

# Degradation Breakout Session

Lakewood, CO

10/26/05

# Overarching Items

- Reaction
- Contamination
- Mass Transport
- Driving force differences
- Thermal cycling—transients (but linked to reasonable extremes)

- Seals: Glass-based—Crystallization (CTE, volume change), Interfacial reaction, electrical conductivity, volatility
- Interconnect—Phase transformations, oxidation, fuel effects, mechanical (creep), scale conductivity (CTE, stress, volatility)
- Cathode/IC contact zone: paste, coatings, delamination, mass transport, coarsening of paste
- Cathode: Cr poisoning, coarsening, overpotential as a driving force for
- Cathode/Electrolyte—potential-induced degradation, phase formation
- Anode: Ni Sintering,
- Thermal and environmental transients—

- Case study for protocols: Cr poisoning
  - 1) pre-oxidation or no? Does this even have an effect when it's coated??
  - 2) Geometry for gas phase
  - 3) GE/PNNL/ANL have pretty good protocols
  - 4) Cathode; chemistry, microstructure
  - 5) Characterized doser
- Possible Mechanisms:
  - Chemical reaction ( $\text{Mn}^{2+}$ , Cr reaction with LSM surface)
  - **e-chemical deposition**: one of the leading candidates
  - surface effects
  - microstructural changes
  - SOLUTION APPROACHES: Gas phase getter for Cr, Dwell at OCV, Change  $P_{\text{O}_2}$ ?

## Seal Stability

- 1) compound formation (internal and external)
- 2) mechanical stability (CET match, Modulus) (it all comes down to hermicity)
- 3) volatility

## Possible Action Items:

- Obtain input from industry
- From this, design non-proprietary structures for Core teams to test with
- Test Protocols for:
  - Tension, shear
  - Leak location
  - Heating/cooling rate effects (thermal profile).
  - Time at temperature

# Degradation Events Submitted

- Cathode/IC contact (5)
- Cathode/Contact Paste (3)
- Cathode/electrolyte interface (2)
- Ni coarsening in anode (4)
- Seal damage (thermal cycling/degradation/rextal) (7)
- Interconnect stability (1)

# Cathode/IC contact

- ASR as a function of time
  - need correct chemical boundary conditions--dual atmosphere?
  - Contact paste--LSM paste (for LSM/YSZ cathode)
- Contact Paste/IC and Contact Paste/Cathode
  - Is IC coated?