Effect of SOFC Interconnect-Coating Interactions on Coating Properties and Performance

Jeffrey W. Fergus
Auburn University
Materials Research and Education Center

BACKGROUND

Coatings for SOFC Interconnects
- Reduce chromium volatilization from interconnect and thus cathode poisoning
- Changes in coating composition during operation can affect performance

DOE Laboratory Partnership
- Auburn University supports Pacific Northwest National Laboratory (PNNL) with fundamental studies on successful coating materials
  - –Thermodynamic and transport properties
  - –Prediction of changes during use
  - –Effect of changes on coating performance

AUBURN
SAMUEL GINN COLLEGE OF ENGINEERING

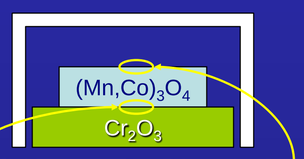
$Mn_{1.5}Co_{1.5}O_4 + Cr_2O_3$ at 1000°C

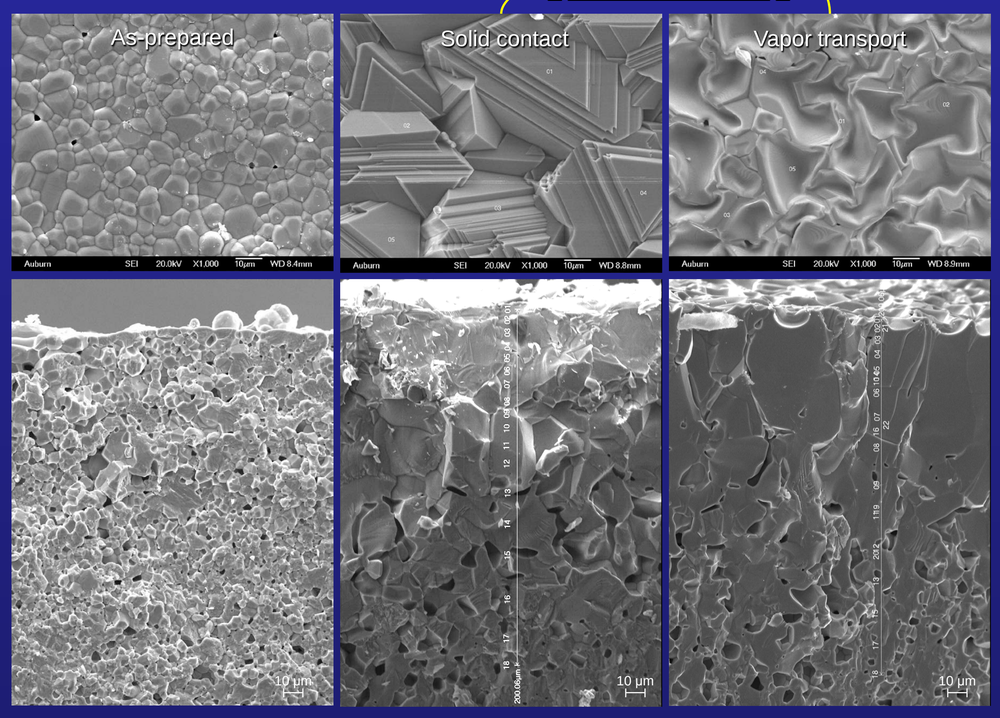
Recent Progress

$Mn_{1.5}Co_{1.5}O_4 + Cr_2O_3$ at 1200°C

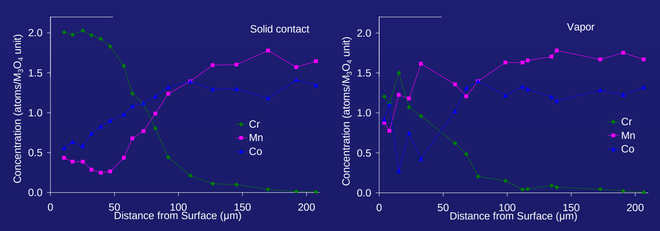
Solid-solid contact
- Faceted morphology
- $Mn_{0.4}Co_{0.4}Cr_2O_4$ on surface

Vapor transport
- Lower Cr content
- Grain-boundary growth

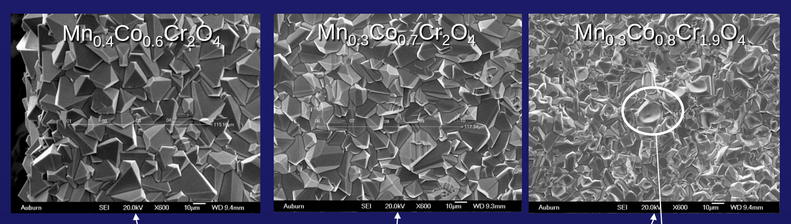




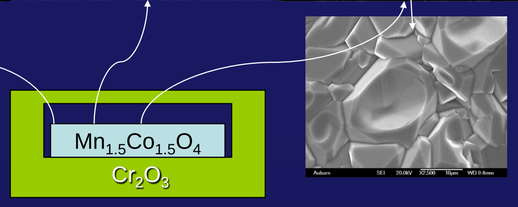
$Mn_{1.5}Co_{1.5}O_4$
1200 °C
336 hours



$Mn_{1.5}Co_{1.5}O_4$
1200 °C
72 hours



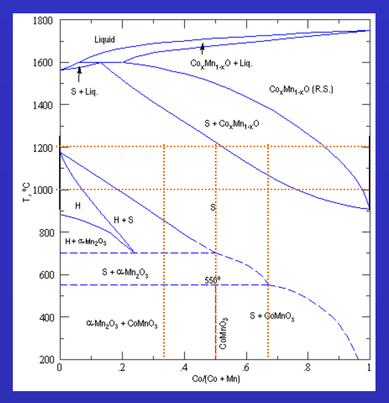
$Mn_{0.4}Co_{0.6}Cr_2O_4$ can form from vapor



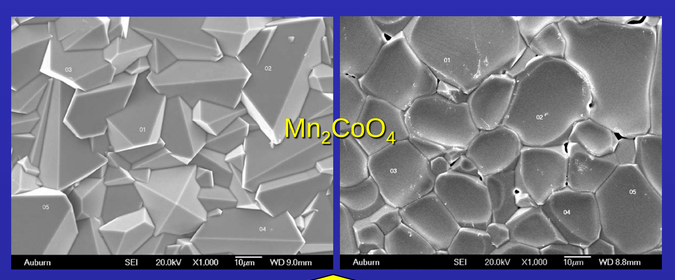
Effect of Composition

Morphology
- Similar to $Mn_{1.5}Co_{1.5}O_4$
- Less prominent grain-boundary growth for $MnCo_2O_4$ in vapor

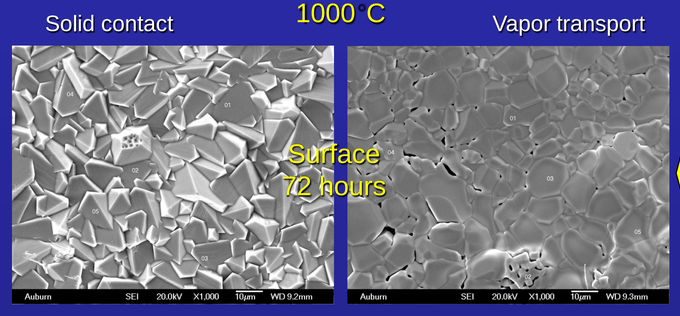
Composition
- Co content in reaction layer higher than in original spinel

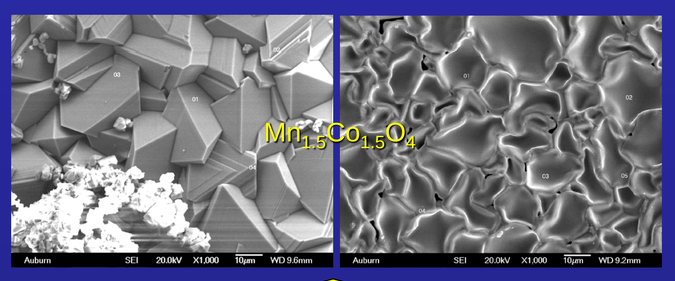


Surface
1200 °C
72 hours

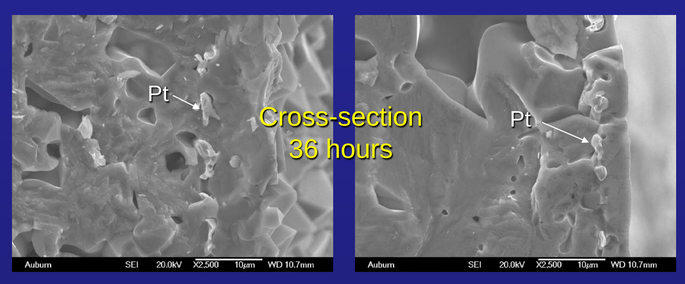


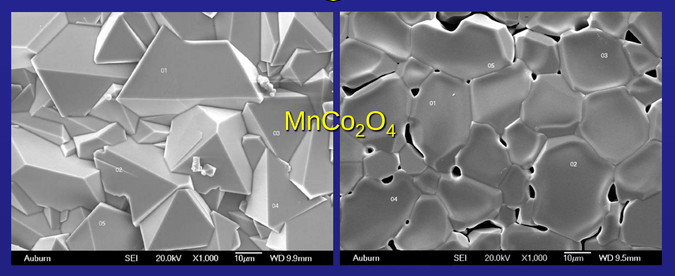
$Mn_{1.5}Co_{1.5}O_4$
1000 °C

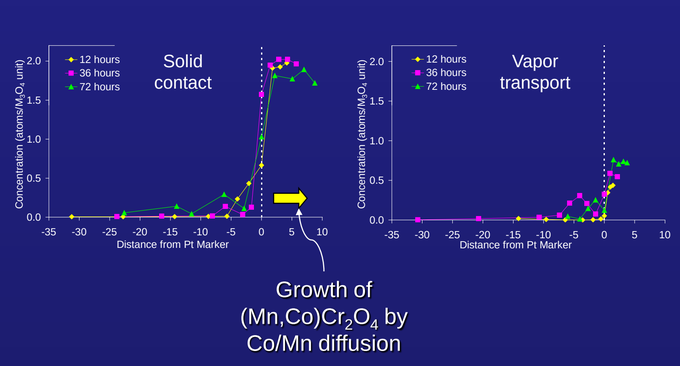


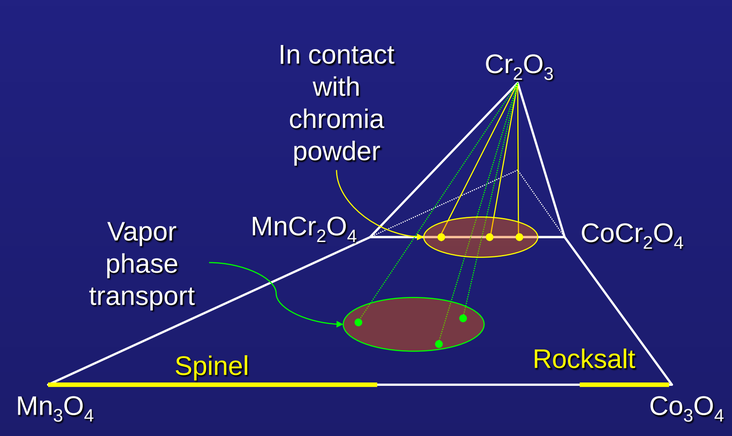


Pt marker









Future Plans

Lower temperature (IT-SOFC)
- Phase formation and growth mechanism
- Predict performance at long time through extrapolation

Effects of reaction on coating performance
- Prepare bulk analogues of reaction products
- Characterize properties
  - *e.g.* electrical conductivity (cell resistance), structure (ion transport), CTE (thermal stresses)

Participants

Auburn University
- Kangli Wang (postdoc)
- Yingjia Liu (Ph.D. student)

DOE
- Collaborators
  - -Gary Yang (PNNL)
  - -Jeff Stevenson (PNNL)
- Program Managers
  - -Tim Fitzsimmons (BES)
  - -Briggs White (NETL)