Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Exploiting the Different Polarity in Piezoresistive Characteristics of Conducting Polymers for Strain Gauge Applications MELDA SEZEN, JEFFREY T. REGISTER, Dept. of Chemical and Biological Engineering, Princeton University, YAO YAO, BRANKO GLISIC, Dept. of Civil and Environmental Engineering, Princeton University, YUEH-LIN LOO, Dept. of Chemical and Biological Engineering, Princeton University — Piezoresistivity defines the change in resistance of a material in response to mechanical stress. We exploited the effects of structural modifications on the piezoresistive properties of conducting polymers, poly(2-acrylamido-2-methyl-1-propanesulfonic acid) doped polyaniline, PANI-PAAMPSA, and poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate), PEDOT:PSS, for strain gauge applications. Under tensile deformation, the resistances of as-cast PANI-PAAMPSA and PEDOT:PSS increase due to increased separation between the electrostatically stabilized conducting polymer particles. Upon solvent annealing in dichloroacetic acid, DCA, PANI-PAAMPSA's resistance decreases whereas PEDOT:PSS's resistance still increases with tension. While DCA treatment reduces the electrostatic interactions between PANI and PAAMPSA, it only removes the PSS overlayer in PEDOT:PSS. The change in the polarity of PANI-PAAMPSA's piezoresistivity is attributed to the unlocking of the globular structure of the as-synthesized conducting polymer complex with DCA-treatment, which then enables strain-induced crystallization on deformation. By tuning the piezoresistive characteristics of the polymers through structural modification, we can design strain gauge circuits for monitoring the conditions of civil structures.

Melda Sezen
Dept. of Chemical and Biological Engineering, Princeton University

Date submitted: 12 Nov 2014 Electronic form version 1.4