Monday Morning, May 12, 2025

Plenary Lecture
Room Town & Country A - Session PL-MoM

Plenary Lecture

Moderator: Peter Kelly, Manchester Metropolitan University

8:00am **PL-MoM-1 Welcome and Opening Remarks***,*

8:20am **PL-MoM-2 ICMCTF Plenary Lecture: Past, Present and Future of All Solid State Batteries – Challenges and Opportunities***, Shirley Meng,* Argonne National Lab, The University of Chicago, USA **INVITED**

Compared with their liquid-electrolyte analogues, Solid state electrolytes SSEs have drawn increased attention as they promote battery safety, exhibit a wide operational temperature window, and improve energy density by enabling Li metal as anode materials for next-generation lithium-ion batteries. Despite suitable mechanical properties to prevent Li dendrite penetration, relatively wide electrochemical stability windows, comparable ionic conductivities, and intrinsic safety, most SSEs are found to be thermodynamically unstable against Li metal, where SSE decomposition produces a complex interphase, analogous to the SEI formed in liquid electrolyte systems. An ideal passivation layer should consist of ionically conductive but electronically insulating components to prevent the SSE from being further reduced. The past four decades have witnessed intensive research efforts on the chemistry, structure, and morphology of the solid electrolyte interphase (SEI) in Li-metal and Li-ion batteries (LIBs) using liquid or polymer electrolytes, since the SEI is considered to predominantly influence the performance, safety and cycle life of batteries. All-solid-state batteries (ASSBs) have been promoted as a highly promising energy storage technology due to the prospects of improved safety and a wider operating temperature range compared to their conventional liquid electrolyte-based counterparts. While solid electrolytes with ionic conductivities comparable to liquid electrolytes have been discovered, fabricating solid-state full cells with high areal capacities that can cycle at reasonable current densities remains a principal challenge. Silicon anode offers a possibility to overcome the challenges that lithium metal anode faces. In this talk, we will highlight solutions to these existing challenges and several directions for future work are proposed.

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