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In situ Mechanistic Investigation of an Organic Radical Polymer Cathode on Interfacial Charge Transport and Cycling Stability FEI LI, JODIE LUTKENHAUS, Artie McFerrin Department of Chemical Engineering, Texas A&M University — Organic radical polymers have gained increased attention as cathodes for organic radical batteries due to their fast charge transport and high cycling stability. These features make them a promising alternative to conventional lithium-ion batteries. One polymer of interest is a nitroxide radical polymer, poly(2,2,6,6-tetramethylpiperidinyloxymethacrylate) (PTMA), which is capable of a two-electron transfer process. The specific capacity of PTMA as cathode has a reported value between 77 to 220 mAh/g, depending on the charge/discharge conditions. Most work with PTMA has largely emphasized electrode optimization to improve its capacity by adding highly conductive materials or by designing new forms of radical polymers. There is little molecular level detail on the charge storage process and electrode/electrolyte interfacial activities in such systems. Here, we present the application of in situ characterization techniques towards the charge storage process in PTMA. Electrochemical quartz crystal microbalance with dissipation monitoring (EQCM-D) monitors various electrode physical properties (e.g. mass, shear viscosity) during controlled electrochemical interrogation (cyclic voltammetry, charge discharge). Electrochemical impedance spectroscopy probes various charge storage and transport events at a range of frequencies and potentials. With this information attained, a clearer picture of charge storage in organic radical battery cathodes can be formed.

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