Charge Transport Properties of P3HT-PEO block copolymers that are Electrochemically Oxidized in the Solid-State

SHRAYESH PATEL, UC Berkeley, Dept. of Chemical and Biomolecular Engineering, ANNA JAVIER, Lawrence Berkeley National Lab, NITASH BALSARA, UC Berkeley, Dept. of Chemical and Biomolecular Engineering — We report on the relationship between morphology and electronic/ionic charge transport of Poly(3-hexylthiophene)-b-Poly(ethylene oxide) (P3HT-b-PEO) and lithium bis-(trifluoromethanesulfonyl) imide (LiTFSI) mixtures. Using ac impedance spectroscopy, we show that P3HT-b-PEO/LiTFSI mixtures can conduct electronic and ionic charges simultaneously. The electronic resistance of P3HT-b-PEO can be controlled through the electrochemical oxidation of P3HT with LiTFSI. We designed an all solid-state electrochemical cell with three terminals to measure the electronic conductivity of P3HT-b-PEO under applied potentials. The addition of a third terminal within the P3HT-b-PEO layer allows for the \textit{in-situ} measurement of the electronic conductivity as a function of the P3HT electrochemical oxidation level. Our experimental setup is unique in that electrochemical oxidation occurs in the presence of solid-polymer electrolyte. Previous studies on the electrochemical oxidation of polythiophenes have been done in the presence of a liquid electrolyte. The results of the \textit{in-situ} electronic conductivity measurements as a function of electrochemical doping level and block copolymer composition will be presented.

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