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Proof**CONTROL ID:** 676673**CONTACT (NAME ONLY):** Fevzi Cebeci**Abstract Details****PRESENTATION TYPE:** Oral Presentation Preferred**SYMPOSIUM:** FF: Mechanical Behavior of Nanomaterials—Experiments and Modeling**KEYWORDS:** Composition & Microstructure / Material Type / composite, Properties / Mechanical / elastic properties.**Abstract****TITLE:** Electrochemically-Induced Percolative Mechanical Properties of Polyaniline Nanofiber-Polymer Composites**AUTHORS (FIRST NAME, LAST NAME):** Fevzi C. Cebeci¹, Daniel J. Schmidt¹, Christine Ortiz², Paula T. Hammond¹**INSTITUTIONS (ALL):** 1. Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA.

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ABSTRACT BODY: Stimulus-responsive percolative materials are of great interest due to expected dramatic changes in properties, in particular mechanical behavior, below and above the percolation threshold whereby the responsive units contact each other and form a continuous path through the entire system. Responsive constituents with high aspect ratios are expected to produce extremely low (as low as 1% volume fraction) percolation thresholds. In this work, we expect to create an easily disruptable percolative network that will yield impactful changes in composite modulus. Here, we describe the design of an electrochemically-responsive, percolative composite composed of stiff, high aspect ratio, conducting polymer nanofibers interdispersed with more compliant macromolecular spacer layers. Specifically, the responsive nanofibers are polyaniline interdispersed with hydrogen-bonded layer-by-layer (LbL) assemblies of poly(ethylene oxide) (PEO) and poly(acrylic acid) (PAA). Synthesis of polyaniline nanofibers was carried out similarly to previously published methods in the literature using an ammonium persulfate (oxidant)-hydrochloric acid (dopant) solution added to an acidic aniline and p-phenylenediamine solution. The average length and diameter of the nanofibers were calculated as approximately 2 μ m and 40nm by TEM, respectively, with an aspect ratio of 50. The mechanical properties of the nanocomposite films (10 layers of polyaniline embedded within 20 bilayers of PEO/PAA) were investigated upon application of an electric potential of -0.2V for reduction and 0.4V for oxidation vs. Ag/AgCl by aqueous atomic force microscopy-based nanoindentation. Incorporation of nanofibers into the PEO/PAA LbL films increased the indentation modulus of the nanocomposite film, and upon application of electrochemical potentials (at -0.2V and 0.4V vs. Ag/AgCl), the films were found to undergo several-fold changes in indentation modulus. The effects of multilayer assembly architecture (i.e., volume fraction of the nanofibers and composition of the spacer layers in the film) on the mechanical switching of the nanocomposite films were also explored. Such "mechanomutable" material systems hold great potential for a variety of applications such as responsive armor textiles and substrates for tunable cell interactions for tissue engineering.

(No Table Selected)