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Well-Defined Fullerene-Containing Diblock Copolymers Based on Regioregular Poly(3-hexylthiophene) and Poly(methyl methacrylate): Synthesis and Photovoltaic Properties JEA UK LEE, WON HO JO, Materials Science and Engineering, Seoul National University, ALI CIRPAN, TODD EMRICK, THOMAS RUSSELL, Polymer Science and Engineering, University of Massachusetts — Polymer solar cells based on conjugated polymer and fullerene materials have opened a new avenue to develop economically renewable energy resources. Recently, bulk heterojunction solar cells fabricated by simple blending regioregular poly(3- hexylthiophene) with fullerene derivatives have resulted in great improvement in the power conversion efficiency. Although a remarkable progress has been made, bulk heterojunction solar cells still have several problems. First, in all of the bulk heterojunction solar cells, the conjugated polymer and electron acceptor have been randomly interspersed throughout the film. Second, the blend of conjugated polymer and fullerene derivatives usually results in macrophase separation, limiting the charge separation and thus the power conversion efficiency in a photovoltaic device. We have designed and synthesized novel diblock copolymers composed of regioregular poly(3-hexylthiophene) and fullerene containing poly(methyl methacrylate). The diblock copolymers self-assemble into nanostructured morphologies (lamellae or hexagonally packed cylinder), which provide exitons with large interfaces for charge separation on the nanometer scale.

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