16th Annual July 14-16, 2015
SOLID OXIDE FUEL CELL WORKSHOP
Pittsburgh Airport Marriott Hotel
GENERAL SESSION - SALON A, B, C, AND D

7:30 - 9:00 a.m.  
Registration - SALON C FOYER  
Continental Breakfast - CORAOPOLIS, FINDLAY, AND MOON ROOMS

OPENING SESSION

9:00 - 9:05 a.m.  
Workshop Opening and Introduction  
Heather Quedenfeld, Director, Advanced Energy Systems Division,  
U.S. Department of Energy, National Energy Technology Laboratory

9:05 - 9:15 a.m.  
Welcoming Remarks  
Grace M. Bochenek, Ph.D., Director,  
U.S. Department of Energy, National Energy Technology Laboratory

9:15 - 9:45 a.m.  
National Energy Technology Laboratory’s Fuel Cell Program Overview  
Shailesh Vora, Technology Manager, Fuel Cells,  
U.S. Department of Energy, National Energy Technology Laboratory

9:45 - 10:15 a.m.  
BREAK - CORAOPOLIS, FINDLAY, AND MOON ROOMS

SOFC INDUSTRY TEAMS

MODERATOR: JOSEPH STOFFA, U.S. DEPARTMENT OF ENERGY, NATIONAL ENERGY TECHNOLOGY LABORATORY

10:15 - 12:00 p.m.  
Reliable SOFC Systems  

SOFC Power System Development  
Rick Kerr, Delphi

LG Fuel Cell Systems Program and Technology Update  

12:00 - 1:30 p.m.  
LUNCH - CORAOPOLIS, FINDLAY, AND MOON ROOMS

SOFC CORE PROJECTS: RELIABILITY, ROBUSTNESS, AND ENDURANCE

MODERATOR: PATCHARIN BURKE, U.S. DEPARTMENT OF ENERGY, NATIONAL ENERGY TECHNOLOGY LABORATORY

1:30 - 3:10 p.m.  
Mitigation of Cr Impurity Effects  
Srikanth Gopalan, Boston University

Materials and Approaches for the Mitigation of SOFC Cathode Degradation in SOFC Power Systems  
Prabhakar Singh, University of Connecticut

Long-Term Degradation of LSM-Based SOFC Cathodes: Use of a Proven Accelerated Test Regimen  
Mark R. De Guire, Case Western Reserve University

Advanced SOFC Quality Control and the Role of Manufacturing Defects on Stack Reliability  
Neil Fernandes, Acumentrics SOFC, Inc.

3:10 - 3:25 p.m.  
BREAK - CORAOPOLIS, FINDLAY, AND MOON ROOMS
TUESDAY, JULY 14TH

GENERAL SESSION - SALON A, B, C, AND D

ARPA-E REBELS PROJECTS: INTERMEDIATE TEMPERATURE FUEL CELLS FOR DISTRIBUTED GENERATION

3:25 - 4:40 p.m.

Reliable Electricity Based on Electrochemical Systems (REBELS): Program Overview

Low Temperature Solid Oxide Fuel Cells for Transformational Energy Conversion
Bryan Blackburn, Redox Power Systems

Nanocomposite Electrodes for a Solid Acid Fuel Cell Stack Operating on Reformate
Alex Papandrew, University of Tennessee

4:40 p.m.

ADJOURN

4:45 - 6:30 p.m.

POSTER SESSION/RECEPTION - CORAOPOLIS, FINDLAY, AND MOON ROOMS

WEDNESDAY, JULY 15TH

GENERAL SESSION - SALON A, B, C, AND D

7:00 - 8:00 a.m.

Registration - SALON C FOYER
Continental Breakfast - CORAOPOLIS, FINDLAY, AND MOON ROOMS

NATIONAL LABORATORIES

MODERATOR: BRIGGS WHITE, U.S. DEPARTMENT OF ENERGY, NATIONAL ENERGY TECHNOLOGY LABORATORY

8:00 - 10:30 a.m.

NETL R&D: SOFC Materials Development and Degradation Modeling
Kirk Gerdes, U.S. Department of Energy, National Energy Technology Laboratory

Durability and Reliability of Materials and Components for SOFCS: Measurement of Residual Stresses
Edgar Lara-Curzio, U.S. Department of Energy, Oak Ridge National Laboratory

Evaluation of Feedstock Materials for SOFC Performance Reliability
Brian Ingram, U.S. Department of Energy, Argonne National Laboratory

SOFC Development at PNNL: Overview
Jeff Stevenson, U.S. Department of Energy, Pacific Northwest National Laboratory

Integrating the PNNL SOFC Multi-Physics Model into the NETL Aspen System Model as a Reduced Order Model
Gregory A. Hackett, U.S. Department of Energy, National Energy Technology Laboratory

10:30 - 10:45 a.m.

BREAK - CORAOPOLIS, FINDLAY, AND MOON ROOMS
## DETAILED PROGRAM

### WEDNESDAY, JULY 15TH

**GENERAL SESSION - SALON A, B, C, AND D**

**SOFC Core Projects: Reliability, Robustness, and Endurance**

**Moderator: Briggs White, U.S. Department of Energy, National Energy Technology Laboratory**

<table>
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<tr>
<th>Time</th>
<th>Session</th>
<th>Presenters</th>
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<tr>
<td>10:45 -12:00 p.m.</td>
<td><strong>Durable, Impermeable Brazes for Solid Oxide Fuel Cells</strong> &lt;br&gt; Yue Qi, Michigan State University</td>
<td>Cost-Effective Manufacturing and Morphological Stabilization of Nanaostructured Cathodes for Commercial SOFCs &lt;br&gt; Tae-Sik Oh, University of Pennsylvania</td>
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<td>Development of Durable and High Performance Mixed Conducting Cathodes Supportive of Lower Cost SOFCs &lt;br&gt; Xiao-Dong Zhou, University of South Carolina</td>
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<td>12:00 - 1:30 p.m.</td>
<td><strong>LUNCH - CORAOPOLIS, FINDLAY, AND MOON ROOMS</strong></td>
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<td><strong>ARPA-E REBELS Projects: Intermediate Temperature Fuel Cells for Distributed Generation</strong> &lt;br&gt; <strong>Moderator: Seth Lawson, U.S. Department of Energy, National Energy Technology Laboratory</strong></td>
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<td>1:30 - 3:10 p.m.</td>
<td>Development of an Intermediate Temperature Proton Conducting SOFC Stack with Internal Fuel Reforming &lt;br&gt; Dave E. Tew, United Technologies Research Center</td>
<td>Low-Cost, Intermediate Temperature, Fuel-Flexible Protonic-Ceramic Fuel Cell and Stack &lt;br&gt; Jianhua Tong, Colorado School of Mines</td>
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<td>A Novel Intermediate Temperature Fuel Cell Tailored for Efficient Utilization of Methane &lt;br&gt; Meilin Liu, Georgia Tech</td>
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<td>Medium-Temperature, Oxygen-Conducting Fuel Cell Based on a Novel Membrane Structure &lt;br&gt; Ashish V. Pattekar, Palo Alto Research Center</td>
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<td>3:10 - 3:25 p.m.</td>
<td><strong>BREAK - CORAOPOLIS, FINDLAY, AND MOON ROOMS</strong></td>
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<td><strong>ARPA-E REBELS Projects: Load-Following Intermediate Temperature Fuel Cells</strong></td>
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<td>4:15 p.m.</td>
<td><strong>ADJOURN</strong></td>
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**DETAILED PROGRAM**

**THURSDAY, JULY 16TH**

**GENERAL SESSION - SALON A, B, C, AND D**

7:00 - 8:00 a.m.  
Registration - SALON C FOYER  
Continental Breakfast - CORAOPOLIS, FINDLAY, AND MOON ROOMS

**SOFC Core Projects: Reliability, Robustness, and Endurance**

**Moderator: Steve Markovich, U.S. Department of Energy, National Energy Technology Laboratory**

8:00 - 10:30 a.m.

**Fundamental Investigations and Rational Design of Durable, High-Performance Cathode Materials**  
Meilin Liu, Georgia Tech

**Mechanistic Enhancement of SOFC Cathode Durability**  
Eric Wachsman, University of Maryland

**Surface-Modified Electrodes: Enhancing Performance Guided by In Situ Spectroscopy and Microscopy**  
Michael Machala, Stanford University

**Enhancement of SOFC Cathode Electrochemical Performance Using Multi-Phase Interfaces**  
Dane Morgan, University of Wisconsin

**Novel Nanostructure Tailored Highly Active and Stable Electrocatalytic Architecture on Surface of Cathode of SOFCs**  
Xueyan Song, West Virginia University

**Scalable and Cost-Effective Barrier Layer Coating to Improve Performance and Stability of SOFC Cathode**  
Xingbo Liu, West Virginia University

10:30 - 10:45 a.m.  
**BREAK - CORAOPOLIS, FINDLAY, AND MOON ROOMS**

**ARPA-E REBELS Projects: Liquid Fuel-Producing Intermediate Temperature Fuel Cells**

10:45 - 12:00 p.m.

**Intermediate Temperature Electrogenerative Cells for Flexible Cogeneration of Power and Liquid Fuel**  
Greg Tao, Materials & Systems Research, Inc.

**Liquid Fuels and Electricity From Intermediate Temperature Fuel Cells**  

**Intermediate Temperature Hybrid Fuel Cell System for the Conversion of Natural Gas to Electricity and Liquid Fuels**  
Theodore Krause, U.S. Department of Energy, Argonne National Laboratory
12:00 - 1:30 p.m.  LUNCH - CORAOPOLIS, FINDLAY, AND MOON ROOMS

ARPA-E REBELS PROJECTS: LOAD FOLLOWING INTERMEDIATE TEMPERATURE FUEL CELLS AND SOFC PROJECTS
MODERATOR: PATCHARIN BURKE, U.S. DEPARTMENT OF ENERGY, NATIONAL ENERGY TECHNOLOGY LABORATORY

1:30 - 3:35 p.m.

A Bifunctional Ceramic Fuel Cell Energy System  
Kevin Huang, University of South Carolina

Intermediate Temperature Proton Conducting Fuel Cells for Transportation Applications  
S. (Elongo) Elangovan, Ceramatec, Inc.

Pressurized Testing of Solid Oxide Fuel Cells  
Louis G. Carreiro, Naval Undersea Warfare Center Division Newport

Scaling Up WATT Fuel Cell’s Additive Manufacturing Process (AMP) for Tubular SOFCs  
Benjamin J. Emley, WATT Fuel Cell Corporation

High Temperature Ceramic Heat Exchanger for Solid Oxide Fuel Cell  
James F. Walton II, Mohawk Innovative Technology, Inc.

3:35 p.m.  WORKSHOP CLOSES
La$_{2}$NiO$_{4+\delta}$-Infiltration to Improve both Performance and Stability of (La$_{0.6}$Sr$_{0.4}$)$_{0.995}$Co$_{0.2}$Fe$_{0.8}$O$_{3-\delta}$ Cathode for Solid Oxide Fuel Cells
Xinxin Zhang and Xingbo Liu, West Virginia University

Fundamental Investigations and Rational Design of Durable High-Performance SOFC Cathodes
Yu Chen, Georgia Institute of Technology

Effects of Steam on Long Term Performance of Metal Ferrite Infiltrated Solid Oxide Fuel Cell
Yueying “Lynn” Fan, AECOM

Degradation of LSM-Based SOFC Cathodes Under Accelerated Testing
Celeste Cooper and Mark R. De Guire, Case Western Reserve University

Large Scale, Homogeneous SOFC Cathode Infiltration by Single Step, Ultrasonic Spraying Process
Shiwoo Lee, AECOM

In-Operando XRD of LSM/YSZ Cathodes in Combined H$_2$O + CO$_2$ during 1000+ h SOFC Tests
John S. Hardy, Pacific Northwest National Laboratory

Mechanical Property of Cathode Contact Materials and Surface Texture Effect on Cathode Contact Strength of Solid Oxide Fuel Cells
Y-S Matt Chou, Pacific Northwest National Laboratory

Single-Step, Infiltrated Cathodes for SOFC
Yuan Cheng, University of Pennsylvania

Fluidized Bed Production of Surface Functionalized Powders for SOFC Cathodes
Nick M. Sbrockey, Structured Materials Industries, Inc.

Enhancement of SOFC Cathode Electrochemical Performance Using Multi-Phase Interfaces
Yueh-Lin Lee, Massachusetts Institute of Technology

Tailoring Infiltrate Particle Size Through Precursor Solution Desiccation or Nano-Ceria Preinfiltration
Theodore E. Burye, Michigan State University

Determining the Phase Stability and Oxygen Nonstoichiometry of Lanthanum Strontium Ferrite Structures by Combining Density Functional Theory and Thermodynamics
Tridip Das, Michigan State University

Oxygen Surface Exchange Measurements on Porous Lanthanum Strontium Ferrite Thick Films
Yuxi Ma, Michigan State University

Surface Modified LSCF Powders for SOFC Cathodes
Jeffrey F. Roeder, Sonata, LLC
POSTER SESSION

TUESDAY, JULY 14  4:45 - 6:30 P.M.

CORAOPOLIS, FINDLAY, AND MOON ROOMS

YSZ SOFC Interconnect Barriers via ALD  
Jeffrey F. Roeder, Sonata, LLC

Dip Coating Reactive Air Aluminization Process for SOFC Components  
Jung Pyung Choi, Pacific Northwest National Laboratory

Protective Ceramic Coatings for Solid Oxide Fuel Cell (SOFC) Balance-of-Plant Components  
Raymond Winter, InnoSense, LLC

Protective Coatings for Metallic Components in Solid Oxide Fuel Cell Systems  
Chris Corwin, NexTech Materials, Ltd. and Robin Kimbrell, Fuelcellmaterials.com

Cost-Effective Dense YSZ Coatings for SOFC Interconnects  
Cheol-Woon Kim, MO-SCI Corporation

An Alkali-Free Barium Borosilicate Viscous Sealing Glass for Solid Oxide Fuel Cells  
Cheol-Woon Kim, MO-SCI Corporation

Durability and Reliability of SOFC Materials and Components  
Edgar Lara-Curzio, Oak Ridge National Laboratory

A Discrete Element Model for Toughness of Rough Interfaces  
Brian J. Koeppel, Pacific Northwest National Laboratory

Reduced Order Model Creation for SOFC Power System Models  
Kevin Lai, Pacific Northwest National Laboratory

Prediction of SOFC Performance via Multi-Physics Simulation Tool with Realistic Microstructure Properties  
Tao Yang, West Virginia University

High Temperature Ceramic Heat Exchanger for Solid Oxide Fuel Cell  
Jose Luis Cordova and James F Walton II, Mohawk Innovative Technology, Inc.

Intermediate-Temperature Fuel Cells Tailored for Efficient Utilization of Methane  
Ben Rainwater, Georgia Institute of Technology
Advanced Materials and Manufacturing Processes for MW-Scale SOFC Power Systems for Improved Stack Reliability, Durability, and Cost  

Innovative SOFC Technologies  

High Power, Low Cost SOFC Stacks for Robust and Reliable Distributed Generation  
*Bryan Blackburn*, Redox Power Systems

In-Operando Evaluation of SOFC Cathodes for Enhanced ORR Activity and Durability  
*Eric Wachsman*, University of Maryland

Low-Cost, Durable, Contaminant-Tolerant Cathodes for SOFCs  
*Yu Chen*, Georgia Institute of Technology

Environmentally-Assisted Reactive Sintering of Spinel Layers for SOFC Cathode-Side Contact Application  
*Jiahong Zhu*, Tennessee Technological University

Developing Accelerated Test Protocols and Tuning Microstructures of the Common Materials to Improve Robustness, Reliability, and Endurance of SOFC Cells  
*Xiao-Dong Zhou*, University of South Carolina

Scalable Nano-Scaffold Architecture on the Internal Surface of SOFC Anode for Direct Hydrocarbon Utilization  
*Xueyan Song*, West Virginia University

LSCF-CDZ Composite Cathodes for Improved SOFC Electrical Performance  
*Gianfranco DiGiuseppe*, Kettering University

Investigating Oxygen Exchange Kinetics on Model SOFC Electrodes Using In Situ Optical Transmission Relaxation  
*Sean Bishop*, Massachusetts Institute of Technology

Matrix Study of Aged Cells: Performance and Materials Degradation  
*Neil Fernandes*, Acumentrics SOFC, Inc.

Processing of SOFC Anodes for Enhanced Intermediate Temperature Catalytic Activity at High Fuel Utilization  
*Soumendra Basu*, Boston University
Advanced Materials and Manufacturing Processes for MW-Scale SOFC Power Systems for Improved Stack Reliability, Durability, and Cost
Charles Osborne, LG Fuel Cell Systems, Inc.

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High Power, Low Cost SOFC Stacks for Robust and Reliable Distributed Generation
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