Dual Interconnect Coatings for Planar SOFC Stacks

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Introduction

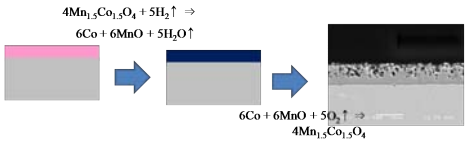
Chromia-forming ferritic stainless steels are usually used as interconnect materials of SOFC stacks. However, volatile Cr-containing species originating from this scale can poison the cathode material in the cells and subsequently cause power degradation in the devices. To prevent this and to enable durable hermetic sealing, conductive MnCoO spinel coatings and non-conductive RAA (reactive air aluminizing) coatings can be applied. However, the coating method for each coating is very different. Therefore, in this study, a dual coating method has been developed, and the results from single-cell stack test ing will be shown.

Objective

Prevent Chromia species evaporation and enable hermetic sealing during long term operation at high temperature. Conductive and non-conductive coatings must be compatible.

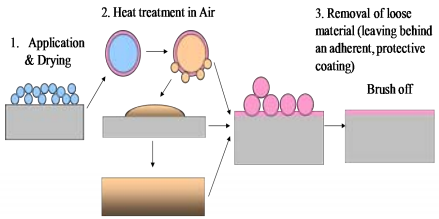
Experiment

MnCoO-spinel



Reduction and Oxidation heat treatment

RAA



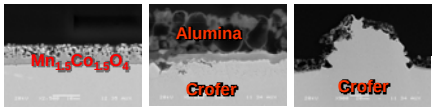
Only Oxidation heat treatment

Optimizing Coating Process

Process	Coating		Heat treatment I		Coating		Heat treatment II		Heat treatment III	
	Spinel	Al	Re	Ox	Spinel	Al	Re	Ox	Re	Ox
A	√	-	√	-	-	√	-	√	-	-
B	-	√	-	√	√	-	√	-	-	√
C	√	√	√	-	-	-	-	√	-	-
D	√	√	-	√	-	-	-	-	-	-

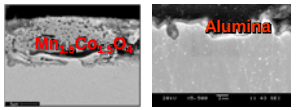
*Re : Reduction heat treatment, Ox : Oxidation heat treatment

- Process A



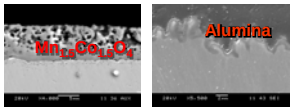
RAA does not work with pre-formed Chromium oxide layer before coating.

- Process B



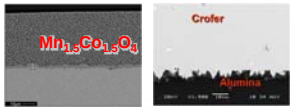
From pre-formed chromium oxide layer, spinel coating shows spallation.

- Process C



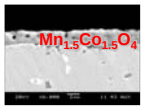
Both coatings show good microstructure.

- Process D

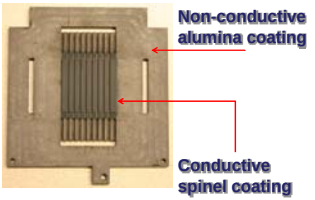


Spinel does not sinter enough.

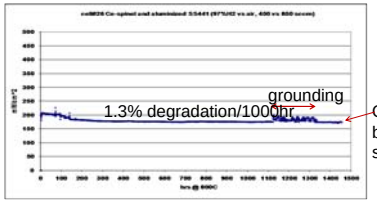
Optimized spinel coating



Dual Coated Cathode Plate



Single Cell Test



Results

- Pre-existing chromium oxide layer degrades both spinel and alumina coating performance.
- Simultaneous fabrication of coatings successfully achieved.
- This dual coating approach is novel, very durable and shows high performance, enabling hermetic seal ing and preventing volatilization of chromium species.

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