

YTTRIA-STABILISED ZIRCONIA MEMBRANES FOR SOLID OXIDE FUEL CELL APPLICATIONS BY PULSED LASER DEPOSITION

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Solid oxide fuel cells (SOFC) are developed predominantly for applications in stationary energy supplies. The electrolyte thickness in anode-supported SOFC applications vary from 5 to 20 μm . To lower the operating temperature from 800 °C down to 650 °C while maintaining the electrochemical power density, 1 to 2 μm thick electrolyte membranes should be realised in combination with improved electrode materials. Yttria stabilised zirconia (YSZ) films were deposited by pulsed laser deposition (248 nm) from a YSZ target in oxygen atmospheres on dense (porosity < 2 %) NiO/YSZ surfaces at 400 to 700 °C. YSZ films were obtained in the range of 1 to 2.5 μm thickness. The films have been investigated with respect to surface morphology, microstructure, film defects and variation of the film thickness. The film morphology varied from porous columnar to dense microstructure depending on the oxygen pressure and the substrate temperature. In the oxygen pressure range of 0.01 to 0.5 mbar the films consisted of cubic and tetragonal YSZ whereas at low pressures and low temperatures also the rhombohedral $\text{Y}_4\text{Zr}_3\text{O}_{12}$ phase was detected. Surface artefacts bigger than the film thickness led to film defects while smaller artefacts were coated by a dense layer.