Probing Exciton Transport in Conjugated Polymer Nanoparticles

Louis C. Groff and Jason D. McNeill

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 quantification of the exciton diffusion length, accounting for intrinsic defects within the polymer structure. Solvent-induced swelling methods coupled with time-resolved anisotropy make probing the rate of exciton energy transfer between chromophores possible. 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 and imaging applications.