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Electrochemical performances of nanostructured La-perovskites layers deposited by pulsed laser technique for IT-SOFC cathode applications

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Abstract

Reduction of SOFC operating temperatures is a prerequisite for their use in portable devices. This can be achieved reducing the electrolyte thickness thus reducing its ohmic resistance and indeed micro-scaled solid oxide fuel cells (μ -SOFCs) can be fabricated using materials in thin film form. The development of μ -SOFCs opens new scenarios about power generation technology. However, lowering the SOFC operating temperature makes slow the kinetics of charge transfer reactions at the electrolyte-electrode interfaces, mainly at the cathode. To overcome this shortcoming, materials with a high chemical thermal and chemical stability as well as high electrocatalytic activity towards oxygen reduction reaction, are usually required for IT-SOFC applications. Furthermore, to ensure the required performance, cathodes must possess a large active surface area with low area specific resistance (ASR) and large triple phase boundary (TPB) at the electrode/electrolyte interface.

In this paper, we investigated the microstructural features and the electrochemical properties of dense and nano-porous $\text{La}_{0.8}\text{Sr}_{0.2}\text{Fe}_{0.8}\text{Co}_{0.2}\text{O}_{3-d}$ electrodes, deposited by pulsed laser deposition (PLD) onto yttria-stabilized zirconia (YSZ) polycrystalline substrates. Dense and nanoporous morphologies were tuned varying the laser ablation conditions and by low temperature post-annealing treatments. A further comparative analysis of dense $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ and $\text{La}_{0.8}\text{Sr}_{0.2}\text{Fe}_{0.8}\text{Co}_{0.2}\text{O}_{3-d}$ electrodes onto polycrystalline YSZ and samaria-doped ceria (SDC) was carried out to evaluate the electrodes overpotential due to the electrode/electrolyte interface.