Materials Engineering Program
Texas Center for Superconductivity at the University of Houston
Center for Integrated Bio and Nano Systems

Advancements in Solid-State Electrolyte Synthesis for Next-Generation Lithium Metal Batteries: Previous Lessons, Electrifying Opportunities

Friday, January 26, 2024

In Person Only, 1:00 – 2:00 pm

Houston Science Center (HSC), Rm.102

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Abstract: In the dynamic landscape of batteries for electric vehicles, the growing demand has spurred intensive research on advanced battery materials, specifically solid-state electrolytes (SSEs), with the aim of enabling Lithium metal batteries. Lithium SSEs are expected to improve next-generation energy storage technology on the basis of specific energy, safety, and cost. However, there has been limited success in the mass production of solid-state separators with transport properties and comparable thickness to a traditional polypropylene separator used in state-of-the-art lithium-ion batteries. This problem is especially difficult with both sulfide- and oxide-based solid electrolytes together with integrating effective thin interlayers that enable Lithium metal anodes. In this seminar, techniques based on scalable solution-based chemistries will be presented for sulfide- and oxide-based SSEs including argyrodites, garnets, and borates. The pivotal role of advanced manufacturing techniques in addressing synthetic challenges will be discussed, with a specific focus on argyrodite-type sulfide-based SSEs and lithium metal. The seminar will also highlight innovative strategies involving dopants and pseudocapacitive interlayers for Lithium metal batteries. The results presented in this talk will highlight new opportunities for manufacturing oxide- and sulfide-based solid electrolytes with tunable electrochemical properties, form factors, and surface areas. The insights from this work are expected to serve as fundamental guidelines for future optimization toward solution-based processing of superionic SSE materials for next-generation lithium metal batteries.

Bio: Dr. Zachary Hood, a Group Leader and Materials Scientist, leads the Advanced Electrochemical Materials Group within the Energy Storage and Conversion Department of Argonne National Laboratory's Applied Materials Division. Under his guidance, the group pioneers inventive synthetic approaches to create cutting-edge solid-state materials, employing various characterization techniques to unravel their properties and performance across the nano-to-macro scale. Zachary Hood received his B.S. from Wake Forest University, his Ph.D. from the Georgia Institute of Technology, and his postdoctoral at the Massachusetts Institute of Technology. He has received prestigious awards, including the Argonne Board of Governors Excellence in Diversity, Equity, Inclusion, and Accessibility Award in 2023, Impact Argonne Award, the Maria Goeppert Mayer Director's Fellowship at Argonne National Laboratory, and the Materials Research Society Graduate Student Award (Gold), showcasing his leadership in pushing the boundaries of energy storage research.