Effects of strong cathodic polarization of the Ni-YSZ interface

Long-term strong cathodic polarization experiments of down to -2.4 V vs. $E^\circ(O_2)$ of the Ni-YSZ interface were performed at 900°C in 97% H₂/3% H₂O on model electrodes. The Ni-YSZ interface underwent extensive changes and a large affected volume with a complex microstructure and phase distribution resulted. Impedance spectroscopy shows initial decrease but later increase in the series resistance and polarization resistance during the 140-160 h of polarization, and significant inductive behavior. An intermetallic Ni-Zr phase that formed during polarization was preserved when the polarization was kept during cooling, and was identified post-mortem by transmission electron microscopy as Ni₇Zr₂. ZrO₂ nanoparticles were formed on the Ni-gas surface next to the Ni-YSZ-gas triple phase boundary. Explanations of the observed features are offered based on electron microscopy and impedance spectroscopy.

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