Solidifying batteries: The laborious route to the solid state

seminar

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NANO-SYSTEMS FROM IONS, SPINS AND ELECTRONS

Abstract

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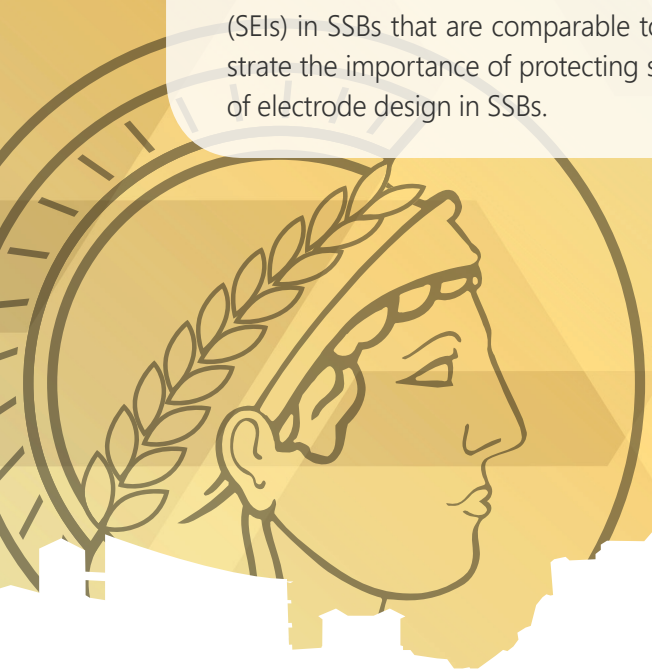
Solid-state batteries (SSB) have recently attracted great interest as safer high-energy long-term storage devices that may even incorporate lithium metal anodes. However, key materials issues are yet unsolved and serious barriers must be overcome to commercialize SSBs. In SSBs, the liquid electrolyte is replaced with a solid ionic conductor and some advantages are expected: (1) prevent chemical cross-talk between the electrodes, (2) use lithium metal as an anode for higher energy densities, and (3) prevent dendrite formation.

In this seminar we will discuss some of our approaches to understand the underlying structures of some ionic conductors and optimizing their ionic conductivities in order to identify an ideal solid electrolyte for SSBs. We will further show that the general belief that solid electrolytes are chemically- and electrochemically-inert is wrong. Using in situ X-ray photoemission spectroscopy and time-resolved electrochemical measurements it is possible to monitor the growth of solid-electrolyte interfaces (SEIs) in SSBs that are comparable to those in liquid-based lithium ion batteries. Lastly, we demonstrate the importance of protecting solid electrolytes from the cathode material and the importance of electrode design in SSBs.



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