MIT Chemical Engineering Department
Spring 2021 Seminar Series
http://cheme.mit.edu/seminar-series/

Engineering Polymeric Ionic Liquids for Metal Ion Conduction

Rachel Segalman, Ph.D.
Schlinger Distinguished Chair of Chemical Engineering and Associate Director of the UT/UCSB/LBL EFRC: Center for Materials for Water and Energy Systems
University of California, Santa Barbara

Friday, March 12, 2021
3:00pm

Abstract: Metal-ion rechargeable batteries are the technology of choice for numerous applications, yet the energy density and safety of commercial devices is often limited by using organic liquid electrolytes with high flammability and poor stability of electrode/electrolyte interfaces during operation. Ionic liquids are a class of functional liquid salts that address both voltage and thermal stability concerns. Incorporation of ionic liquid moieties onto a polymer to form polymeric ionic liquids (PILs) synergistically combines the functionality of ionic liquids with the mechanical robustness and mesostructured control imparted by the polymer backbone. I will discuss the design of ionic liquid-metal cation interactions and overall polymer design to create all solid-state polymer electrolytes with high ionic conductivity of Li+ as well as higher valency metal cations relevant to next generation batteries. These metal ion-IL interactions are frequently metal-coordination bonds that simultaneously act as reversible cross-links, lending additional mechanical strength. The metal-ligand bond lifetime therefore determines both the ionic conduction and time-dependent mechanical properties. Further, this lifetime is shown to dominate performance to a much greater extent than other variables including polymer dielectric constant.