Microstructural, thermo-mechanical and corrosion properties of electrophoretically co-deposited Cu and Fe doped Mn–Co spinel coatings for solid oxide cell interconnects

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Abstract:

Chromia forming ferritic stainless steels are employed as interconnects in SOC stacks; the deposition of a manganese-cobalt spinel protective coating is widely accepted as a viable solution to mitigate both the oxidation and the chromium evaporation. Electrophoretic deposition (EPD) offers the possibility to deposit homogeneous coatings in few seconds and at room conditions and the need of a simple and adaptable apparatus, thus reducing processing time and cost. A successful deposition is ensured by the optimization of both the starting suspensions in terms of colloidal properties and the post-deposition sintering profile. Electrophoretic co-deposition is an innovative approach for the simultaneous deposition of spinel precursors and for designing in-situ modified manganese-cobalt spinel coatings.

A systematic microstructural, thermo-mechanical and electrical characterization of simultaneous Fe–Cu doped Mn–Co spinel coatings processed by electrophoretic co-deposition on Crofer 22 APU is here reported and discussed. We demonstrate the feasibility to co-deposit Fe_2O_3, CuO and Mn–Co spinel to produce dense, stable and effective doped spinel coatings. Improved functional properties of produced coatings are assessed in terms of microstructure development, oxidation kinetics and area specific resistance at SOC stack relevant conditions. Furthermore, an assessment of the dilatometric properties of the Fe–Cu doped spinels reveals the influence of different doping levels on the thermo-mechanical compatibility of the Fe–Cu doped Mn–Co spinel coatings with the interconnect.

This work proposes the electrophoretic co-deposition method as an innovative approach for the simultaneous deposition of spinel precursors and for designing in-situ modified coatings.