Versatile cation transport in imidazolium based polymerized ionic liquids

CHRISTOPHER EVANS, UCSB, RACHEL SEagalMAN, University of California, Santa Barbara — Polymerized ionic liquids (PIL) with tethered imidazolium groups are able to conduct a diverse array of cations relevant for energy applications. The well-known complexation of imidazolium with transition metals is exploited to bind ions such as H+, Li+, Cu2+, and Ni2+ by doping the neutral PIL with the appropriate Cation-TFSI− salt. Conductivities were first determined via AC impedance indicating that H+ salts lead to the highest conductivity (due to low ion mass and potential Grotthus mechanism) followed by Cu2+, Li+, Ag+, and Ni2+. The equilibrium constant for imidazolium complexation is larger for Cu2+ relative to Li-, Ag-, and Ni-imidazolium complexes leading to greater salt dissociation and higher conductivities. For LiTFSI and CuTFSI2 salts, metallic lithium or copper electrodes were employed in battery cells to pass a steady DC current and confirm that the cations are in fact carrying current. Interestingly, the divalent Cu2+ also ionically crosslinks the polymer leading to a plateau in the viscosity. Thus, divalent ions provide an unique route to high conductivity, high modulus polymeric electrolytes. Future studies involving ZnTFSI2 and MgTFSI2 for battery applications are proposed to examine how versatile the PIL platform is for cation transport.