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Polymer stability and function for electrolyte and mixed conductor applications[1] PAULA HAMMOND, NICOLE DAVIS, DAVID LIU, CHIBUEZE AMANCHUKWU, Massachusetts Institute of Technology, NATE LEWIS, California Institute of Technology, YANG SHAO-HORN, Massachusetts Institute of Technology — Polymers exhibit a number of attractive properties as solid state electrolytes for electrochemical energy devices, including the light weight, flexibility, low cost and adaptive transport properties that polymeric materials can exhibit. For a number of applications, mixed ionic and electronic conducting materials are of interest to achieve transport of electrons and holes or ions within an electrode or at the electrode-electrolyte interface (e.g. aqueous batteries, solar water splitting, lithium battery electrode). Using layer-by-layer assembly, a mode of alternating adsorption of charged or complementary hydrogen bonding group, we can design composite thin films that contain bicontinuous networks of electronically and ionically conducting polymers. We have found that manipulation of salt concentration and the use of divalent ions during assembly can significantly enhance the number of free acid anions available for ion hopping. Unfortunately, for certain electrochemical applications, polymer stability is a true challenge. In separate studies, we have been investigating macromolecular systems that may provide acceptable ion transport properties, but withstand the harsh oxidative environment of lithium air systems. An investigation of different polymeric materials commonly examined for electrochemical applications provides insight into polymer design for these kinds of environments.

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