



William Chueh

Associate Professor of Materials Science and Engineering and Senior Fellow at the Precourt Institute for Energy

CONTACT INFORMATION

- **Administrator**

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Bio

BIO

The availability of low-cost but intermittent renewable electricity (e.g., derived from solar and wind) underscores the grand challenge to store and dispatch energy so that it is available when and where it is needed. Redox-active materials promise the efficient transformation between electrical, chemical, and thermal energy, and are at the heart of carbon-neutral energy cycles. Understanding design rules that govern materials chemistry and architecture holds the key towards rationally optimizing technologies such as batteries, fuel cells, electrolyzers, and novel thermodynamic cycles. Electrochemical and chemical reactions involved in these technologies span diverse length and time scales, ranging from Ångströms to meters and from picoseconds to years. As such, establishing a unified, predictive framework has been a major challenge. The central question unifying our research is: “can we understand and engineer redox reactions at the levels of electrons, ions, molecules, particles and devices using a bottom-up approach?” Our approach integrates novel synthesis, fabrication, characterization, modeling and analytics to understand molecular pathways and interfacial structure, and to bridge fundamentals to energy storage and conversion technologies by establishing new design rules.

ACADEMIC APPOINTMENTS

- Associate Professor, Materials Science and Engineering
- Senior Fellow, Precourt Institute for Energy
- Principal Investigator, Stanford Institute for Materials and Energy Sciences

ADMINISTRATIVE APPOINTMENTS

- Faculty Director Energy Innovation and Emerging Technologies Program, Stanford University, (2018- present)
- Faculty Co-Director of Storage-X Initiative, Stanford University, (2018- present)

HONORS AND AWARDS

- Outstanding Young Investigator Award, Materials Research Society (2018)
- Science Award Electrochemistry, BASF/Volkswagen (2016)
- Camille Dreyfus Teacher-Scholar Award, Camille Dreyfus Foundation (2016)
- Alfred P. Sloan Research Fellowship in Chemistry, Alfred P. Sloan Foundation (2016)
- CAREER Award, National Science Foundation (2015)

- Young Scientist Award, International Society for Solid State Ionics (2013)
- Top 35 innovators under the age of 35, MIT Technology Review (2012)
- Professor of the Year Teaching Award, Stanford Society of Women Engineers (2013)
- Demetriades-Tsafka-Kokkalis Prize in Energy, Caltech (2011)
- President Harry S. Truman Distinguished Postdoctoral Fellowship, Sandia National Laboratories (2010)
- Graduate Student Award, American Vacuum Society Thin Film Division (2009)
- Josephine de Karman Fellowship, Josephine De Karman Fellowship Trust (2009)
- Graduate Excellence in Materials Science Diamond Award, American Ceramics Society (2008)

PROFESSIONAL EDUCATION

- PhD, Caltech , Materials Science (2010)
- BS, Caltech , Applied Physics (2005)

LINKS

- The Chueh Group: <http://chuehlab.stanford.edu>
- Stanford Energy Professional Certificate Program: <https://scpd.stanford.edu/public/category/courseCategoryCertificateProfile.do?method=load&certificateId=13886655>

Teaching

COURSES

2021-22

- Thermodynamic Evaluation of Green Energy Technologies: MATSCI 144 (Spr)

2020-21

- Defects in Crystalline Solids: MATSCI 196, MATSCI 206 (Win)
- Thermodynamic Evaluation of Green Energy Technologies: MATSCI 144 (Spr)

2019-20

- Defects in Crystalline Solids: MATSCI 196, MATSCI 206 (Win)
- Principles, Materials and Devices of Batteries: MATSCI 303 (Aut)
- Thermodynamic Evaluation of Green Energy Technologies: MATSCI 144 (Spr)

2018-19

- Defects in Crystalline Solids: MATSCI 196, MATSCI 206 (Win)
- Principles, Materials and Devices of Batteries: MATSCI 303 (Aut)
- Thermodynamic Evaluation of Green Energy Technologies: MATSCI 144 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Anthony Bombik, Josh Rabinowitz, Jimmy Rojas, Hansen Wang

Postdoctoral Faculty Sponsor

Zhelong Jiang, Stephen Kang, Jimmy Kuo, Junghwa Lee, Kipil Lim, Xin Xu, Che-Ning Yeh

Doctoral Dissertation Advisor (AC)

Iwnetim Abate, Eddie Barks, Grace Busse, Evan Carlson, Sofia Catalina, Peter Csernica, Xiao Cui, Ana De La Fuente Duran, Dean Deng, Devi Ganapathi, Norman Jin, Emma Kaeli (she/her), Nidhi Kapate, Robert Kasse, Vivek Lam, Allen Yu-Lun Liang, Geoff McConohy, Aadith Moorthy, Emily Penn, Hari Ramachandran, Justin Rose, Harry Thaman, Jianbo Wang, Sunny Wang

Orals Evaluator

Jinwei Xu

Doctoral Dissertation Co-Advisor (AC)

Andrew Lee, Philipp Muscher, Swati Narasimhan, Jinwon Oh, Jihan Zhuang

Doctoral (Program)

Jaime Avilés Acosta, Evan Carlson, Devi Ganapathi, Robert Kasse, Swati Narasimhan

Postdoctoral Research Mentor

Zhelong Jiang, Jimmy Kuo, Junghwa Lee, Adam Marks, Che-Ning Yeh

Publications

PUBLICATIONS

- **Semiconductor/Mixed Ion & Electron Conductor Heterojunction for Elevated-Temperature Water Splitting.** *Phys. Chem. Chem. Phys.*
Ye, X., Melas-Kyriazi, J., Feng, Z., A., Melosh, N., A., Chueh, W., C.
2013; 15: 15459-15469
- **Determination of the Surface Structure of CeO₂(111) by Low-Energy Electron Diffraction.** *J. Chem. Phys.*
Siegel, D., Chueh, W., C., Gabaly, F., El, McCarty, K., Figuerera, J., de la, Blanco-Rey, M.
2013; 139: 114703
- **Sr- and Mn-doped LaAlO₃ for Solar Thermochemical H₂ and CO Production.** *Energy Environ. Sci.*
McDaniel, A., H., Miller, E., Arfin, D., Ambrosini, A., Coker, E., O'Hayre, R., Chueh, W. C.
2013; 6: 2424-2428
- **Identifying Electrochemical Intermediate Species in H₂ Redox Reactions on Solid-State Electrolytes.** *Chem. Comm.*
Gabaly, F., El, McDaniel, A., H., Grass, M., E., Chueh, W., C., Bluhm, H., Liu, Z.
2012; 48: 8338-8340
- **Ionic and Electronic Conductivity of Nanostructured, Samaria-Doped Ceria.** *J. Electrochem. Soc.*
Souza, E., C. C., Chueh, W., C., Jung, W., Muccillo, E., N. S., Haile, S., M.
2012; 159: K127-K135
- **Electrochemistry of Mixed Oxygen Ion & Electron Conducting Electrodes in Solid Electrolyte Cells.** *Annu. Rev. Chem. Biomol. Eng.*
Chueh, W., C., Haile, S., M.
2012; 3: 313-341
- **High Stability and Reactivity of Ce³⁺ on Doped CeO₂ Surface Revealed In operando.** *Chem. Mater.*
Chueh, W., C., McDaniel, A., H., Grass, M., E., Hao, Y., Jaibeen, N., Liu, Z.
2012; 24: 1876-1882
- **Experimental Determination of Transmittance of Porous Cerium Oxide Media in the Spectral Range 300 – 1,100 nm.** *Exp. Heat Transfer*
Lang, Z., Chueh, W., C., Ganesan, K., Haile, S., M., Lipinski, W.
2011; 24: 285-299
- **Decoupling Surface Reaction & Bulk Transport in Mixed Conductors with Electrochemically-Active Surfaces: A 2-D Numerical Study of Ceria.** *Phys. Chem. Chem. Phys.*
Ciucci, F., Chueh, W., C., Goodwin, D., G., Haile, S., M.
2011; 13: 2121-2135

- **Reducing Error & Measurement Time in Impedance Spectroscopy Using Model-based Optimal Experimental Design.** *Electrochim. Acta*
Ciucci, F., Carraro, T., Chueh, W., C., Lai, W.
2011; 56: 5416-5434
- **Unusual Decrease in Conductivity Upon Hydration in Acceptor Doped, Microcrystalline Ceria.** *Phys. Chem. Chem. Phys.*
Chueh, W., C., Yang, C. K., Garland, C., M., Lai, W., Haile, S., M.
2011; 13: 6442-6451
- **High-Flux Solar-Driven Thermochemical Dissociation of CO₂ & H₂O Using Nonstoichiometric Ceria.** *Science*
Chueh, W., C., Falter, C., Abbott, M., Scipio, D., Furler, P., Haile, S., M.
2010; 330: 1797-1801
- **Thermochemical Study of Ceria: Exploiting an Old Material for New Modes of Energy Conversion of CO₂ Mitigation.** *Phil. Trans. R. Soc. A.*
Chueh, W., C., Haile, S., M.
2010; 368: 3269-3294
- **Ceria as a Thermochemical Reaction Medium for Selectively Generating Syngas or Methane from H₂O & CO₂.** *Chem. Sus. Chem.*
Chueh, W., C., Haile, S., M.
2009; 2: 735-739
- **Electrochemical Studies of Capacitance in Cerium Oxide Thin Films and Its Relationship to Anionic and Electronic Defect Densities.** *Phys. Chem. Chem. Phys.*
Chueh, W., C., Haile, S., M.
2009; 11: 8144-8148
- **Electrochemical Behavior of Ceria with Selected Metal Electrodes.** *Solid State Ionics*
Chueh, W., C., Lai, W., Haile, S., M.
2008; 179: 1036 - 1041
- **Inverse Opal Ceria-Zirconia: Architectural Engineering for Heterogeneous Catalysis.** *Energy Environ. Sci.*
Umeda, G., A., Chueh, W., C., Noailles, L., Haile, S., M., Dunn, B., S.
2008; 1: 484 - 486
- **Tunability of Propane Conversion over Alumina Supported Pt and Rh Catalysts.** *Top. Catal.*
Chueh, W., C., Shao, Z., Haile, S., M.
2007; 46: 402 - 413
- **High Power-Density Single-Chamber Fuel Cells Operated on Methane.** *J. Power Sources*
Shao, Z., Mederos, J., Chueh, W., C., Haile, S., M.
2006; 162: 589 - 596