CHARACTERIZATION OF GD^{3+} DOPED NANOCERIA ELECTROLYTE MEMBRANE AND ITS COMPOSITE ELECTRODES COMPATIBILITY FOR IT-SOFC APPLICATIONS

R.V.Mangalaraja [(1)], S.Ananthakumar [(2)], Marta Lopez [(1)], Carlos P.Camurri [(1)], Ricardo E.Avila [(3)]

(1) Department of Materials Engineering, University of Concepcion, Concepcion, CHILE
(2) Materials and Minerals Division, National Institute for Interdisciplinary Science and Technology (NIIST), CSIR, Trivandrum, INDIA
(3) Department of Nuclear Materials, Chilean Commission of Nuclear Energy, CHILE

E-mail: mangal@udec.cl

ABSTRACT

Gd^{3+} doped ceria nanocrystalline powders prepared by nitrate-fuel combustion technique and calcined at 700℃ for 2h, were fabricated and consequently sintered at a low temperature of 1200℃ for 2h to get dense nanoceria electrolyte membrane. Similarly, NiO/Gd-CeO_2 and $LaSrCoFe_2O_3$ (LSCF)/ Gd-CeO_2 nano composites powders were prepared and coated as electrodes of anode and cathode on each one side of the sintered electrolyte for further sintering at 1100 and 1000℃ for 2h, respectively. Figures 1 and 2 show the foamy precursor powders structure of CeO_2 and NiO/Gd-CeO_2, respectively. The as-prepared and calcined powders were characterized into X-ray diffraction (XRD) analysis to confirm the formation of phases. The particle sizes of the powders analyzed using transmission electron microscopy (TEM) were between 10 and 25 nm.

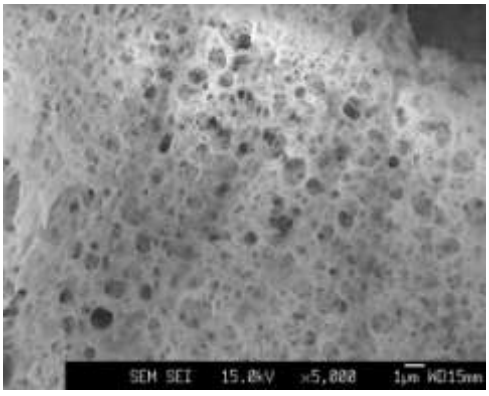

Figure 1

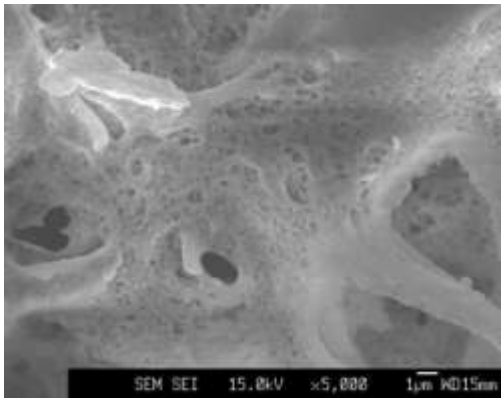

Figure 2

The physical compatibility and mechanical durability of the cell was determined by microstructural and Vickers hardness studies. The mechanical Vickers hardness and fracture toughness of the order of 8.5±0.5 GPa and 1.8±0.3 MPa $m^{1/2}$, respectively, were obtained for pure Gd-CeO_2 electrolyte. The electrical characterization of the cell was studied to improve the intermediate temperatures solid oxide fuel cells (IT-SOFC) performance of materials. The scanning electron microscopy (SEM) analysis of the sintered cell showed the dense electrolyte and porous electrodes with nano grains structure.