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Department of Chemistry

Seminar

9:45 a.m. Thursday, September 19, 2013 • 331 Smith Hall



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Excitons Dancing in Conjugated Polymers

Research interests: investigation of a variety of dynamic events in condensed media with investigations ranging from basic chemical reaction dynamics in solution to energy and charge transfer dynamics in new materials targeted at applications in solar energy conversion.

Website: <http://www.chem.umn.edu/groups/blank/>.

Abstract

One of the fundamental differences between silicon based solar cells and organic photovoltaics is the fact that light absorption in the organic systems creates a bound electron hole pair (i.e. an exciton) rather than creating free charge carriers directly. Mobility of the exciton is one of the important factors in cell efficiency. With typical exciton diffusion distances that are roughly 10% of the cell thickness required for efficient light absorption, limits on transport of the exciton to a heterogeneous interface for charge separation are referred to as the exciton bottleneck. Using a combination of time integrated and time resolved spectroscopies, we have investigated the exciton dynamics in one of the most commonly employed organic systems, poly-3(hexylthiophene) (P3HT). Exciton dynamics on individual polymer chains are isolated using a series of size selected P3HT samples and model thiophene based dendrimer systems dispersed in solution. Interestingly, down-the-chain exciton transport appears to be more facile than interchain transport in the films, and thus potentially at odds with efficient charge transport. The influence of intermolecular interactions between two polymer chains is isolated in solution using P3HT-PtBA-P3HT (rod-coil-rod) triblocks, where the interaction between the P3HT blocks can be controlled by the quality of the solvent. These results are then compared with excitons in a series of thin films, where the interchain interactions are tuned using mixtures of regio-regular and regio-random P3HT. Overall, the lecture will offer a detailed look at the nature of excitons and their mobility in one of the more commonly employed materials in organic electronics.

Refreshments will be served prior to the seminar.