Influence of coprecipitation route on electrical conductivity of ceria-based ceramics

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Abstract:

Ceria-based ceramics (CeO_2) are oxygen ion conductors and have high ionic conductivity at temperatures around 500ºC, allowing their application as solid electrolyte in Intermediate Temperature Solid Oxide Fuel Cells (IT-SOFC). In this work, samaria- and gadolinia-doped ceria powders with composition $Ce_{0.8}(SmGd)_{0.2}O_{1.9}$ were synthesized by hydroxide, oxalate and carbonate coprecipitation routes. A concentrate of rare earths containing 90 wt.% of CeO_2 and another containing 51 wt.% of Sm_2O_3 and 30 wt.% of Gd_2O_3, prepared from monazite processing, were used as starting materials. The main purpose of this work is to study the effect produced by several precipitant agents on the electrical conductivity of doped-ceria and to verify the possibility of using rare-earth concentrates to obtain sintered ceramics with high density and suitable electrical properties. The obtained powders were calcined at 600°C and the pressed pellets were sintered at 1500°C. The results have shown that the powders have high values of specific surface area (>100 $m^2.g^{-1}$) and cubic fluorite-type structure. The morphologies of particles and agglomerates, observed by scanning electron microscopy, depend on the precipitant agent. Highly dense samples (> 95% of the theoretical value) were obtained. The electrical conductivity behavior determined by impedance spectroscopy depends on the employed precipitant agent. Moreover, a considerable electronic conductivity is verified due to a combined electrical effect of several rare-earth cations present in these concentrates.