Thermal Actuation Behavior of Conductive Polymer Composites

Kadumudi Firoz Babu, 최원묵*, M. Anbu Kulandainathan[1], 정진석
울산대학교 화학공학부; [1]Central Electrochemical Research Institute
(wmchoi98@ulsan.ac.kr*)

Thermally responsive polymer (TRP) composites are one such class of materials where the polymers can respond to external thermal stimuli causing molecular level global or local dimensional changes. Here, we demonstrate the anomalous thermal actuation behaviour of conducting polymer composite formed on the cellulosic flexible substrate by in situ polymerisation technique. Polypyrrole forms a strong interaction with cellulosic substrate via hydrogen bonding between −OH group and −NH group. A reversible thermally responsive bending behaviour was observed with 100 % recovery. Mechanism for the thermal actuation was explained using temperature modulated differential scanning calorimetric (TMDSC) and dynamic mechanical analysis (DMA). From these analysis, we observed that the segmental motions of polypyrrole occurred at the interface are responsible for the recoverable thermal actuation. This study indicates that intermolecular motions causing the thermal actuation is completely reversible and repeatable for many cycles and the sample keep this thermal history for ≈15 minutes.