IT-SOFC electrolytes investigated by impedance spectroscopy

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Solid Oxide Fuel Cells (SOFCs) have attracted worldwide interest for their high energy conversion efficiency (50 % – 70 %), structure integrity, easy operation, and less impact to environment as well as the high tolerance to fuels [1, 2]. Due to the high operating temperatures (900^0 C – 1000^0 C) the requirements imposed to the materials that constitute the cells with solid oxide electrolyte, to produce them, at the present moment, is very restrictive. In response to these challenges, intermediate temperature solid oxide fuel cells (IT-SOFCs) are being developed to reduce high-temperature material requirements, which will extend useful lifetime, improve durability and reduce cost, while maintaining good fuel flexibility[3, 4]. A major challenge in reducing the operating temperature (600^0 C – 800^0 C) of SOFCs is the development of solid electrolyte materials with sufficient conductivity to maintain acceptably low ohmic losses during operation. Impedance spectroscopy is a powerful technique for unraveling the complexities of such materials, which functions by utilizing the different frequency dependences of the constituent components for their separation [5-7]. Thus, electrical inhomogeneities in ceramic electrolytes and electrode/electrolyte interfaces can all be probed, successfully, using this technique. In the present work we have studied by impedance spectroscopy the bulk and grain boundary effects on electrical conduction of $La_{0.8}Sr_{0.2}Ga_{0.83}Mg_{0.17}O_{3-\delta}$ / GCO electrolyte, and the temperature dependence of their ionic conduction. Our investigations show that these $La_{0.8}Sr_{0.2}Ga_{0.83}Mg_{0.17}O_{3-\delta}$ / GCO systems are promising materials as electrolytes for reduced-temperature solid oxide fuel cells.

References

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