Electrical conductivity studies of Ti-substituted $Pr_{0.45}La_{0.45}Sr_{0.1}Ga_{0.8}Mg_{0.2}O_{2.85}$ and determination of partial electronic conductivity of Sm doped CeO_2

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Abstract

Research on solid electrolytes has drawn much attention in recent years because of a variety of important possible applications in solid-state devices that include fuel cells, sensors, high energy density rechargeable (secondary) batteries, electrochromic displays, and photo-galvanic solar cells. Also, solid electrolytes turned out to be very useful for the determination of thermodynamic quantities, such as Gibbs energies, entropies, enthalpies, activity coefficients and non-stoichiometries of solids, and kinetic parameters, such as chemical diffusion coefficients for fundamental scientific characterization and understanding of materials [1].

Currently, the development of new oxide ion electrolytes and electrodes for the intermediate temperature SOFC (approximately 400-700 °C) is rapidly progressing [2]. Typical examples are the better understanding of the kinetic and thermodynamic properties of low temperature oxide ion conducting perovskite-type $La_{1-x}Sr_xGa_yMg_yO_3$ (LSGM), metal ion doped LSGM and fluorite-type CeO_2 as a function of temperature and pO_2.

In the present contribution, we report the effect of electrical conductivity on Ti-substitution in Pr-doped LSGM [3]. The total electrical conductivity decreases with increasing Ti content in $La_{0.45}Pr_{0.45}Sr_{0.1}Ga_{0.8-x}Ti_x\ Mg_{0.2}O_3$. We also describe the electrical conductivity properties of Fe-substituted $SrSnO_3$ perovskite-type oxides as a function of temperature and oxygen partial pressures. The total electrical conductivity increases with increasing Fe content in $SrSn_{1-x}Fe_xO_{3-\delta}$. Compounds containing low Fe contents ($x < 0.5$) are mixed oxide ion and electronic conductors, while high Fe-content ($x > 0.5$) compounds are found to be predominant electronic conductors over wide range of oxygen partial pressures (10^{-23}- 0.21 atm) [4].

The oxides were prepared by solid state reactions using stoichiometric amounts of metal oxides and carbonates at elevated temperature. Powder XRD, AC impedance under different oxygen activities and OCV measurements were performed for characterization.

The partial electronic conductivity of Sm-doped CeO_2 has been determined by using the Hebb-Wager polarization method and results will be discussed.

Reference:

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