are available for the preparation of LSM ($La_{0.80}Sr_{0.20}MnO_3$) or SDC ($Sm_{0.2}Ce_{0.8}O_2$) powders, e.g. sol-gel synthesis, co-precipitation, spray pirolysis, self combustion, hydrothermal reaction and solid state reaction. The success of these materials as an oxidative catalyst is related to its ability to perform as a Solid Oxide Fuel Cell (SOFC) cathode, once that require the adsorption and reduction of molecular oxygen, and subsequent transport of oxide ions. The ideal characteristics of an LSM and SDC powders for catalysis or fuel cells, were that they be pure, with a small average particle size and large surface area [1]. The aim of this work was to show the influence of the ethyl cellulose in the morphology of the obtained material and the efficiency of film deposition method.

In this work, the LSM/SDC systems were prepared by a method similar to Pechini using gelatin as a polymerization agent. The SDC synthesis took place by the same form. The LSM/SDC powders were mixed with ethyl cellulose (EC) and ethanol and stirred for 45 min at ambient temperature. The LSM/SDC suspensions were deposited over YSZ substrate by spin-coating technique and sintered at 1150 °C for 4 hours with a heating rate of 2 °C.min^{-1}. The films were structurally and morphologically characterized by X-ray diffraction and scanning electron microscopy. The quantification of the phases present in the calcined powders and sintered films was performed using the Rietveld method.

As shown in Fig. 1, LSM/SDC film with 10% of EC exhibits only the phases LSM and SDC, the phase YSZ is due to substrate. The LSM exhibits rhombohedral phase with space group R-3c and the phase SDC presents the cubic fluorite structure. Fig. 2 shows a cross-sectional image of LSM/SDC film, it is observed that the film has a thickness of about 10 μm and it is well adhered to the substrate.

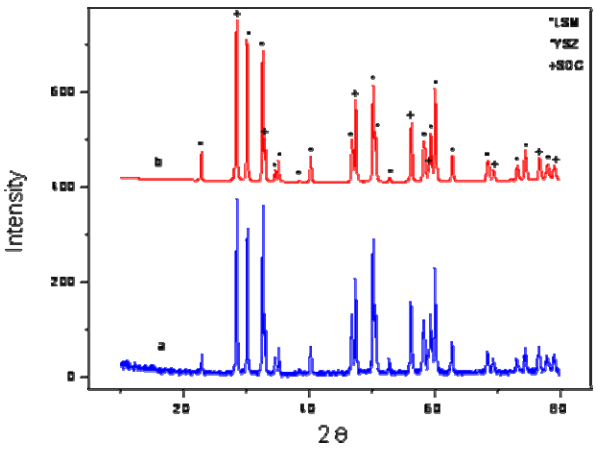

Figure 1: X ray diffraction of film with 10% of EC, **a)** experimental and **b)** Rietveld.

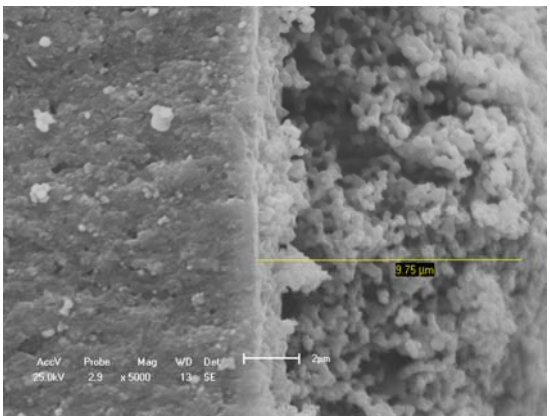

Figure 2: Scanning electron microscopy of film with 10% of EC.

References

[1] R.S.Gui, Q.T.Wei, H.L.Li, F.H.Wang. Materials Letters, 60 (2006) 261-265.