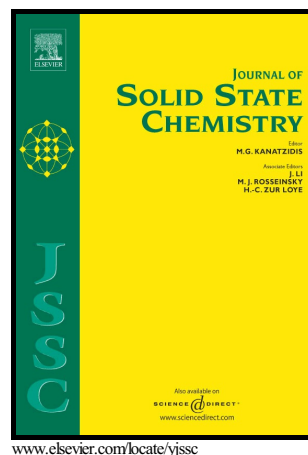


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ACCEPTED MANUSCRIPT

High-temperature properties of (La,Ca)(Fe,Mg,Mo)O_{3-δ} perovskites as prospective electrode materials for symmetrical SOFC

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Abstract

La_{1-y}Ca_yFe_{0.5+x}(Mg,Mo)_{0.5-x}O_{3-δ} oxides with the orthorhombic GdFeO₃-type perovskite structure have been synthesized at 1573K. Transmission electron microscopy study for selected samples shows the coexistence of domains of perovskite phases with ordered and disordered B-cations. Mössbauer spectroscopy studies performed at 300K and 573K show that while compositions with low Ca-content (La_{0.55}Ca_{0.45}Fe_{0.5}Mg_{0.2625}Mo_{0.2375}O_{3-δ} and La_{0.5}Ca_{0.5}Fe_{0.6}Mg_{0.175}Mo_{0.225}O_{3-δ}) are nearly oxygen stoichiometric, La_{0.2}Ca_{0.8}Fe_{0.5}Mg_{0.2625}Mo_{0.2375}O_{3-δ} is oxygen deficient with δ ≈ 0.15. Oxides are stable in reducing atmosphere (Ar/H₂, 8%) at 1173K for 12h. No additional phases have been observed at XRPD patterns of all studied perovskites and Ce_{1-x}Gd_xO_{2-x/2} electrolyte mixtures treated at 1173K-1373K, while Fe-rich compositions (x ≥ 0.1) react with Zr_{1-x}Y_xO_{2-x/2} electrolyte above 1273K. Dilatometry studies reveal that all samples show rather low thermal expansion coefficients (TECs) in air of 11.4-12.7 ppm K⁻¹. In reducing atmosphere their TECs were found to increase up to 12.1-15.4 ppm K⁻¹ due to chemical expansion effect. High-temperature electrical conductivity measurements in air and Ar/H₂ atmosphere show that the highest conductivity is observed for Fe- and Ca-rich compositions. Moderate values of electrical conductivity and TEC together with stability towards chemical interaction with typical SOFC electrolytes make novel Fe-containing perovskites promising electrode materials for symmetrical solid oxide fuel cell.

Graphical abstract

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