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Nano-porous Poly(3-hexylthiophene) films: A novel route to prepare bulk heterojunction photovoltaic devices TIRTHA CHATTERJEE, KULANDAIVELU SIVANANDAN, CRAIG J. HAWKER, EDWARD J. KRAMER, Mitsubishi Chemicals-Center for Advanced Materials, Materials Research Laboratory, University of California, Santa Barbara, CA 93106 — Conjugated polymers are excellent candidates for use in low-cost electronics and photovoltaics applications. Bulk heterojunction (BHJ) morphologies are promising device architecture as the close proximity of the electron donor and acceptor micro-domains (with domain size comparable with the exciton diffusion length) facilitates the charge transport process. In order to achieve a well ordered BHJ architecture, poly(3-hexylthiophene) (P3HT) based rod-coil copolymers are synthesized where coil blocks are grafted to the P3HT chain through a cleavable linker. The linker and the attached sacrificial coil block can easily be cleaved and removed by chemical treatment leaving a rough nano-porous P3HT film. Scanning force microscopy and grazing incidence small angle X-ray scattering convincingly show the nano-pore formation. Further, depth profiling using dynamic secondary ion mass spectroscopy indicates that nano-pores probably penetrate the entire depth of the film (device thickness). Subsequently refilling of the nano-pores by electron transporting component (fullerene derivatives) provides the required device morphology.

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