Characterizing Excited State Diffusion in PCDTBT Using Transient Absorption Microscopy

Eric S. Massaro *, Chemistry and Biochemistry, Montana State University, Bozeman
Andrew H. Hill, Montana Materials Science Program, Montana State University, Bozeman
Casey L. Kennedy, Chemistry and Biochemistry, Montana State University, Bozeman
Saranyan S. Ragunath, Montana Materials Science Program, Montana State University, Bozeman
Alexander R. Hathaway, Chemistry and Biochemistry, Montana State University, Bozeman
Erik M. Grumstrup, Department of Chemistry and Biochemistry and Montana Materials Science Program, Montana State University, Bozeman

Organic semiconducting polymers (OSPs) are an attractive alternative to traditional inorganic semiconductors for use in photovoltaic devices and other optoelectronic applications because they are cost effective and solution processable. Here we describe our efforts towards under-standing excited state transport in micron-scale domains of the OSP, poly [N-9''-hepta-decanyl-2,7-carbazole-alt-5,5-(4',7'-di-2-thienyl-2',1',3'-benzothiadiazole)] (PCDTBT) utilizing transient absorption microscopy (TAM). Using TAM, we directly image excited state diffusion across mi-cron scale domains of PCDTBT thin films, reducing the effects of morphological heterogeneity in these complex polymeric systems. To further understand exciton diffusion and dissociation dynamics we have begun the development of two individual experiments. This presentation will discuss the theoretical evaluation of both experiments as well as preliminary experimental development. The first experiment has been investigated by Monte Carlo simulation of exciton dissociation at microfabricated donor-acceptor interfaces. The second experiment relies on the fabrication of polymer devices so that carrier diffusion can be characterized under the influence of an electric field. Investigation and implementation of these experiments was made possible by support from the Montana Academy of Sciences and will provide a more thorough understanding of the excited state transport dynamics in micron scale regions of PCDTBT.