DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

SPRING 2018 SEMINAR SERIES

PRESENTS:

Microscopic Insights into Conductivity and Stability of Solid Electrolyte Interfaces

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Friday, April 13, 2018
11:00 AM – 12:00 NOON
Nedderman Hall 108

Abstract

Lithium-ion batteries are currently one of the leading electrochemical energy storage techniques for many transportation and stationary applications. However, the use of liquid electrolytes negatively effects their capacity, lifetime, and safety. Solid-state electrolytes are being investigated as one of the best solutions to overcome these challenges and are considered as a critical component in future-generation lithium battery systems, which includes their use as the primary electrolytes in all-solid-state batteries, and the interfacial separation layer for Li-air or aqueous batteries. An ideal solid electrolyte material must be highly ionically conductive and exhibit desirable stability with metallic lithium. Over the past several decades, new solid electrolyte materials were developed that demonstrated high conductivity, which is comparable to that of organic liquid electrolytes. However, unexpectedly high resistivity from grain boundaries and electrolyte-electrode interfaces is often observed and is the major limitation in realizing the practical application of these materials. Elucidating the fundamental origin of high interfacial impedance and its evolution upon electrochemical cycling will accelerate the design and application of next generation energy storage. Due to spatial confinement and structural and chemical complications, understanding these interfaces however is challenging to both experiment and theory. In this seminar, I will talk about our recent efforts in probing interfacial phenomena in solid electrolytes, by using *in situ* and atomic-resolution scanning transmission electron microscopy (STEM) and electron energy loss spectroscopy (EELS). A new STEM technique, vibration spectroscopy, that can probe local ion conduction behavior, will also be introduced. I hope to demonstrate the power of electron microscopy in providing valuable guidelines to the design and the synthesis of high performance solid-solid interfaces.

Bio

Miaofang Chi currently is a senior staff scientist at the Center for Nanophase Materials Sciences (CNMS) at Oak Ridge National Laboratory (ORNL). She received her Ph.D. in Materials Science and Engineering from University of California, Davis in 2008. Her primary research interest lies in the development and application of novel electron microscopy techniques for energy materials, especially on analytical functional imaging and atomic-scale *in situ* microscopy for battery materials and fuel cell catalysts. She received the ORNL Director's Award for Outstanding Individual Accomplishment in Science and Technology (2015) and the ORNL's Early Career Research Award (2015). She was recently awarded the Burton Metal by the Microscopy Society of America (2016). Miaofang is the author and co-author of more than 150 peer-reviewed journal articles. She serves on the award committee at the Microscopy Society of America.

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