

Abstract Submitted
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Photoluminescence of P3HT nanoparticles¹ IRENE DUJOVNE, JOELLE LABASTIDE, UMass Amherst, Chem. Dept., MINA BAGHGAR, UMass Amherst, Phys. Dept., AIDAN MCKENNA, UMass Amherst, Chem. Eng. Dept., AUSTIN M. BARNES, UMass Amherst, Phys. Dept., D. VENKATARAMAN, MICHAEL D. BARNES, UMass Amherst, Chem. Dept. — Polythiophenes are semiconducting polymers that have been designed to crystallize. The photophysics of semicrystalline polythiophene and polythiophene-blends are the focus of intense research efforts across different disciplines. In these systems there is a competition between charge separation and recombination. Exciton diffusion length in organic-semiconductors is a major road-block for efficient solar energy harvesting devices since, for direct bandgap organic materials, this distance is about 10 nanometers. Thus, efficient extraction of photogenerated electrons and holes requires engineering polymer domain dimensions in this size range. In our initial investigations of the photophysics of isolated P3HT nanoparticles (15 - 130 nm), we have observed several intriguing size-dependent features in the single-particle photoluminescence (PL) connected with exciton diffusion and dissociation dynamics. In addition to the short-time behavior, we also observe size-dependent differences in PL decay at long times. In the 10 - 100 ns time regime, the PL originates not from radiative transitions of bound excitons, but rather from charge-separation followed by bi-polaron recombination—and thus provides an interesting measure of exciton fission probability within the nanoparticle.

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