

Development of ceria-based direct ethanol intermediate-temperature solid oxide fuel cell

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Solid oxide fuel cells (SOFCs) have several advantages over traditional energy-generating devices. A key property is the possibility of using various fuels such as natural gas and ethanol, which are strategic for Brazil. This study addresses two aspects that need to be improved in SOFC: (a) the high operating temperature of the cell that brings several problems for assembly and operation of a power system, and (b) the deactivation of the cell due to the deposition of carbon on the surface of the nickel anode when the cell is fed with carbon-containing fuels. The properties of ceria-based/Ni cermets both as the anode material and as the catalytic layer for bio-ethanol fueled SOFC with yttria-stabilized zirconia electrolyte were investigated. Ceria-based/Ni cermets were studied as the catalytic layer deposited onto the standard yttria-stabilized zirconia/Ni anode for direct ethanol SOFCs. Properties of both Zr- and Nb-doped (10 mol%) ceria / Ni (15 vol%) cermets were investigated as the catalytic layer in direct ethanol SOFCs. Electrolyte-supported fuel cells with doped-ceria /Ni catalytic layer were tested for ~100 hours under (dry) ethanol. Fuel cells using the different ceria/Ni cermets showed excellent stability on ethanol. The promising results obtained with ceria-based anodes for SOFC of ethanol motivated the development of ceria-based SOFCs. Thus, intermediate-temperature SOFCs using doped-ceria electrolytes have been tested at 600 °C using hydrogen. Preliminary results show that direct ethanol SOFC are promising devices for efficient energy conversion at intermediate temperatures.