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Versatile cation transport in imidazolium based polymerized ionic liquids CHRISTOPHER EVANS, UCSB, RACHEL SEGALMAN, 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^+, Cu^{2+}, and Ni^{2+} 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 Cu^{2+}, Li^+, Ag^+, and Ni^{2+}. The equilibrium constant for imidazolium complexation is larger for Cu^{2+} relative to Li-, Ag-, and Ni-imidazolium complexes leading to greater salt dissociation and higher conductivities. For LiTFSI and $CuTFSI_2$ 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 Cu^{2+} 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 $ZnTFSI_2$ and $MgTFSI_2$ for battery applications are proposed to examine how versatile the PIL platform is for cation transport.

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