Long Term Stability Test of Low Temperature and Standard Reactive Air Aluminization Interconnect Part

Jung Pyung Choi and Jeffry W. Stevenson

Pacific Northwest NATIONAL LABORATORY

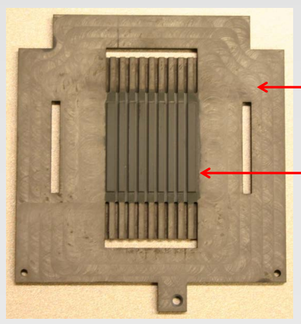
Introduction

Chromia-forming ferritic stainless steels are preferred interconnect-materials for planar SOFCs because of their resistance to oxidation and low cost. However, they produce Cr-containing volatile species at SOFC operating temperatures, which can cause cathode poisoning. Hence, a protective coating is required on the surface of the metal interconnect materials. The Reactive Air Aluminization (RAA) method was developed to provide a protective coating for prevention of chrome poisoning in the cathode and minimization of reaction with sealing materials. The RAA process is typically performed at 1,000°C. However, SOFC developers would benefit if the processing temperature can be reduced. In this presentation, we will report the long-term stability test of low temperature, and standard RAA processed samples in oxidation and reduction atmosphere.

Objective

Prevent Chromia species evaporation and enhance sealing performance. Reducing process temperature of reactive air aluminization (RAA) for industrial application.

Issue and idea



RAA process: Normally done at 1000°C. However, industrial partners would prefer a lower temperature.

Results

Sample: SS441
1. Original RAA
2. Mn addition with 900°C heat treatment (Low temperature RAA)

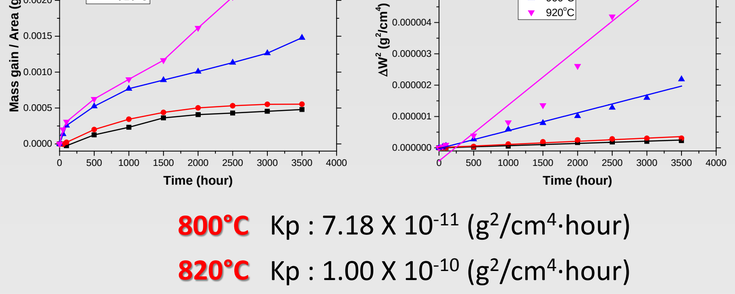
Thermal cyclic Test (Air)

Original RAA

800°C Kp : 4.88 X 10^{-11} (g^2/cm^4·cycle)

900°C Kp : 7.23 X 10^{-10} (g^2/cm^4·cycle)

Low Temperature RAA



800°C Kp : 3.01 X 10^{-11} (g^2/cm^4·hour)

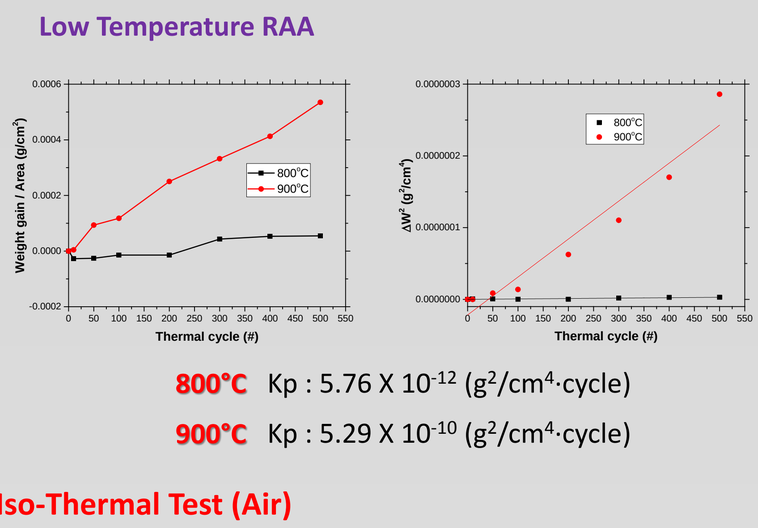
820°C Kp : 2.36 X 10^{-11} (g^2/cm^4·hour)

900°C Kp : 1.73 X 10^{-9} (g^2/cm^4·hour)

920°C Kp : 2.59 X 10^{-9} (g^2/cm^4·hour)

Low Temperature RAA

Low Temperature RAA



800°C Kp : 7.18 X 10^{-11} (g^2/cm^4·hour)

820°C Kp : 1.00 X 10^{-10} (g^2/cm^4·hour)

900°C Kp : 5.7 X 10^{-10} (g^2/cm^4·hour)

920°C Kp : 1.78 X 10^{-9} (g^2/cm^4·hour)

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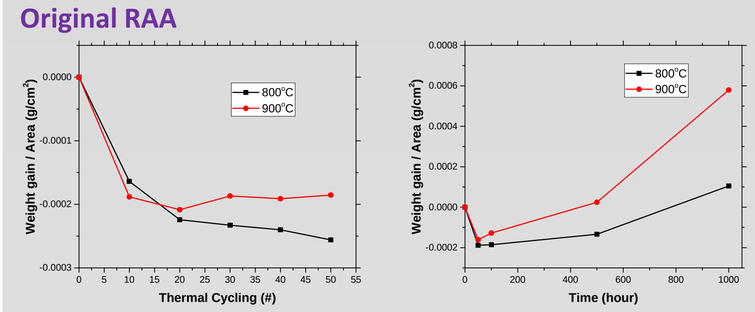
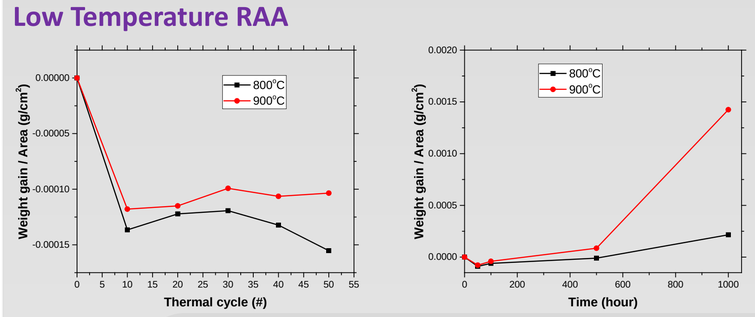
Low Temperature RAA

Thermal cyclic and Iso-Thermal Test (Reduction)

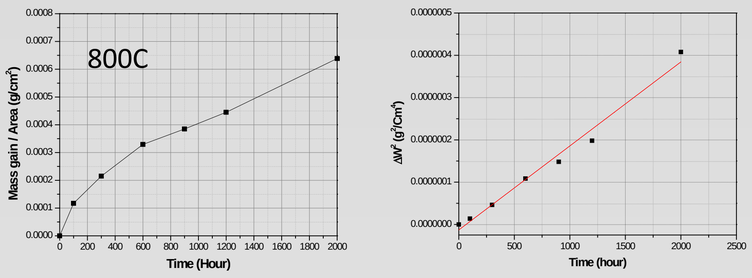
Original RAA



Low Temperature RAA



Iso-Thermal Test (Air)



Bare-SS441
Kp : 1.9866 X10^{-10} (g^2/Cm^4 • hour)

Original RAA

800°C Kp : 7.18 X 10^{-11} (g^2/cm^4·hour)

820°C Kp : 1.00 X 10^{-10} (g^2/cm^4·hour)

900°C Kp : 5.7 X 10^{-10} (g^2/cm^4·hour)

920°C Kp : 1.78 X 10^{-9} (g^2/cm^4·hour)

ABOUT

Pacific Northwest National Laboratory

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For more information on the science you see here, please contact:

Jung Pyung Choi
Pacific Northwest National Laboratory
P.O. Box 999, MS-IN: K6-28
Richland, WA 99352
(509) 375-2120
jungpyung.choi@pnnl.gov

Acknowledgements

The U.S. Department of Energy's Office of Fossil Energy funded the work summarized in this paper as part of the Solid Oxide Fuel Cell Core Technology Program. Battelle Memorial Institute operates PNNL for the U.S. Department of Energy under Contract DE-AC06-76RLO1830.

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