Special Seminar in Energy Research

at the

University of Pennsylvania

Charge Generation and Recombination in Organic and Hybrid Quantum Dot Photovoltaics

Abtract

Solar cells made from solution-processed organic semiconductors now exhibit power conversion efficiencies exceeding 11%. However, this value is still less than half that predicted by theory. The challenge of designing systems with improved performance is hampered by a lack of mechanistic understanding of charge generation and recombination in these complex systems. In this talk, I will focus on two complementary aspects of the organic/inorganic interface and how it can control charge generation and recombination. I will describe transient photovoltage, transient photocurrent, and scanning probe based surface photovoltage measurements to explore the role that molecular modifiers play at the organic/inorganic interface and will show how they influence non-geminate recombination losses in various solution processed solar cells. In selected organic bulk heterojunctions, I will show that chemical modification of the hole extracting contact can increase carrier lifetimes and improve open circuit voltages. Furthermore, using semiconductor quantum dots as model electron acceptors, I will discuss the role of excess photon energy on photoinduced hole transfer, and the role of chemical modification at the donor/acceptor interface on charge recombination in bulk heterojunction blends. I will discuss broader implications of these results for optimizing both organic and hybrid thin film PV devices.

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1:00 PM