

Title Tailoring defect-strain coupling of complex oxides for energy conversion and storage

Speaker Prof. Nicola H. Perry

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Abstract

Solid-state electrochemical devices – electrolysis cells, fuel cells, and batteries – require materials that can transport ions rapidly, catalyze interfacial reactions, and withstand the chemical stresses inherent in operation. These properties derive in part from the types, arrangements, and dynamics of point defects – atomic scale anomalies including vacancies, interstitials, dopants, and electronic species. This talk will focus on our recent work uncovering the relationships between strain, defect equilibria/kinetics, and functional properties in ion-conducting perovskite oxides. Case studies to be highlighted include: 1) lowering deleterious chemical expansivity in ceramics that “breathe,” 2) raising surface catalytic activity through chemo-mechanical actuation, and 3) boosting ionic conductivity through strain engineering. This work involves both bulk ceramic and thin film synthesis, through sol-gel and pulsed laser deposition methods, respectively. We then apply various in situ diffraction, spectroscopic, electrochemical, optical, thermogravimetric, and dilatometric characterization methods up to ~1000 °C in precisely controlled chemical potential environments to assess links between defect chemistry, crystal/micro-structure, and resulting functional behavior. By understanding and tailoring chemo-mechanical coupling, we are able to develop new electrodes and electrolytes that are more efficient and durable.

About the Speaker

Nicola H. Perry is an Assistant Professor in the Department of Materials Science and Engineering at the University of Illinois, Urbana-Champaign. Her group’s research focuses on point-defect-mediated properties in electro-chemo-mechanically active oxides for energy conversion/storage applications. She received a BS in Materials Science and Engineering and BA in French Studies, magna cum laude, from Rice University in 2005, and a PhD in Materials Science and Engineering from Northwestern University in 2009. After this she held postdoctoral appointments in the Energy Frontier Research Center for Inverse Design at Northwestern University, then at the International Institute for Carbon-Neutral Energy Research (WPI-I²CNER) and at MIT. Prior to moving to Illinois in 2018, she served as a WPI Assistant Professor in I²CNER and a Research Affiliate at MIT. Her awards include a NSF CAREER Award, J. Bruce Wagner Jr. Award from ECS, DOE Early Career Award, two Kakenhi Awards from JSPS, and Edward C. Henry best paper award from ACerS.

Registration

https://zoom.us/webinar/register/WN_bNKbanKfSdOoAUGvl-O1QA

Host Prof. Tatsumi Ishihara

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