Electrochemical properties of alkaline earth metals-doped Lanthanum manganites for SOFC applications

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Solid oxide fuel cells (SOFCs) attract a great attention as alternative electric power-generation systems due to high energy-conversion efficiency, fuel flexibility (including the prospects to directly operate on natural gas or ammonia) and environmental safety. All materials composing a cell are solid at the operating temperature (1000°C) and perovskite-type oxides like $La_{1-x}A_xMnO_3$ (A=Ca, Sr) are commonly used as cathode materials of SOFC rather than metals.

The objective of this work is to enable to successfully apply electrochemical impedance spectroscopy techniques (EIS) to ours application needs. Electrochemical *ac* impedance spectroscopy methods was used to study the oxygen reaction kinetics of $La_{(1-x)}Ca_xMnO_3$ and $La_{0.75}Sr_{0.25}MnO_3$–based cathodes on Y_2O_3-stabilized ZrO_2 (YSZ). In other words the performance of perovskite-type oxides electrodes as a function of the doped composition is investigated experimentally through electrochemical impedance spectroscopy.

All samples like $La_{1-x}A_xMnO_3$ (A=Ca, Sr; $0<x<1$) have been prepared by conventional solid state reaction using stoichiometric amounts of the precursor oxides. The samples have been characterised by X-ray powder diffraction (XRD) and Scanning Electron Microscope (SEM) equipped with Energy Dispersive Spescrometer (EDS). Finally the impedance spectroscopy measurements were carried out as a function of temperature (T) and phase composition (x).

First experimental results were interpreted in the form of equivalent electrical circuit fitting, and compared with the results reported in the literature. For data analysis, non-linear least-squares fitting was performed using the Equivcrt program. Moreover we can determine the activation energy (E_{el}) for cathode reactions from a plot of the natural log of the R_{el} components versus the reciprocal of the absolute temperature in according to the Arrhenius equations.