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Conducting Polymers under Mechanical Strain: Tuning Polyaniline's Piezoresistivity through Structural Control MELDA SEZEN, YUEH-LIN LOO, Dept. of Chemical and Biological Engineering, Princeton University — The use of conducting polymers in various flexible or conformable electronics applications necessitates control over their piezoresistive response. We show that we can tune both the polarity and the magnitude of the piezoresistive response of PANI-PAAMPSA by controlling its thin-film morphology. PANI-PAAMPSA forms electrostatically-stabilized colloidal particles as-synthesized whose size affects the solid-state structure of PANI-PAAMPSA. By altering the molecular weight of PAAMPSA at the onset of synthesis, we change the particle size of PANI-PAAMPSA and the crystallinity of PANI. As the molecular weight of PAAMPSA decreases, PANI-PAAMPSA forms smaller particles and PANI's crystallinity increases. These structural changes cause PANI-PAAMPSA's gauge factor (GF) to decrease linearly and even become negative with decreasing PAAMPSA molecular weight. The tunability of PANI-PAAMPSA's piezoresistive response, especially our access to negative gauge factors, has resulted in design rules with which we can specify a priori, and synthesize accordingly, PANI-PAAMPSA with defined piezoresistive response for strain sensing (high GF) or flexible chemo- or thermo-resistive sensor (zero GF) applications.

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