High Performance Nano-Ceria Electrodes for Solid Oxide Cells - DTU Orbit (08/11/2017)

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In solid oxide electrochemical cells, the conventional Ni-based fuel-electrodes provide high electrocatalytic activity but they are often a major source of long-term performance degradation due to carbon deposition, poisoning of reaction sites, Ni mobility, etc. Doped-ceria is a promising mixed ionic-electronic conducting oxide that could solve these issues if it can be integrated into an appropriate electrode structure. Two new approaches to obtain high-performance nanostructured doped-ceria electrodes are highlighted. The first is an infiltration-based architecture with $Ce_{0.8}Pr_{0.2}O_{2-\delta}$ forming the active surfaces on a porous backbone with embedded electronic current collector material, yielding one of the highest performances reported for an electrode that operates either on fuel or oxidant. The second is a nano-$Ce_{0.9}Gd_{0.1}O_{2-\delta}$ thin film prepared by spin-coating, which provides an unprecedented electrode polarization resistance of ~0.01 Ω cm^2 at 650 °C in H_2/H_2O. These results demonstrate that nano-ceria has the ability to achieve higher performance than Ni-based electrodes and show that the main challenge is obtaining sufficient electronic current collection without adding too much inactive material.

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