Stretchable Rod-Coil Block Copolymer Thin Films for Organic Transistor Applications via Metallo-Supramolecular Strategy

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Abstract

Recently, wearable electronics have been drawn numerous interests. It is crucial important to develop flexible or stretchable devices to satisfy the future demands. Here, a newly designed poly(3-hexylthiophene)-*block*-polystyrene (P3HT-*b*-PS) block copolymer was presented. Instead of the traditional synthetic methods, the supramolecular methodology was utilized to construct a novel type of diblock copolymer, which could significantly shorten the synthesis time. End-functionalized P3HT segment with terpyridine-based ligand and Zn^{II}-terpyridine-capped PS part were adopted, forming heteroleptic metal coordination complexes. The P3HT-b-PS-based thin film transistors showed comparable electrical performance to P3HT-based ones, with mobility up to 10^{-2} cm^2 V^{-1} s^{-1}. Furthermore, atomic force microscopy (AFM) and 2D grazing incidence X-ray diffraction (2D-GIXD) analysis were conducted to look deep into surface morphology and molecular orientation, respectively. The block copolymer thin films also demonstrated better stretchability contrasted with pristine P3HT thin films during stress-strain test. The results revealed the practicality and the potential of this unique block copolymer for future wearable electronics applications.

Keywords – Block copolymer, metallo-supramolecular polymer, flexible electronics, organic thin-film transistor.