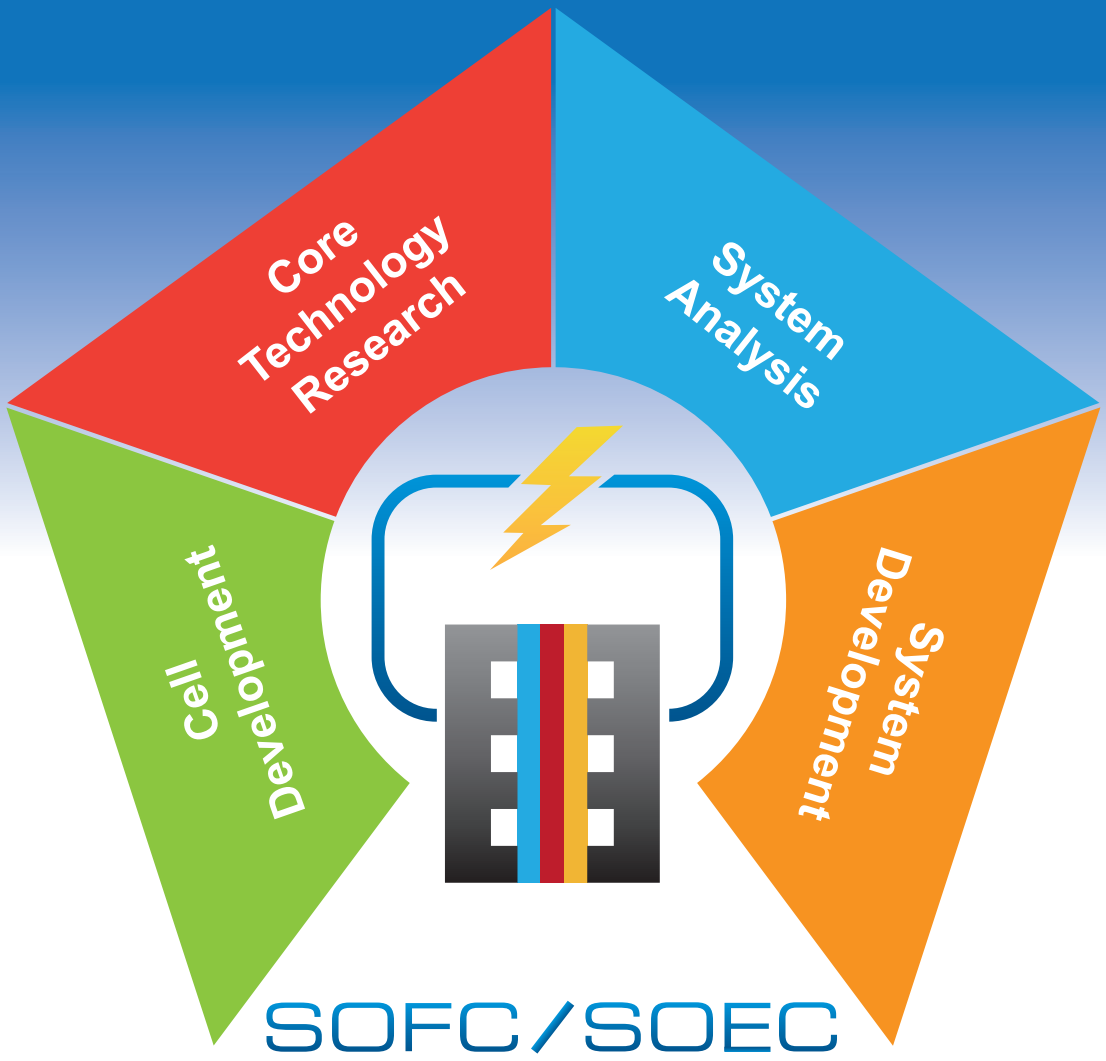


23rd Annual

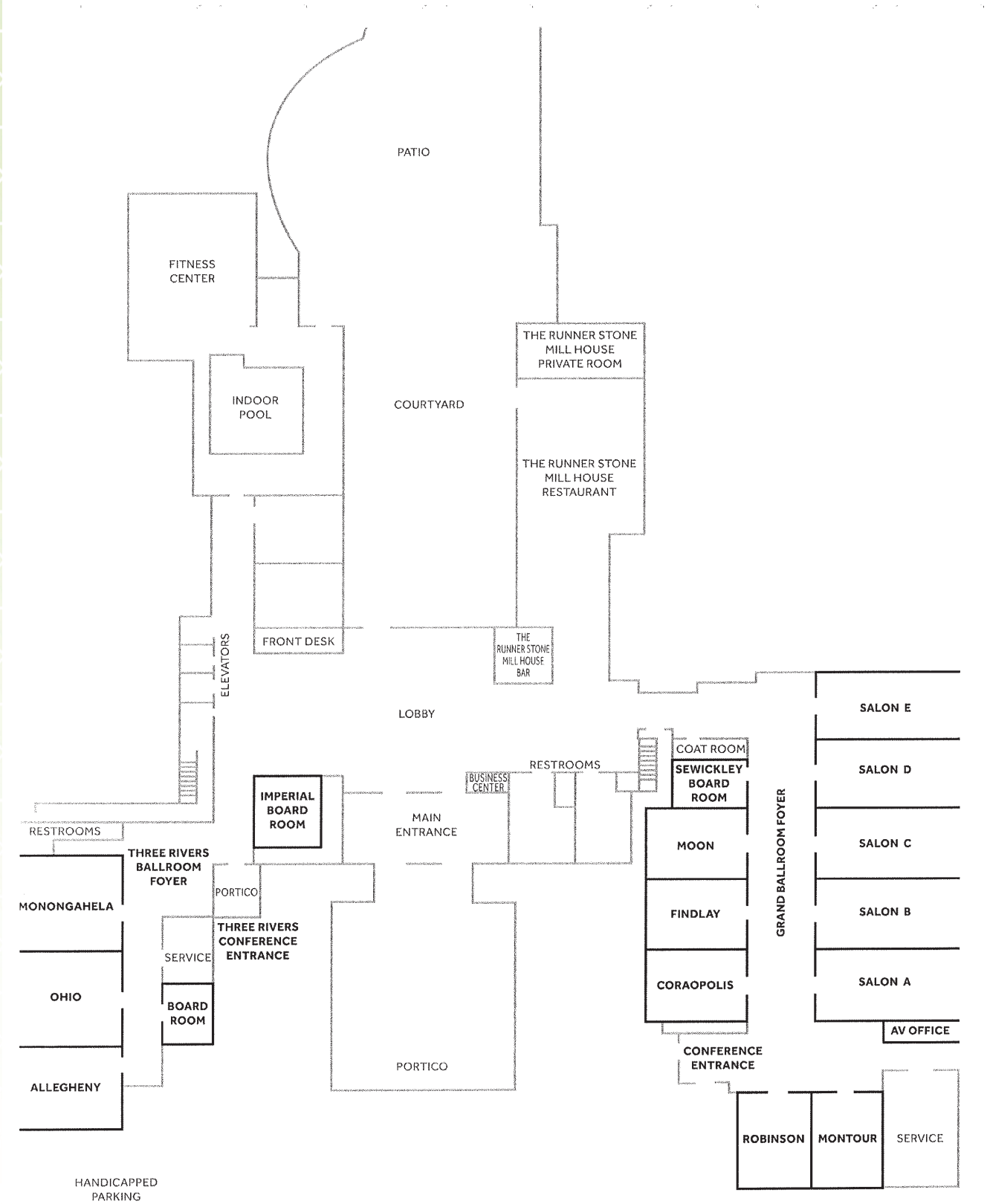
October 25-27, 2022

Solid Oxide Fuel Cell Project Review Meeting

Pittsburgh Airport Marriott Hotel

U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

Pittsburgh Airport Marriott Hotel Floor Plan



Day 1 - Tuesday, October 25, 2022 - Grand Ballroom

8:00 AM **Registration and Full Breakfast - Salon D & E**

9:00 AM **Welcome and Introduction**
Shailesh Vora, SOFC Technology Manager, National Energy Technology Laboratory, U.S. Department of Energy

9:05 AM **SOFC Program Overview**
Shailesh Vora, SOFC Technology Manager, National Energy Technology Laboratory, U.S. Department of Energy

Moderator: **Patcharin Burke, National Energy Technology Laboratory**

9:35 AM **Progress in SOFC Technology Development at FuelCell Energy** (FE31648, FE31639)
Ghezel-Ayagh Hossein, FuelCell Energy

10:05 AM **BREAK**

10:25 AM **Next Generation Durable, Cost Effective, Energy Efficient Tubular Solid Oxide Fuel Cell** (FE31674)
Theodore Ohrn, Special Power Sources, LLC

10:55 AM **SOFC Performance and Durability using Commercially Viable Coal-Derived Syngas** (DE-FE0031977 and DE-FE0024233-5.1)
Zhien Liu, University of North Dakota's Energy and Environmental Research Center (UNDEERC)

11:25 PM **Improving Cost and Efficiency of the Scalable Solid Oxide Fuel Cells Power System** (FE31941)
Lars Henrichsen, Cummins, Inc.

11: 55 AM **LUNCH - Salon D & E**

Moderator: **Drew O'Connell, National Energy Technology Laboratory**

1:30 PM **Low Cost Solid Oxide Fuel Cells for Small-Scale Distributed Power Generation** (FE31976)
Bryan Blackburn, Redox Power Systems, LLC

2:00 PM **Modular Fuel Cells Providing Resiliency to Data Centers and Other Critical Power Users** (FE31978)
Dan Connors, Aris Energy Solutions, LLC

2:30 PM **Low Cost, Large Area SOEC Stack for H_2 & Chemicals** (FWP-77108)
Olga Marina, Pacific Northwest National Laboratory

3:00 PM **BREAK**

Moderator: **Debalina Dasgupta, National Energy Technology Laboratory**

3:20 PM **Performance Validation of a Thermally Integrated 50 kW High Temperature Electrolyzer System** (FWP-B600-20-04)
Tyler Westover, Battelle Energy Alliance, LLC (Idaho National Laboratory)

3:50 PM **Reactivation of Chromia Poisoned SOFC Cathodes by Controlled Surface Acidity** (FE31668)
Harry Tuller, Massachusetts Institute of Technology

4:20 PM **ADJOURN**

4:30 PM–6:00 PM **POSTER SESSION/RECEPTION - Junior Ballroom**

Day 2 - Wednesday, October 26, 2022 - Grand Ballroom

8:00 AM **Registration and Full Breakfast - Salon D & E**

Moderator: **Debalina Dasgupta, National Energy Technology Laboratory**

9:00 AM **Reversible Solid Oxide Cell Degradation Characterization, Simulation, and Mitigation** (FWP1022411)
Harry Abernathy, National Energy Technology Laboratory

9:30 AM **Enabling Solid Oxide Fuel Cells for Integrated Energy Systems** (FWP1022460)
Sam Bayham, National Energy Technology Laboratory

10:00 AM **Performance Improvements for Reversible Solid Oxide Fuel Cell Systems** (FE31974 and FE32032)
Hossein Ghezel-Ayagh, FuelCell Energy, Inc. (FCE)

10:30 AM **BREAK**

Moderator: **Drew O'Connell, National Energy Technology Laboratory**

10:50 AM **Reversible Solid Oxide Fuel Cell (SOFC) and Solid Oxide Electrolysis Cell (SOEC) Stacks Based on Stable Rare-Earth Nickelate Oxygen Electrodes** (FE31972)
John Pietras, Saint-Gobain Ceramic Materials

11:20 AM **A Highly Efficient and Affordable Hybrid System for Hydrogen and Electricity Production** (FE31975)
Junsung Hong, Phillips 66 Company

11:50 AM **Progress on Reversible Solid Oxide Cell, Stack, and System Technologies** (FE31986)
Samuel Horlick, Nexceris, LLC

12:20 PM **LUNCH - Salon D & E**

Moderator: **Sarah Michalik, National Energy Technology Laboratory**

1:30 PM **Improving Durability and Performance of Solid Oxide Electrolyzers by Controlling Surface Composition on Oxygen Electrodes** (FE32102)
Bilge Yildiz, Massachusetts Institute of Technology

2:00 PM **Cummins Reversible-Solid Oxide Fuel Cell System Development** (FE31971)
Lars Henrichsen, Cummins, Inc.

2:30 PM **BREAK**

Moderator: **Evelyn Lopez, National Energy Technology Laboratory**

2:50 PM **Efficient, Reliable and Cost-Effective Reversible Solid Oxide Fuel Cell Technology for Hydrogen and Electricity Production** (FE31940, FE32107)
Nguyen Minh, The Regents of the Univ. of Calif., UC San Diego

3:20 PM **Development of Stable Solid Oxide Electrolysis Cell for Low-Cost Hydrogen Production** (FE32105)
Elango Elangovan, OxEon Energy, LLC

3:50 PM **ADJOURN**

Day 3 - Thursday, October 27, 2022 - Grand Ballroom

8:00 AM **Registration and Full Breakfast - Salon D & E**

Moderator: **Diane Revay Madden, National Energy Technology Laboratory**

9:00 AM **Designing Internal Surfaces of Porous Electrodes in Solid Oxide Electrolysis Cells for Highly Efficient and Durable Hydrogen Production** (FE32112)
Xueyan Song, West Virginia University Research Corporation

9:30 AM **Development and Understanding of High-Performance Solid Oxide Electrolysis Cells** (FE32110)
Xiao-Dong Zhou, University of Louisiana at Lafayette

10:00 AM **Durable and High-Performance SOECs Based on Proton Conductors for Hydrogen Production** (FE32115)
Meilin Liu, Georgia Tech Research Corporation

10:30 AM **BREAK**

Moderator: **Sarah Michalik, National Energy Technology Laboratory**

10:50 AM **Developing Stable Critical Materials and Microstructure for High-Flux and Efficient Hydrogen Production through Reversible Solid Oxide Cells** (FE32111)
Kevin Huang, University of South Carolina

11:20 AM **Heterostructured Chromium Resistant Oxygen Electrode for Solid Oxide Electrolysis Cells** (FE32116)
Yu Zhong, Worcester Polytechnic Institute

11:50 AM **Additive Manufacturing of Centrifugal Impellers for SOFC Anode Recycle Blowers** (SC20793)
Jose Luis Cordova, Mohawk Innovative Technology, Inc.

12:20 PM **LUNCH - Salon D & E**

Moderator: **Evelyn Lopez, National Energy Technology Laboratory**

1:30 PM **Multi-Constituent Airborne Contaminants Capture with Low Cost Oxide Getters and Mitigation of Cathode Poisoning in Solid Oxide Fuel Cells** (FE31647)
Prabhakar Singh, University of Connecticut

2:00 PM **High-Performance Circuit Pastes for Solid Oxide Fuel Cell Applications** (FE31672)
Jason Nicholas, Michigan State University

2:30 PM **Aluminization Coatings and Glass Seals for a High Temperature Hydrogen Reactor** (TCF-21-25024)
John Hardy, Pacific Northwest National Laboratory

3:00 PM **Roll-to-Roll Manufacturing of Solid Oxide Fuel Cells** (TCF-20-20119)
Jianlin Li, Oak Ridge National Laboratory

3:30 PM **ADJOURN**

Poster Session

Unconventional Highly Active and Stable Oxygen Reduction Catalysts Informed by Computational Design Strategies
Jian Liu[1], Ryan Jacobs[1,2], Bo Guan[1,3], Tao Yang[1,3], Richard Pineault[1], Gregory Hackett[1], Thomas Kalapos[1,3], Harry Abernathy[1], Dane Morgan[2]
[1] DOE National Energy Technology Laboratory, 3610 Collins Ferry Road, Morgantown, WV 26507, USA
[2] Department of Materials Science and Engineering, University of Wisconsin- Madison, Madison, WI, USA
[3] NETL Support Contractor, 3610 Collins Ferry Road, Morgantown, WV 26507, USA

Improving Durability and Performance of Solid Oxide Electrolyzers by Controlling Surface Composition on Oxygen Electrodes
Filip Grajkowski,[1] Sophie Coppieters 't Wallant,[2] Bill Liu,[2] Olga Marina,[3]
Lorraine Seymour,[3] Bilge Yildiz[2,4*]
[1]Department of Chemistry, Massachusetts Institute of Technology
[2]Department of Materials Science and Engineering, Massachusetts Institute of Technology
[3]Pacific Northwest National Laboratory
[4]Department of Nuclear Science and Engineering, Massachusetts Institute of Technology

Development of Oil Free Centrifugal Blower as Enabling Technology for Solid Oxide Fuel Cell Anode Gas Recycling
Rochelle S. Wooding and José Luis Córdova,, Mohawk Innovative Technology, Inc.

Additive Manufacturing of Impellers for High Temperature Anode Recycle Blower for Solid Oxide Fuel Cell
José Luis Córdova* & Rochelle S. Wooding
Mohawk Innovative Technology, Inc. (MiTi®)

Rapid Assessment of SOC Electrode Degradation Using Computer Vision and Machine Learning
William K Epting,[1,*] Yinkai Lei, [1,2] Jerry H. Mason, [1,2] Thomas Kalapos, [1,2] Gregory A Hackett,[1] Harry Abernathy[1]
[1] National Energy Technology Laboratory, Pittsburgh, PA / Morgantown, WV / Albany, OR
[2] NETL Support Contractor, Pittsburgh, PA / Morgantown, WV / Albany, OR

Nanoparticles Infiltration in Air Electrode of LSM-YSZ/YSZ/Ni-YSZ Cells to Improve Performance and Mitigate Performance Degradation under Reversible SOFC/SOEC Operation
Yueying Fan[1, 2], Harry Abernathy[1, 2], Richard Pineault[1], Yun Chen[1, 3], Xueyan Song[1, 3], Rick Addis[1, 3], Greg Hackett[1], Thomas Kalapos[1, 2]
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[2] Leidos Research Support Team, DOE National Energy Technology Laboratory, Morgantown, WV 26507, USA
[3] Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV 26506, USA

Atomic Layer Deposition of Nickel Anchor to Prevent SOEC Degradation
Katherine Hansen, Oleg Maksimov, John M. Vohs, and Harish Bandari
Radiation Monitoring Devices (RMD) Inc.

High Temperature Glass Seal Development for Tubular Cells
Y-S Chou, J-Y Kim, J-P Choi, and J. Hardy
Pacific Northwest National Laboratory

Reactive Air Aluminization (RAA) Application Study for High-Temperature Hydrogen Reactor
Jung Pyung Choi and John Hardy
Pacific Northwest National Laboratory

Design and Validation of Steam Ejector in R-SOFC System using Fully Automated CFD Based Optimization Workflow
Nikhil Ajotikar and Lars Henrichsen, Cummins, Inc.

Obtaining Electrokinetic Data of Oxygen Electrodes in Solid Oxide Cells
Yeting Wen, Jiaxin Lu and Kevin Huang
Department of Mechanical Engineering, South Carolina SmartState Center for Solid Oxide Fuel Cells, University of South Carolina, Columbia, SC29201

Effect of Microstructural Variability and Operating Condition on Cr-poisoning in Solid Oxide Fuel Cell Cathode Using HPC Simulations
Hokon Kim[1,2], William K. Epting[3,4], Harry W. Abernathy[5,6], Gregory A. Hackett[5], Anthony D. Rollett[1,2], and Paul A. Salvador[*,1,2]
[1] U.S. DOE National Energy Technology Laboratory, Pittsburgh, PA, USA
[2] Carnegie Mellon University, Materials Science and Engineering, Pittsburgh, PA, USA
[3] U.S. DOE National Energy Technology Laboratory, Albany, OR, USA
[4] NETL Support Contractor, 1450 Queen Avenue SW, Albany, OR 97321, USA
[5] U.S. DOE National Energy Technology Laboratory, Morgantown, WV, USA
[6] NETL Support Contractor, 3610 Collins Ferry Road, Morgantown, WV 26507, USA

Morphology Control of LSCF Powders and Reliable Lab-Scale Evaluation for Enhanced SOFCs Electrode Performance
Jae Jin Kim,[a] Anh D. Vu,[a] Donald C. Cronauer,[b] John D. Carter,[a] Victor A. Maroni,[a] Adam S. Hock,[c,d] Brian J. Ingram[a]
[a] Chemical Sciences and Engineering Division, [b] Applied Materials Division, [c] Materials Science Division, Argonne National Laboratory, 9700 S. Cass Ave., Lemont, IL 60439, USA.
[d] Department of Chemistry, Illinois Institute of Technology, 3101 South Dearborn Street, Chicago, IL 60616, USA.

Modeling Ni Redistribution in the Fuel Electrode of Solid Oxide Cells
Yinkai Lei[a,b], Yueh-Lin Lee[a,b], William K. Epting[a], Jerry H. Mason[a,b], Tian-Le Cheng[a,b], Harry Abernathy[a], Gregory Hackett[a], and You-Hai Wen[a]
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[b]NETL Support Contractor, Albany OR/Morgantown WV/Pittsburgh PA

Defect Thermodynamics and Transport Properties of Proton Conducting Oxide $BaZr_{1-x}Y_xO_{3-\delta}$ ($x \leq 0.1$) Evaluated Based on Density Functional Theory Model
Yueh-Lin Lee[a,b], Yuhua Duan[a], Dan C. Sorescu[a], Wissam A. Saidi[a], Dane Morgan[c], Thomas, Kalapos[a,b], William T. Epting[a], Gregory Hackett[a], and Harry Abernathy[a]
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Development of Proton Conducting Electrolytes with Enhanced Performance and Stability for Reversible Solid Oxide Cells
Zheyu Luo, Yucun Zhou, Xueyu Hu, and Meilin Liu
Georgia Institute of Technology

Air Electrode Interlayer for Proton Conductor Based Solid Oxide Cells
Byunghyun Min, Junsung Hong, Sarah Bushyhead, and Ying Liu
Phillips 66 Company

Surface Energies of $LaMnO_3$ High-Index Surfaces Obtained from Density-Functional Theory
Yves A. Mantz[1] and Yueh-Lin Lee[2,3]
[1] U.S. Department of Energy, National Energy Technology Laboratory, 3610 Collins Ferry Road, Morgantown, West Virginia 26507
[2] U.S. Department of Energy, National Energy Technology Laboratory, 626 Cochrans Mill Road, Pittsburgh, Pennsylvania 15236
[3] NETL Support Contractor, 626 Cochrans Mill Road, Pittsburgh, Pennsylvania 15236

Multi-Physics Modeling for Identification of Critical Factors in Solid Oxide CO_2-Steam Co-Electrolysis System Performances and Durability
Dewei Wang, Jie Bao*, Christopher Coyle, Olga Marina
Pacific Northwest National Laboratory, Richland, WA, USA

Development of Novel 3D Cell Structure and Manufacturing Processes for Highly Efficient, Durable and Redox Resistant Solid Oxide Electrolysis Cells
Nguyen Minh, University of California San Diego

Strong, Electrically-Conductive Silver-Based Braze Joints & Electrical Contacts Between Chromia- and/or Alumina-Protected Stainless-Steel
Genzhi Hu and Jason D. Nicholas
Michigan State University, Chemical Engineering and Materials Science Department

Development of Durable, Cost-effective, and Efficient Tubular Solid Oxide Fuel Cell
Hsiang-Jen (Jason) Wang[1], Xueyan Song[2], Joe Deering[1], Cris Debellis[1], Ted Ohrn[1]
[1] Special Power Sources, Alliance, OH 44601
[2] West Virginia University, Department of Mechanical and Aerospace Engineering, Morgantown, WV 26505

Multi-Constituent Airborne Contaminants Capture with Low-Cost Oxide Getters and Mitigation of Cathode Poisoning in Solid Oxide Fuel Cell
Pawan Dubey, Kevin Lee, Michael Reisert, Seraphim Belko and Prabhakar Singh
University of Connecticut, Storrs, CT

Carbon-Free and Electrochemically Active High-Entropy Alloy (HEA) Anode for SOFC Applications
Kevin X. Lee, Pawan K. Dubey, M. R. Anisur, Seraphim Belko, Rabi Bhattacharya[1], Prabhakar Singh
Department of Materials Science and Engineering, University of Connecticut, Storrs, CT
[1] UES Inc., Dayton OH

Sr Surface Segregation & Grain Boundary Degradation of LSCF/SDC Oxygen Electrode Operated in Both Fuel Cell and Electrolysis Mode
Yun Chen, [a,b] Yueying Fan, [a,c] Harry Abernathy, [a] Gregory Hackett, [a] Xueyan Song [a,b]
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[b] Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown,.
[c] Leidos Research Support Team, National Energy Technology Laboratory, Morgantown, WV

Reversible Solid Oxide Cell and Stack Technology
Taylor Cochran, Nexceris, LLC

Computationally Guided Design of MULTIPLE Impurities Tolerant Electrode
Rui Wang[a], Lucas R. Parent[b], Srikanth Gopalan[c], Yu Zhong[a,*]
[a]Mechanical and Materials Engineering Department, Worcester Polytechnic Institute
[b]Innovation Partnership Building, the University of Connecticut, Storrs, CT 06269, USA
[c]Division of Materials Science & Engineering, Boston University, MA 02215, USA

Commercially Available SOFCs Performance and Durability Using Coal-Derived Syngas
Jivan Thakare[1], Alireza Karimaghaloo[1], Jasmine Oleksik[1], Chad Wocken[1*], Harry Abernathy[2], Jerry Mason[2,3], Tao Yang[2,3], and Yu Zhong[2,4]
[1] University of North Dakota Energy & Environmental Research Center
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[4] Worcester Polytechnic Institute, Worcester, MA 01609

Solid Oxide Fuel Cell Test Center (SOFCtc) Development and Demonstration
John A. Brunner, Jivan Thakare, Michael E. Collings, Alireza Karimaghaloo, and Chad A. Wocken*
University of North Dakota Energy & Environmental Research Center

A Systematical Ab Initio Study of Diffusivity and Ionic Conductivity of $Ln_2NiO_{4+\delta}$ (Ln=La, Nd, Pr) Solid Oxide Fuel Cells (SOFCs)

Songge Yang[1], Guangchen Liu[1], Yueh-Lin Lee[2], Yu Zhong[1*]
[1]Department of Material Science and Engineering, Worcester Polytechnic Institute
[2]National Energy Technology Laboratory, 626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, Pennsylvania 15236-0940, USA

Numerical Study to Optimize the Microstructure of an LSM/YSZ Backbone for Nanoparticle Infiltration

Tao Yang[a,b], Bo Guan[a,b], Jian Liu[a], Yueying Fan[a,b], Harry Finklea[a,c], Willam K. Epting[a], Harry W. Abernathy[a], Gregory A. Hackett[a], Thomas L. Kalapos[a,b]
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[c]Eugene Bennett Department of Chemistry, West Virginia University, Morgantown, WV 26506, USA

Exploring the Microstructure-Performance Behaviors of Reversible Solid Oxide Fuel Cells

Jillian R. Mulligan[1], Ayesha Akter[1], John-In Lee[1], Srikanth Gopalan[1,2], Uday B. Pal[1,2], John Pietras[3], Soumendra N. Basu[1,2,4]
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[3]Saint-Gobain Research North America, Northborough, MA 01532, USA
[4]Photonics Center, Boston University, Boston, MA 02215, USA

Additive Manufacturing of Anode-Supported SOFCs through Aerosol Deposition

J. Tenney[a], E. Sabolsky[a], K. Sabolsky[a], E. Helgeson[a], J. Conte[a], H. Abernathy[b]
[a]West Virginia University
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