418b Electrospun Nanofibers of Conjugated Polymers

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Semiconductor nanowires, nanodots and other nanostructures have a variety of unique optical, electronic and magnetic properties arising from confinement effects. Nanowires of conjugated polymers are ideal system for studying 1-D confinement effects on optical and electrical properties and hold promise as building blocks for nanoelectronics. Electrospinning is a simple technique of growing interest for the preparation of nanofibers of diverse materials [1]. We have prepared high quality nanofibers from conjugated polymers, such as poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (MEH-PPV) and its blends with poly(3-hexylthiophene) (PHT) or poly(9,9-dioctylfluorene) (PFO), using the electrospinning technique and investigated the effect of one-dimensional confinement on the optical and electronic properties of conjugated polymer nanofibers [2,3]. Morphological and photophysical studies showed that the phase-separated domains in the MEH-PPV/PHT nanofibers (30-50 nm) are much smaller as compared to the blend thin films (100-150 nm) and efficient energy transfer was observed in these blend nanofibers. The MEH-PPV/PFO blend nanofibers had co-continuous or core-shell structures and significant energy transfer was absent in these blend nanofibers as compared to the bulk thin films. Field-effect transistors based on the MEH-PPV/PHT blend nanofibers exhibited p-channel transistor characteristics with hole mobility in the range of $(0.05\text{-}1)\times10^{-4}$ cm^2/Vs. Our results demonstrate that conjugated polymer nanofibers are promising 1-D system to study confinement effects on charge transport and optical properties. [1] Li, D.; Xia, Y. Adv. Mater. 2004, 16, 1151. [2] Dan, Li; Babel, A.; Jenekhe, S. A.; Xia, Y. Adv. Mater. 2004, 16, 2062. [3] Babel, A.; Li D.; Xia, Y.; Jenekhe, S. A. Macromolecules 2005, 38, 4705.