Cu- and Ni-Doped $Mn_{1.5}Co_{1.5}O_4$ Spinel Coatings on Metallic Interconnects for Solid Oxide Fuel Cells

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Solid oxide fuel cells (SOFCs) represent the most efficient way to generate electricity from a variety of fuels such as hydrogen, methane and natural gases. To increase the output voltage of the SOFC system, multiple cells are connected in electrical series using interconnects. In a stack, an interconnect electrically connects unit cells and separates fuel from oxidant in the adjoining cells.

Chromia-forming ferritic stainless steels are considered the most promising candidate alloys for SOFC interconnects due to their high electronic and heat conductivities, low cost, easy fabrication, and appropriate thermal expansion behavior. However, the exposure of these alloys to an oxidizing atmosphere at high temperatures can cause the growth of oxide scales, which leads to (i) a significant increase of interfacial resistance and (ii) a severe degradation in the cathode performance due to the poisoning effect of Cr species. A promising approach to overcome the issues is the surface modification of the metallic interconnects with conductive oxide coatings. For example, $(Mn,Co)_3O_4$ spinel coatings on metallic interconnects have been known to act as an effective barrier to oxygen inward and Cr outward diffusion [1].

In this work, $Mn_{1.5}Co_{1.5}O_4$ spinels doped with Cu and Ni are synthesized by a modified Pechini method. The X-ray diffraction analysis indicates that the materials are composed of two phases, *i.e.*, cubic and tetragonal phases. The materials properties, such as electrical conductivities and thermal expansion coefficients, are extensively characterized. Dense protective coatings are fabricated on a metallic interconnect (Crofer 22 APU) by a dip-coating process, followed two-step heat-treatment. The oxidation experiments indicate that the area-specific resistance of the spinel-coated interconnect is strongly dependent on the doping element. In addition, the loss of electrocatalytic activity of LSCF cathode due to Cr poisoning is evaluated as a function of time in the presence of the spinel-coated interconnects.

Reference

[1] N. Shaigana, W. Qu, D.G. Ivey, W. Chen, J. Power Sources 195 (2010) 1529.

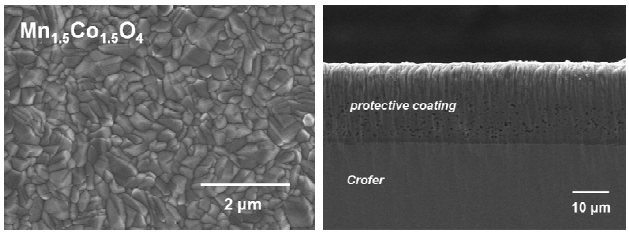

Fig. 1. SEM micrographs of surface and cross-section of the protective coating on a Crofer 22 APU substrate.