

Controlling the Nano-Phase Segregation of Polythiophene- fullerene Blends

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Abstract

A strategy for controlling the extent of phase segregation in electron donor and acceptor blends of π -conjugated polymers (π CPs) and fullerenes is described. The strategy was investigated by synthesis of a conjugated polymer bearing graft chains that are compatible with a fullerene chemically modified with a similar motif. The graft copolymer was obtained by nitroxide-mediated radical polymerization of vinyl triazole onto a post-functionalized poly(3-hexyl)thiophene (P3HT) backbone. The graft copolymer was blended with a fullerene modified with a pendant triazole functionality (TAZC₆₀). TEM analysis reveals the graft polymer undergoes extensive mixing with the fullerene to form bicontinuous 10 nm phase domains and retained their nano-meter phase after annealing. Graft copolymer (P3HT-*g*-PVTAZ:TAZC₆₀) blends exhibit substantially reduced photoluminescence compared to P3HT:TAZC₆₀ blends. The chemical similarity of the triazole functionality attached to P3HT and the fullerene leads to the formation of films with uniform, stable, nanophase morphologies.