In-operando observation of microstructural evolution in a solid oxide cell electrolyte operating at high polarization - DTU Orbit (30/01/2019)

In the present work a symmetric scandia yttria stabilized zirconia electrolyte based solid oxide cell is investigated in-operando by synchrotron X-ray diffraction as a function of time and position within the electrolyte while annealing at 700 °C in air and at a polarization of 2 V. In addition, scanning electron microscopy experiments are carried out on similar cells operating at temperatures of 700, 800 and 900 °C. Void formation in the grain boundaries of the electrolyte close to the anode/electrolyte interface is detected as early as 6 h. No clear trend is observed with respect to cell operation time and temperature in cells with equal grain size. However, grain boundary surface area may be inversely related to the frequency of void observations. A decrease of d-spacing in the anode interface region can be attributed to compressive stress associated with oxygen pressure build up. Decrease of d-spacing in the cathode/electrolyte region could be associated to oxide ion deficiency. Dark field X-ray microscopy is used to map for the first time the strain gradients within an electrolyte grain close to the anode region. Changes in strain domains after 10.5 h at operating conditions are assumed to be associated with early stages of void formation.

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