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Formation, Structure and Electrochemical Impedance Analysis of Microporous Polyelectrolyte Multilayers JODIE LUTKENHAUS, KATHLEEN MCENNIS, PAULA HAMMOND, Massachusetts Institute of Technology — Microporous networks are of interest as electrolyte materials, gas separation membranes and catalytic nanoparticle templates. Here, we create microporous polyelectrolyte networks of tunable pore size and connectivity using the layer-by-layer (LBL) technique. In this method, a film is formed from the alternate adsorption of oppositely charged polyelectrolytes from aqueous solution to create a cohesive thin film. Using poly(ethylene imine) (PEI) and poly(acrylic acid) (PAA), LBL thin films of variable composition and charge density were assembled; then, the films were treated in an acidic bath, which ionizes PEI and de-ionizes PAA. This shift in charge density induces morphological rearrangement realized by a microporous network. Depending on the assembly pH and acidic bath pH, we are able to precisely tune the morphology, which is characterized by atomic force microscopy and scanning electron microscopy. To demonstrate the porous nature of the polyelectrolyte multilayer, the pores were filled with non-aqueous electrolyte (i.e. ethylene carbonate, dimethyl carbonate and lithium hexafluorophosphate) and probed with electrochemical impedance spectroscopy. These microporous networks exhibited two time constants, indicative of ions traveling through the liquid-filled pores and ions traveling through the polyelectrolyte matrix.

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