

UC SAN DIEGO NANOENGINEERING SEMINAR

Wednesday, April 11, 2018

Seminar Presentation: 11:00am - 12:00pm

ASML Conference Center (SME 248)

“Electrolyte Dictated Materials Design for Beyond Lithium Ion Batteries”

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Abstract: Lithium ion batteries have reshaped our life with their omnipresence in portable electronics. In lithium ion batteries, lithium ions are shuttled in a nonaqueous solvent between a graphite electrode and a transition metal oxide electrode through intercalation redox reactions. Over the past two decades, lithium ion batteries have steadily improved in terms of cost and lifetime. However, increasing the specific energy of these batteries is reaching its limit and high-profile fire accidents (e.g. cell phones spontaneously combusting) cast doubt of their applications in electric vehicles and large-scale energy storage. Emerging “beyond lithium ion” batteries with alternative battery chemistries may potentially offer new technologies with cost-effective materials, safe operation, and a long-life battery performance. With that being said, each beyond lithium ion battery chemistry has its own distinct fundamental challenges, and sometimes, these challenges are not very well understood. Most often, the battery’s electrolyte plays an important role in the materials design. In this talk, I will describe the distinct challenges in three beyond lithium ion batteries: aqueous, Mg ion, all solid-state batteries, and the corresponding examples of electrolyte-dictated materials design. Understanding their respective problems in combination with the ability to design new materials to tackle these challenges could enable unprecedented device performance towards cheaper, safer, and energy-dense batteries.

Biosketch: Dr. Yan Yao is an associate professor of Electrical and Computer Engineering at the University of Houston. He received his Ph.D. in Materials Science and Engineering from UCLA in 2008 (with Prof. Yang Yang). Prior to joining the University of Houston as an assistant professor in 2012, he served as a senior scientist at Polyera Corporation (now Flexterra) from 2008 to 2010 and a postdoctoral fellow at Stanford University (with Prof. Yi Cui) from 2010 to 2012. Dr. Yao’s research focuses on fundamental understanding and materials design in energy storage devices for safe, cost-effective, and long cycle-life battery technologies. His current research interests include magnesium battery electrodes and electrolytes, aqueous batteries, solid-state-electrolyte and all-solid-state batteries, and organic based redox electrode materials. He has authored 72 publications with papers in Nature Materials, Nature Nanotechnology, Nature Comm., JACS, Angewandte Chemie, and citations over 18,000. He also has 13 granted patents and 9 pending applications. Dr. Yao’s honors include Robert A. Welch Professorship (2012-2015), Office of Naval Research (ONR) Young Investigator Award (2013), Ralph E. Powe Junior Faculty Enhancement Award (2014), Teaching Excellence Award (2016), and Scialog Fellow from the Research Corporation (2017). Dr. Yao’s research is funded by the US Department of Energy Vehicle Technology Office, Advanced Research Projects Agency-Energy, Office of Naval Research, National Aeronautics and Space Administration, and the National Science Foundation.