Structure, densification and electrical properties of Gd3+ and Cu2+ co-doped ceria solid electrolytes for SOFC applications.

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The current energy needs are still met by the use of fossil fuels. Due to the increasing demand for new energy sources, solid oxide fuel cell has proven to be a good alternative. However, the development of this technology is limited by needs high operation temperature. Ceria-based solid electrolytes have been considered a promising material due to better ionic conductivities in comparison to traditional yttria-stabilized zirconia ceramics. The main disadvantage of ceria-based electrolyte is the need for high sintering temperatures for complete densification. Transition metal oxides exhibiting low melting points, such as CuO, have been used as additives to lower the sintering temperature of these materials [1]. In this scenario, the present work is focused on the evaluation of the effects of gadolinium oxide (Gd_2O_3) content and small quantity of CuO on the structure, densification and electrical properties of ceria solid solutions [2]. Nominal compositions of $Ce_{0.99-x}Gd_xCu_{0.01}O_{2-\delta}$ ($0 \leq x \leq 0.3$) were synthesized by the polymeric precursor method. The calcined powders were studied by XRD and Rietveld refinement to obtain crystallographic parameters. The sinterability of green bodies was evaluated by dilatometry up to 1200 °C. The electrical properties were investigated by impedance spectroscopy. The electrical conductivity was enhanced by gadolinium addition, reaching a maximum of 7.81 mS cm^{-1} at 600 °C for the composition x=0.15 sintered at a temperature as low as 1050 °C.

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