Probing Exciton Transport in Conjugated Polymer Nanoparticles

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Conjugated polymer nanoparticles (CPNs) represent a versatile class of materials, well-suited for photovoltaic and light-emitting diode technologies, as well as biological imaging applications. We have employed various steady-state and time-resolved spectroscopic methods along with Monte Carlo modeling approaches in order to study these materials. Dye-doping and solvent-induced swelling methods were utilized to quantify the distance scales and rates of exciton transport in CPNs for improvement in device applications, as well as to design better fluorescent probes for imaging applications. Dye-doping methods allowed for the quantification of the exciton diffusion length for these systems, accounting for intrinsic defects within the polymer structure. Solvent-induced swelling methods coupled with time-resolved anisotropy make probing exciton hopping rates possible, and results suggest that exciton transfer rates increase 10x to 60x in the nanoparticle state, compared to free polymer in solution, which has implications for use of specific polymers for device applications versus imaging applications.