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Characterization of Cathode/Electrolyte Interphases for IT-SOFCs

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ABSTRACT

Solid oxide fuel cells (SOFCs) represent an efficient and environmental friendly technology to convert directly hydrogen and fossil fuels into electrical power and heat. These devices require high operation temperature to allow the transport of oxygen ions through the ceramic components of the cell, challenging the long term stability and inducing rapid degradation of the cell. In recent years, a considerable research effort has been done in order to decrease the operation temperature from 800-1000ºC to the 500-800ºC range in the so-called Intermediate Temperature (IT)-SOFCs. One of the materials of choice for IT-SOFCs electrolytes is the ceria based oxides because they present higher oxygen ion conductivities at lower operation temperatures. Nevertheless, the main drawback of using intermediate temperatures is the increase of the cathode overpotential, which limits the overall performance of the cell. This issue can be overcome with the use of nanostructured mixed conducting oxide cathodes. It is also important to note that the performance of the whole cell depends not only of each individual component but also of the interphase between them. In this work, we studied symmetrical cells composed by high performance nanostructured $La_{0.4}Sr_{0.6}Co_{0.8}Fe_{0.2}O_3$ (LSCFO) cathodes deposited by spin coating on $Ce_{0.8}Y_{0.2}O_2$ (CYO) electrolytes. LSCFO cathodes were synthetized by an acetic acid based method, while the CYO electrolytes were synthesized by mechanical milling. The assemblies were studied by Electrochemical Impedance Spectroscopy, X-Ray Diffraction and Transmission and Scanning Electron Microscopy. The correlation between the electrochemical behavior within the 300-600ºC range, and the bulk and interfacial characteristics will be discussed.

Keywords: Solid oxide fuel cells; electrolyte; interphase