Modular Synthesis of Alternating Conjugated Copolymer Based Graft Copolymers for Controlling Their Self-Assembled Nanostructure

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Control of the self-assembled behavior of conjugated polymer-based copolymers is of great importance in determining their properties in polymer-based opto-electronic devices. Here, we present a simple yet powerful modular synthesis of rod-coil graft copolymers containing alternating conjugated copolymers as the rod backbone. As a model system, we synthesized highly emitting poly(fluorene-alt-phenylene) alternating copolymers via Suzuki-Miyaura polycondensation and then grafted P2VP coil chains with different lengths via click reaction to produce a series of poly(fluorene-alt-phenylene) -graft-poly(2-vinylpyridine) (PFP-g-P2VP) with a wide range of P2VP volume fractions (fP2VP). Their self-assembly behaviors were examined in both bulk films and three-dimensional colloidal particles by transmission electron microscopy and small-angle X-ray scattering. Interestingly, PFP-g-P2VP rod-coil polymers had self-assembly behavior of well-ordered cylinders and lamellaes that resembled those of the coil-coil type copolymers. Our synthetic approach paves new method to develop new class of rod-coil copolymers based on alternating conjugated copolymers with well-controlled opto-electronic properties.