

Michigan State University
Science at the Edge
Engineering Seminar

May 17th, 2013

11:30 a.m.

1400 Biomedical and Physical Sciences Building

Refreshments served at 11:15 a.m.

Mark E. Thompson
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University of Southern California

Exciton Management in Organic Solar Cells

Abstract

The exciton is a critical part of each of the processes leading to photocurrents in Organic PhotoVoltaics (OPVs), and being able to control the location, lifetime and energy of the exciton is essential to achieving high efficiency. We have investigated methods for tuning exciton energies and controlling their migration paths, both intramolecularly and within a thin film. I will discuss our most recent work with both organic dyes, such as squaraines and dipyrrens as well as porphyrinic materials for OPVs. This involves a careful materials design study that leads to both low energy absorption (into the nearIR) and the efficient use of multiple absorbers to efficiently harvest photons through the entire visible spectrum. To that end we have used transient absorption spectroscopy and measured the rates of singlet and triplet energy transfers between organic dyes (BODIPY and tetracenes). Both intra- and inter-molecular energy transfers take place on the picoseconds time scale. Thus, the systems are fully equilibrated into the lowest energy triplet state(s) before nonradiative decay. Using this approach we can efficiently harvest energy across the visible and into the NIR. I will also discuss our latest results with new singlet fission materials for efficient light harvesting in OPVs. Our control of singlet and triplet excitons has been important in exploring the use of singlet fission to enhance the efficiencies of OPVs.

Bio

Dr. Mark E. Thompson is Professor of Chemistry and Materials Science at the University of Southern California. He received his B.S. degree in Chemistry in 1980 (U.C. Berkeley) and his Ph.D. in chemistry in 1985 (California Institute of Technology). He spent 2 years as a postdoctoral fellow in the Inorganic Chemistry laboratory at Oxford University. Prof. Thompson took a position in the chemistry department at Princeton University in 1987, as an assistant professor. In 1995 he moved his research team to the University of Southern California, where he is currently a Professor of Chemistry. He has won a number of awards, including the MRS Medal in 2006, given by the Materials Research Society, and the Jan Rachman Prize for Outstanding Achievement in Flat Panel Displays, also in 2006, given by the Society for Information Display. In 2011 he was named the 12 of the top 100 most influential chemists in the world by Thomson-Rueters. In 2012 he was received the Alexander von Humboldt Research Award. He currently has over 250 papers in print and over 125 US patents. His research interests involve the optical and optoelectronic properties of molecular materials and devices, particularly organic LEDs and solar cells, as well as nanoscale materials, catalysis and biosensors.

For further information please contact Prof. Christina Chan, Department of Chemical Engineering and Materials Science at krischan@egr.msu.edu

Persons with disabilities have the right to request and receive reasonable accommodation. Please call the Department of Chemical Engineering and Materials Science at 355-5135 at least one day prior to the seminar; requests received after this date will be met when possible.