Strain Measurements on Multilayer Conducting Polymer Films

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The demand for actuators based on conducting polymers is growing due to their highly desirable features such as large mechanical strength, high power density, sufficient maximum strain values, high reversibility and safe. Reportedly, several attempts in various aspects have been made to improve the actuator performances. We report here some strain measurements on actuators of multilayer free standing films prepared with polypyrrole (PPy) and poly (3,4-ethylenedioxythiophene) (PEDOT) conducting polymers. These multi-layer films were prepared electrochemically, and The PEDOT is very thin compared to PPy layer in this combination. A force-displacement setup is used to measure the mechanical properties and the length change when multilayer conducting polymer film is oxidized and reduced electrochemically. Typical dimensions of the exposed part of the strips were 5 mm (length) x 3 mm (width). Results were compared that of PPy single film. Bilayer film shows a significant increase in the strain measured at higher scan rate (> 100 mV s^{-1}). The force generation between reduced and oxidized state is much higher for trilayer films and then for bilayer films than single layer PPy. These differences are not linked to the Young's modulus of these films. The addition of a thin PEDOT does not change Young's modulus, but change force generation significantly.

Keywords: Conducting polymer, Multilayer films, Strain measurement