

PROCESS AND CHARACTERIZATION OF YSZ THICK-FILMS DEPOSITED BY ELECTROPHORETIC DEPOSITION FOR INTERMEDIATE-TEMPERATURE SOFC

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Preparation of yttria-stabilised zirconia (YSZ) thick films is a critical point for fabrication of solid devices such as solid oxide fuel cells and solid state sensors. YSZ electrolyte films were deposited on planar porous green Ni-YSZ cermet substrates by using 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. The EPD has been applied to coating ceramics with thicknesses of few micrometers to several millimeters (1-3). 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 technological feasibility of applying the technique to solid oxide fuel cells was investigated in different conditions and on different substrates.

The cell used for the EPD experiment had a horizontal setup. A schematic view of the apparatus is shown in figure 1.

A mixture of 65% in NiO and 35% 8 mol% YSZ (TZ8Y Tosoh) was moulded with polyvinylidene fluoride (PVDF binder SOLEF® 6020) and dispersed in N-methyl-2-pyrrolidone. A slurry was spread out with doctor blade and a green membrane was obtained. Disks having 13 mm diameter were cut from the membrane and examined by scanning electron microscope (SEM).

A suspension of YSZ powder was prepared by mixing commercial YSZ (TZ8Y Tosoh) 3wt% $d_{50} \approx 2 \mu\text{m}$ in pure ethanol. The fresh suspension was sonicated 30 minutes before the EPD experiments and the suspension was allowed to settle for 10 minutes.

Porous green Ni-YSZ membranes were used as substrates for EPD experiment. The samples obtained were cofired and analysed. Figure 2 shows a SEM photograph of the surface of YSZ deposited film sintered at 1300 °C for 12h.

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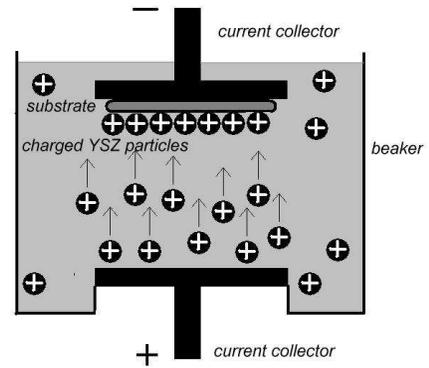


Figure 1: schematic view of the deposition apparatus

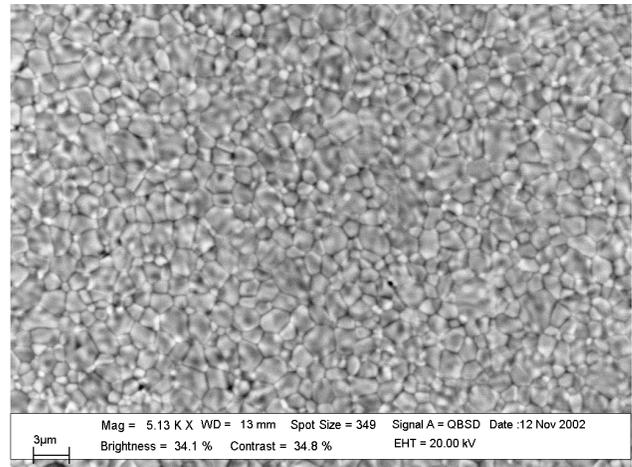


Figure 2: SEM image of YSZ film deposited by EPD sintered at 1300 °C for 12 h