STABLE HIGH CONDUCTIVITY BILAYERED ELECTROLYTES FOR LOW TEMPERATURE SOLID OXIDE FUEL CELLS

Eric Wachsman[1] and Jun-Young Park[1]

[1]University of Florida
Department of Materials Science and Engineering
Gainesville, FL 32611-6400
USA

A ceria/bismuth oxide bilayer electrolyte with high ionic conductivity is being developed to reduce solid oxide fuel cell (SOFC) operating temperatures. The bilayer structure overcomes the limited thermodynamic stability of bismuth oxides and the electronic conductivity of ceria based oxides in reducing atmosphere. Measurements of the conductivity, open-circuit potential, and transference number of (Sm2O3)0.1(CeO2)0.9 (SDC) and SDC coated with (Er2O3)0.2(Bi2O3)0.8 (ESB) are presented. Bilayer electrolytes were formed by depositing a thin layer of ESB of varying thickness via pulsed laser deposition (PLD) and dip-coating on a SDC substrate. The conductivity of bilayer ESB/SDC electrolytes was measured in air and compared with that of SDC. Bilayer samples exhibited slightly higher total conductance than SDC. The OCP of ESB/SDC electrolytes was tested in a fuel cell arrangement as a function of temperature with H2/H2O on the anode side and air on the cathode side. These OCP measurements were compared with the OCP of uncoated SDC samples under the same conditions. The results showed a significant increase in OCP and ti with the bilayer structure, as compared to cells with a single SDC electrolyte layer. Further, the OCP and ti increased with increasing relative thickness of the ESB layers.