Electrochemical Characterization of Anode Supported SOFC Prepared by Co-Firing Technique.

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One of the main problems in the fabrication of anode supported solid oxide fuel cells is related to the sintering of electrolyte layer on anodic substrate, because differential densification of the layers may result in cracks during thermal process. Co-firing approach consists of simultaneous sintering of both electrolyte and anode. In this way, shrinkage of porous layer is compatible with the densification of electrolyte film.

In this work co-firing technique was used for the sintering of YSZ thick films deposited on green NiO-YSZ layers by electrophoretic deposition (EPD). EPD is a colloidal process based on the motion of charged particles in the electric field in the direction of the electrode with opposite charge, thus forming a compact layer. With respect to other techniques, EPD has several advantages: short formation times, little restriction in the shape of substrates, simple deposition apparatus, possibility to have a mass production, low cost, easy control of the thickness of the deposited film through simple regulation of applied potential and deposition time.

The EPD/co-firing combined process allowed to obtain a dense, 10 μm thick, crack free electrolyte layer with a good bonding to the anode.

A slurry was prepared starting from a commercial NiO-YSZ anodic powder (Praxair), polyvinylidene fluoride (PVDF binder SOLEF® 6020, Solvay), a nanometric carbon powder (super P, Carbon Belgium), dispersed in N-methyl-2-pyrrolidone. A green membrane was obtained after evaporation of the solvent.

A suspension of YSZ powder was prepared starting from commercial YSZ (TZ8Y, Tosoh) in methanol and deposited by EPD on a green NiO-YSZ membrane using a planar EPD cell setup.

Co-firing parameters were assessed from the results of TG-DTA analysis performed on green bodies.

Figure 1 shows the results of Hg porosimetry performed on sintered anodes for the determination of residual porosity and surface area.

Green and fired samples were characterized in terms of morphology by scanning electron microscopy (FE-SEM), as reported in Figure 2. EDS linescan performed on the cross section of the cell did not show nickel diffusion in the electrolyte layer.

A cathode layer was deposited on fully sintered half cells via spray-powder technique, using a suspension of commercial LSFC powder (Nextech), followed by a low temperature sintering process.

Electrochemical characterization was performed on button cells in hydrogen in the temperature range 600-800 °C.

Data of the electrochemical characterization will be presented at the conference.

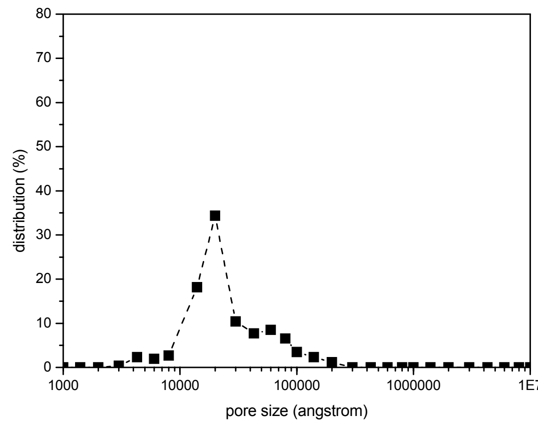

Figure 1. Pore size distribution of NiO-YSZ anode after sintering process

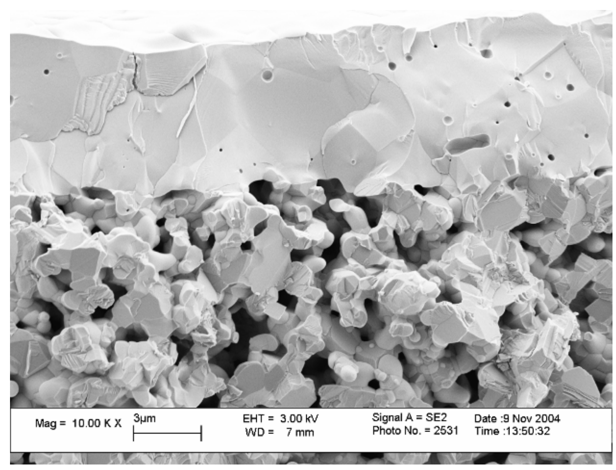

Figure 2. FE-SEM micrograph of the cross section of anode-electrolyte assembly.