3D Microstructural Characterization of Ni/YSZ Electrodes Exposed to 1 Year of Electrolysis Testing

Long-term operation strongly affects the microstructure of Ni/YSZ cermets used in state of the art fuel electrodes for solid oxide cells. The microstructural changes are considered to heavily affect the cell degradation. In this paper, the characterization of the Ni/YSZ electrode of a solid oxide electrolysis cell tested as part of a stack tested for 1 year was performed through focused ion beam-scanning electron microscopy and energy dispersive X-ray spectroscopy. A reference cell and two locations of interest in the tested cell were selected: one at the steam inlet side and the other at the outlet. Considerable microstructural changes were observed in the tested cell compared to the reference cell and between the inlet and outlet side. A decrease in Ni (from 30% in the reference cell to 24% in the tested cell), and in percolating triple phase boundaries length (from 2.83 μm/m² in the reference cell to 0.76 μm/m² in the tested cell) was observed in the active fuel electrode. Based on the results of this work and previous studies we hypothesize that the degradation trend between different operating conditions at the inlet and outlet of the cell is related to the current redistribution inside the cell. (C) 2019 The Electrochemical Society.

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