Oxidation Resistant Coatings for High Temperature Alloys

Keywords: Jet Engines, Coatings, Remanufacturing, Solid Oxide Fuel Cells, Interconnector

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Background

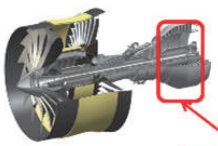
- Metallic materials used at high temperatures always suffer from oxidation damage.
- Surface modification processes are required for avoiding oxidation.
- Selection of oxidation resistant coating materials and processes is essential

Aim

- For turbine blades, a Pt(-Ir) paste method was focused
- Evaluation of the paste coatings : microstructure and properties
- Co-W alloy electroplating was applied on high Cr ferritic stainless steel for SOFC
- Self organization of Cr-diffusion barrier ($CoWO_4$) by the heating treatment

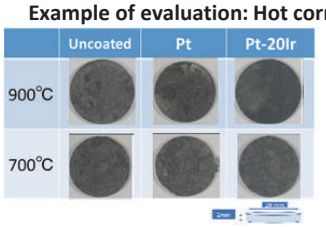
Advanced Research Topics

Paste Coatings for Turbine Blades



Further temperature capabilities of turbine blades are required.

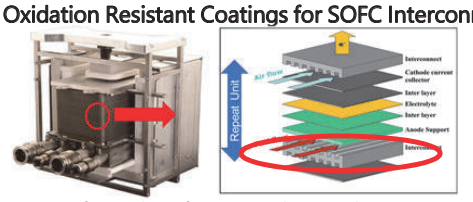
Example of evaluation: Hot corrosion



Improvement of hot corrosion resistance by the Pt-Ir paste coatings was confirmed.

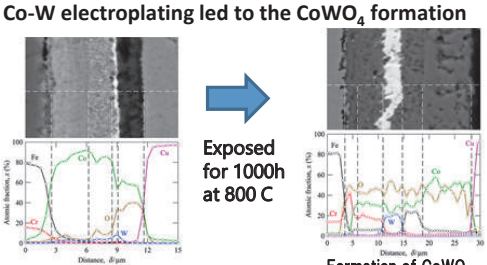
*Collaboration with industries

Oxidation Resistant Coatings for SOFC Interconnectors

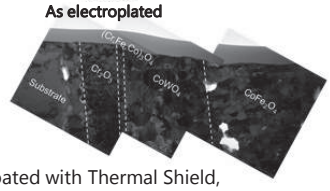


Issues for High-Cr ferritic stainless steel:
Oxidation and evaporation of Cr (Cr poisoning)

Co-W electroplating led to the $CoWO_4$ formation



As electroplated



Formation of $CoWO_4$ hindered the outward diffusion of Cr

TEM–EELS, EBSD analyses evidenced the Cr–blocking mechanism by the presence of $CoWO_4$ layer

*Collaboration with Muroran Institute of Technology

Publications

- EP Patent No. EP3048187A1 Ni Alloy Article Coated with Thermal Shield, and Production Method for Same (2016)
- Lu Gan, H. Murakami, I. Saeki. High temperature oxidation of Co-W electroplated type 430 stainless steel for the interconnect of solid oxide fuel cells. CORROSION SCIENCE. **134** (2018) 162-16

Applied area and future prospects

- Jet engines, gas turbines, aerospace industry,
- Oxidation resistant treatment for SOFCs
- Application to re-manufacturing

Issues for technology transfer

- Coatings on large and complicated surfaces
- Evaluation using actual components
- Cost performance issues