Spectroscopic Signatures of Exciton Dissociation in Single-walled Carbon Nanotube Photovoltaic Blends

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Semiconducting single-wall carbon nanotubes (SWCNTs) have several fundamental properties that make them attractive for photovoltaics, including high electron and hole mobilities, size-tunable ionization potentials and electron affinities in an energy range relevant to many PV devices, and optical transitions in the visible and near-infrared spectral regions. In this presentation, I will discuss studies exploring charge separation in SWCNT PV active layers. Time-resolved microwave conductivity (TRMC) was used to probe the yield and lifetime of free charge carriers produced by exciton dissociation at the SWCNT:fullerene (donor:acceptor) interface. A model will be presented which considers the importance of the diameter-dependent energetics associated with charge transfer and charge/exciton transport, and we will discuss the relevance of the results to design considerations for SWCNT/fullerene solar cells. If time permits, I will also discuss a recent study exploring charge separation in polymer:SWCNT (donor:acceptor) PV blends, in which we attempt to resolve the spectroscopic signatures of both the polymer positive polaron and the delocalized electron on the SWCNT backbone.