

Li-ion and Na-ion Solid State Electrolytes and Their Implementation in Solid State Batteries

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All-solid state Li-ion batteries (ASSBs) have emerged as attractive alternatives to conventional liquid electrolyte cells for automotive transportation, owing to their enhanced safety and higher energy densities.¹ Low-cost solid state Na-ion batteries may prove an excellent alternative for grid storage.^{2,3} ASSBs are founded on high performance fast-ion conducting electrolytes,^{4,5} and in the important search for new materials, alkali thiophosphate halides (and pseudohalides) are a particularly promising class of materials owing to their ductility and good mechanical properties.

This presentation will focus on several new alkali (Li, Na) solid state ion conductors within this class of materials recently developed in our laboratory with conductivities above 1 mS/cm, and the understanding of superionic conductivity in these materials using a combination of structural elucidation via X-ray/neutron diffraction, ion conductivity, solid state NMR, and *ab initio* molecular dynamics simulations. The talk will focus on correlating structure, changes in composition and vacancy population that strongly affect the conductivity, activation energy and diffusivity to provide an understanding of the factors that govern thermodynamic (meta)stability and conductivity. The implementation of artificial interface layers, along with studies to determine stability of the SSE's with respect to metal anodes, and their application in ASSBs will be presented.

References:

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