Abstract: Solid Oxide Cell Performance Degradation

Commercial solid oxide cells (SOCs) exhibit performance degradation for various operation modes: fuel cell, electrolysis, and reversible. Cation migration is a well-established mechanism related to performance degradation, so “barrier” layers are often employed to mitigate this migration and retain the desired composition for electrode particles.

Motivation: SDC Barrier Influence on Cation Migration

Utilize energy dispersive spectroscopy (EDS) in electron microscopes to track cation migration and particle decomposition in air electrodes as a function of long-term (>1,000 hr) operating conditions for commercial cells incorporating a Sm-doped ceria barrier (SDC) layer.

Cation Migration and LSCF/SDC Decomposition Related to Long-Term Operation Mode as Revealed by Electron Microscopy

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Fuel electrode

Air electrode

LSCF

SDC

SOFC

Sample preparation -- FEI NanoLab Focused Ion Beam (FIB) @ CMU
- 30 keV Ga+ beam ion milling, lift-out
- Site-specific analysis: all electrode/electrolyte interface

SEM

EDS Elemental Maps

Figure 1: Sample preparation

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