

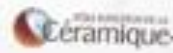
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Phase formation and electroconducting properties of modified lanthanum gallate ceramics as perspective electrolytes for high temperature solid oxide fuel cells

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The modified lanthanum gallate with partial aliovalent substitution of lanthanum and gallium cations with strontium and magnesium cations $(La_{0.8}Sr_{0.2})(Ga_{0.8}Mg_{0.2})O_{3-d}$ (LSGM) is being considered among the most perspective electrolyte materials for the intermediate temperatures solid oxide fuel cells (IT-SOFC) because of its high ionic conductivity in the wide range of the partial pressure of oxygen (1 – 10-22 atm.) and insignificant electronic conductivity^[1]. However LSGM compositions have insufficient thermodynamic stability in the conditions of the IT-SOFC working temperatures. To solve this problem, additional introduction of over stoichiometric additives with low melting temperatures intensifying sintering process and improvement of the functional electroconducting properties may be used.

The purpose of this work was to synthesize new ceramic solid solutions in the system $(La_{0.8}Sr_{0.2})[(Ga_{0.8-x}(Si_{0.2}Mg_{0.2})x)Mg_{0.2}]O_{3-d}$ (LSGSM) ($x=0-0.8$) and to investigate the phase formation and electroconducting properties of ceramic samples, additionally modified by LiF and Bi_2O_3 additives (5 wt. %).

Ceramic samples in LSGSM system were prepared by the solid state reaction method at temperatures $T=1073 - 1723$ K. LiF and Bi_2O_3 additives were introduced after annealing of the samples at $T=1373$ K.

The phase content and crystal structure parameters were studied using the X-ray diffraction method. Electroconducting properties were studied using the dielectric spectroscopy method in the temperature range of 300 – 1000 K at frequencies 100 Hz – 1 MHz.

The additives of lithium fluoride and bismuth oxide were shown to lower the temperature of formation of solid solutions formed through liquid-phase sintering. It was proved that additives influenced phase formation, phase composition and improve electrical conductivity.

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References:

1. T. Ishihara, M. Honda, T. Shibayama, H. Minami, H. Nishiguchi, Y. Takita, Intermediate temperature solid oxide fuel cells using a new LaGaO₃ based oxide ion conductor, J. Electrochem. Soc. 145(9), 3177-3183 (1998)