

The effect of A-site deficiency and B-site dopant concentration on strontium titanate based SOFC anode properties

I. Kivi^{1,*}, S. Paydar¹, J. Aruväli², O. Volobujeva³ and G. Nurk¹

¹ Institute of Chemistry, University of Tartu;

² Institute of Ecology and Earth Sciences, University of Tartu;

³ Department of Materials and Environmental Technology, Tallinn University of Technology;

*indrek.kivi@ut.ee;

(La,Sr,Ca)TiO_{3-δ} (LSCT) is a perovskite (ABO₃) type mixed ionic-electronic conductive (MIEC) oxide and has been proposed as an electrode material for high temperature fuel cell.¹ The material is catalytically active for oxidation of hydrogen and hydrocarbons.² A significant amount of attention has been paid to clarify the dependence between crystallographic and electrical properties of LSCT-based materials.^{1,3} Some papers also deal with stability issues if the material is used as an anode in a solid oxide fuel cell.^{3,4} However, there remains a gap of information regarding the dependence between the A-site stoichiometry and stability of chemical composition- and electrochemical performance of LSCT-based electrodes.

In this work, Ni/Mn dopants ratio in B-site and deficiency of A-site, i.e. A-site stoichiometry of (La_{0.25}Sr_{0.25}Ca_{0.45})_xTi_{0.95}Ni_{0.05-y}Mn_yO_{3-δ} were varied and electrochemical performance was monitored. The electrochemical measurements of symmetric cells (100 h tests) show that small changes in A-site deficiency influence significantly the activity and initial degradation rate of the electrode.

Materials of interest were heat treated in two different gas environments – in synthetic air and in H₂ environment, both at 1123 K for one hundred hours and characterized using XRD, SEM and electrochemical methods. XRD results for studied electrode powders showed significant dependence of the lattice parameters on the deficiency in A-site. The results from impedance spectroscopy (measured at temperatures from 973 to 1123 K in H₂ environment, at OCV) demonstrate a significant influence of the A-site deficiency on the series- and polarization resistance of the electrode. The Ni/Mn ratio influenced significantly the electrode stability. The dependence of electrochemical activity and stability of electrodes on the A-site deficiency and Ni/Mn ratio in B-site will be discussed.

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