WestVirginiaUniversity.
BENJAMIN M. STATLER COLLEGE OF ENGINEERING AND MINERAL RESOURCES

MATERIALS SCIENCE AND ENGINEERING (MS&E) SEMINAR SERIES
Friday September 20, 2019 at 3:00pm in room ESB 207

Leveraging defects and disorder in mixed conducting perovskites for efficient, durable energy conversion

Nicola H. Perry

Assistant Professor in the Department of Materials Science and Engineering at the University of Illinois, Urbana-Champaign, and a WPI Assistant Professor in the International Institute for Carbon-Neutral Energy Research (I2CNER) of Kyushu University

Oxides that can "breathe" and transport oxygen and/or steam are vital components of elevated temperature electrochemical energy conversion and storage devices. Ideally these materials should exhibit rapid surface exchange kinetics and transport, for efficiency, and minimal chemical expansion during stoichiometry changes, for durability. However, in practice, surfaces are almost ubiquitously poisoned by large cation segregation leading to sluggish surface exchange kinetics, and chemical strains are readily large enough to cause mechanical failure. In order to identify which aspects of structure can be controlled to tailor these contributions to efficiency and durability, we synthesize an ionic and electronic conducting perovskite, where we are identifying structural factors that can be incorporated by design to tailor the surface exchange kinetics and chemical expansion. We are learning how to increase the surface exchange kinetics by minimizing cation segregation through non-equilibrium growth and in situ crystallization. Similarly, we are observing how to decrease the coefficient of chemical expansion through tailored charge localization, crystal distortions, and nanostructuring. I will also highlight technique advances that enable these findings, such as in situ optical transmission relaxation and nanoparticle dilatometry.

Nicola H. Perry is an Assistant Professor in the Department of Materials Science and Engineering at the University of Illinois, Urbana-Champaign, and a WPI Assistant Professor in the International Institute for Carbon-Neutral Energy Research (I2CNER) of Kyushu University. She earned her BS in Materials Science and Engineering and BA in French Studies, magna cum laude, from Rice University, and the Ph.D. in Materials Science and Engineering from Northwestern University. After this she held postdoctoral appointments in the Energy Frontier Research Center for Inverse Design at Northwestern University, then at I2CNER and at MIT. Prior to moving to Illinois in 2018, she served as a WPI Assistant Professor in I2CNER, where she ran the "electro-chemo-mechanics" laboratory in the Electrochemical Energy Conversion division and continued as a Research Affiliate at MIT. Her awards include an Edward C. Henry best paper award from ACerS, two Kakenhi awards from JSPS, an IUMRS award for encouragement of research, and a DOE early career award. Her research focuses on point-defect mediated properties in electro-chemo-mechanically active oxides for energy conversion/storage, sensing, and electronic applications.

MS&E Seminar Series is sponsored by the Department of Chemical Engineering, Lane Department of Computer Science and Electrical Engineering, and Department of Mechanical & Aerospace Engineering.

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

1306 Evansdale Drive | PO Box 6106
Morgantown, WV 26506-6106
O 304.293.3111 F 304.293.6689