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Evaluation of Ni and Ti-doped Y_2O_3 stabilized ZrO_2 cermet as an anode in high-temperature solid oxide fuel cells

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Abstract

The compatibility of nickel and Ti-doped 8 mol% Y_2O_3 stabilized ZrO_2 (Ni–Ti–YSZ) cermets has been discussed for use as an anode in high-temperature solid oxide fuel cells (SOFC). The solubility limit of TiO_2 in the YSZ fluorite was estimated to be at least 10 mol%. With increasing Ti content in the Ti–YSZ samples, the average linear thermal expansion coefficient was found to decrease when measured in an H_2 atmosphere. In an H_2 atmosphere, the oxygen vacancy concentration was observed to increase with increasing Ti content and temperature, and its value in the 8 mol% Ti-doped YSZ (8Ti–YSZ) sample was 0.0056 at 1000 °C. Although electronic conduction appeared in the Ti–YSZ samples at temperatures greater than ~ 600 °C in the H_2 atmosphere, their electrical conductivities had a tendency to decrease with increasing Ti content. The mechanical strength of the Ni–Ti–YSZ cermets at room temperature were found to increase with increasing Ti content. Anodic polarization of the 40 vol.% Ni–8Ti–YSZ cermet at 1000 °C was 60 mV at 300 mA cm⁻² in the H_2 atmosphere after firing at 1400 °C for 10 h.

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