Thioantimonate Electrolytes for All-solid-state Sodium Batteries – the Evolving Structure, Interface, and Electrochemical Performance

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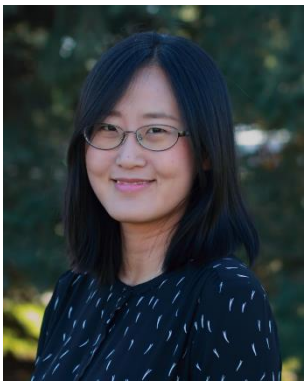
Abstract:

All-solid-state sodium batteries use earth-abundant elements, non-volatile and non-flammable electrolytes, and are considered a safe and sustainable choice to satisfy the growing demand for energy storage. Using solid-state electrolytes (SEs) also eliminates the need for packing when fabricating tandem cells, potentially enabling further enhanced energy density. Developing sodium-ion conductors that exhibit high electrochemical stability is an essential step toward long-lasting and high-performance solid-state batteries. As potential electrolyte materials for all-solid-state sodium batteries, sodium thioantimonate and its substituted analogs exhibit high Na^+ conductivity. To date, a couple of key challenges still exist for developing (electro-) chemically stable thioantimonate-based SEs. These challenges include batch-to-batch variations for producing substituted SEs, and unwanted electrochemical decompositions occurring at the SE/electrode interface.

This seminar will discuss in-depth, multidisciplinary characterizations that can correlate the structure of thioantimonate SEs with their evolving electrochemical performances during the battery cycling process. In particular, X-ray absorption, Raman, NMR, X-ray diffraction, and electron imaging characterizations are combined to provide structural- and morphological-level understanding within the SE materials and the SE/electrode interfaces. These characterizations provide insights into the optimal synthetic approach of these SE materials. The interpretation of the SE/electrode interfacial chemistry made possible by the in-situ analysis marks the criterion of an ideal functional protective layer towards high-performance, long-lasting all-solid sodium batteries.

Short Bio:



Lingzi obtained her B.S. from Xiamen University and her Ph.D. in Chemistry from the University of Arizona. Prior to joining the Department of Chemistry at the University of Alberta, Lingzi conducted her postdoc research at the University of Illinois at Urbana-Champaign. The Sang group is broadly interested in fundamental chemical processes at the interface of energy devices, e.g. batteries and solar cells. Perturbations such as temperature, radiation, and electrical potential during characterization allow the team to correlate materials structure with device functionality. Sang group develop arrange of in-situ measurement tools (in-situ Raman, XANES, tomography) to answer materials chemistry questions. Standing at the interception of analytical, materials, and interfacial chemistry, Sang recently established the Laboratory for Advanced Characterization of Interfaces in Energy Devices (LACIE), a facility with the capacity to comprehensively characterize the fundamental physicochemical nature of interfaces in electrochemical devices. LACIE brings together research tools including vibrational spectroscopy (Raman, IR), X-ray spectroscopy, electrochemistry, thin film fabrication, and solid-state battery fabrication.