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Topic: 4. Ceramics for energy production and storage

La0.9Sr0.1Ga0.8Mg0.2O3-d Ceramic Prepared by Two-Step Sintering

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Lanthanum gallate with partial substitutions on La and Ga sites ($La_{1-x}Sr_xGa_{1-y}Mg_yO_{3-\delta}$) has perovskite structure and high oxide-ion conductivity. Other properties of this ceramic material comprise a relatively wide electrolytic domain and low electronic conductivity. Doped lanthanum gallate is proposed as solid electrolyte for intermediate-temperature solid oxide fuel cells due to its high ionic conductivity and stability over a wide range of oxygen partial pressure. The main problem related to LSGM is the formation of secondary phases, such as $Sr_3La_4O_9$, $LaSrGa_3O_7$, $SrLaGaO_4$ and MgO. These phases may reduce the ionic conductivity, thus decreasing the cell performance. There are few studies investigating in detail the sintering method on phase evolution in this solid electrolyte. In this work, $La_{0.9}Sr_{0.1}Ga_{0.8}Mg_{0.2}O_{3-\delta}$ was prepared by solid state reaction. The pellets were sintered by the two-step process and by the conventional method, for comparison purposes. Tests were made for both the initial temperature (T_1) and for the isothermal temperature (T_2). The specimens were characterized by X-ray diffraction and impedance spectroscopy. The results showed that high T_1 temperatures (1500ºC) reduce the content of secondary phases. The smallest content of secondary phases was obtained for T_1 = 1500°C and T_2 = 1350°C. The amount of secondary phases decreases with increasing of the dwell time. The relative density was higher than 98%. The magnitudes of grain and grain boundary conductivities are slightly lower for specimens sintered by two the step method than those of specimens sintered by the conventional method. This effect seems to be related to the phase composition obtained after each process.