

## **U.S. Department of Energy Final Report**

**DOE Grant No. DE-SC0007302**

**Symposium I: Fundamental Processes of Solar Harvesting in Excitonic Solar Cells:  
2011 Materials Research Fall Meeting, Nov 28-Dec 2, Boston, MA**

### **Symposium Organizers**

Venkat Bommisetty, South Dakota State University, Brookings SD

Mario Leclerc, Université Laval, Canada

Vladimir Dyakonov, Julius-Maximilians University of Würzburg, Germany

Garry Rumbles, National Renewable Energy Laboratory, Golden, CO

Niyazi Serdar Sariciftci, Johannes Kepler University of Linz, Austria

### **Symposium I: Fundamental Processes of Solar Harvesting in Excitonic Solar Cells**

The relevance of organic photovoltaics has steadily increased in consumer applications with aesthetics, mechanical flexibility, and buzz value. Broader commercial adaptation, however, remains elusive in the face of increased competition from inorganic counterparts. The enduring challenges of stability and efficiency will ultimately determine the future application of organic photovoltaics and its broader societal impact.

#### **Following are the important outcomes of this conference:**

1. Announcement of world record efficient organic solar cell (10% efficient cell by Mitsubishi chemical)
2. Highest reported efficiencies in various device architectures
3. Tutorial session on Organic Photovoltaics: Current Challenges and Opportunities
4. All invited session on: Organic Photovoltaics: Materials Challenges
5. All invited session on: Morphology II
6. Financial support to several graduate/undergraduate researchers and invited speakers

### **Symposium Program**

The five-day symposium started with a day-long joint tutorial (with Symposium H) on *Organic Photovoltaics: Current Challenges and Opportunities*. Speakers include Venkat Bommisetty (overview), Jianhui Hou, Chinese Academy of Sciences (Materials design for high-efficiency organic photovoltaics), Selina Olthof, Princeton (Interfaces in OPV), Carsten Deibel, Würzburg, (Multi-scale modeling) Sean Shaheen, Denver (Novel Device Designs). The tutorial covers fundamental and device aspects of organic photovoltaics, including materials design principles, interfaces, multi-scale modeling, and novel device designs. This tutorial began with a general overview of organic photovoltaics. The materials session focused on: how to change the bandgap; the acceptor strength; how to improve the stability, charge mobility; controlling the morphology, etc.,

with relevant examples from highly performing OPV materials. The interfaces session detailed issues such as dipole formation, alignment/bending of energy levels, challenges in predicting the energetic alignment and charge transport through OPV devices and explaining experimental methods to investigate these issues. The multi-scale modeling session described physical models such as charge transport and recombination and simulation principles. Methods of and challenges to implementing physical models in Monte Carlo and macroscopic device simulations were explained. The device designs session focused on methods to enhance the energy conversion efficiency of various device structures, optimizing process conditions, and novel device architectures.

Technical sessions started with a session on Recombination in OPV. Gregory Scholes (Toronto) opened the symposium with an invited talk on Lessons Learned from the Nature about Solar Light harvesting. This talk summarized advantages and limitations of photosynthesis process and potential leads that can be incorporated into existing organic photovoltaics (OPV). Speakers of this session presented different viewpoints on the recombination processes in OPV and methods to characterize these processes qualitatively and quantitatively.

*Morphology* session includes: talks by Thuc-Quyen Nguyen (UCSB) on the connection between device scale open-circuit voltage and nanoscale electrical conductivity. This talk illustrated important physics issues in understanding device characteristics from nanoscale perspective. Herald Ade (NC State) and Pavel Dutta (SD State) presented correlation between nanoscale morphology and carrier recombination and chemical miscibility between donor and acceptor components.

Speakers at Organic Photovoltaics: Materials Challenges (all-invited) session includes Neal Armstrong (Arizona), Jan Hummelen (Groningen), Mingebach (Würzburg), Samson Jenekhe (Washington), Bruetting (Humboldt), Seth Marder (Georgia Tech). This session outlined challenges associated with the engineering of donor and acceptors; development of novel small bandgap polymers, new types acceptors, transparent electrode materials with enhanced stability.

### **Financial Support**

Support was provided to invited speakers, graduate and undergraduate students, postdoctoral researchers, and one symposium organizer. Following are the details:

Visiting Scholar: Mukesh Kumar; K.S. Narayan

Students: Presha Joshi; Rubana Bahar Priti; Ishtiaq Maqsood; Lance D. Cundy

Organizer: Venkat Bommisetty

Proceedings:

Title: Organic Photovoltaics: Materials to Devices

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### Manuscript Title

#### Materials

Naphthodithiophene-Diketopyrrolopyrrole Small Molecule Donors for Efficient Solution-Processed Solar Cells.  
 Doping Effect on Chloroindium Phthalocyanine (ClInPc)/C60 Solar Cells.  
 Enhanced Chlorophyll A Purification and Dye Sensitized Solar Cell Performance  
 Directed Assembly of Model Block Copolymer-PCBM Blend System for Photovoltaic Applications  
 Development of New Fullerene-Based Electron Acceptors for Efficient Organic Photovoltaic Cells  
 A Novel Chemical Synthesis for >1  $\mu\text{m}^2$  Reduced Graphene Oxide Sheets

#### Device and Characterization

Influence of OVPD parameters on the performance of organic solar cells utilizing pentacene/PTCDI absorption layers  
 All-Polymer Bulk Heterojunction Solar Cells with High Fill Factors Based on Blends of Poly-3-Hexylthiophene: Poly(perylene diimide-alt-terthiophene).  
 Towards highly efficient solar cells based on merocyanine dyes  
 Enhanced Open Circuit Voltage in Aluminum Confined Post-Annealing of poly(3-hexylthiophene)/fullerene Bulk Heterojunction Solar Cells under Electric Field  
 Effect of the Temperature of Annealing on the Performance of Fluorene and Bithiophene Copolymer in Bilayer Solar Cells  
 Electrochemical studies and Thermodynamic Parameters of tris(2,2'-bipyridyl) ruthenium (II) in nonaqueous Solutions  
 Effect of Cathode Metal Evaporation Rate on the Deep Trapped Hole Formation in Bulk Heterojunction Organic Solar Cells.  
 Analyzing Open-Voltage of Double-Layer Organic Solar Cells Using Optical Electric-Field-Induced Second-Harmonic Generation

#### Module and processing

Polymer Solar Modules: Laser Structuring and Quality Control by Lock-In Thermography  
 Combinatorial Screening of Polymer/Fullerene Blends for Solar Cells by Inkjet Printing.  
 Fabrication of Organic Polymer Solar Cells by a Novel Solution-Based Vapor-like Mist Deposition Method.  
 Systematic Process Development for Optimization of Manufacturable Organic Solar Cells.

#### Morphology and Transport

The Essence and Efficiency Limits of Bulk Heterostructure Organic Solar Cells.  
 Effect of active layer morphology on recombination mechanism in polymer: fullerene organic bulk heterojunction solar cells  
 Phase Morphology in Poly(thiophene)-Fullerene Thin Film Devices  
 Extended Exciton Diffusion in Rubrene Single-Crystalline Organic Solar Cells

### **Nanostructures in advanced solar cells**

Dyes in Vertically Aligned Carbon Nanotube Arrays for Solar Cell Applications

Metal Electroplating of Three Dimensional (3D) Electrode in Electrolyte-Less Dye Sensitized Solar Cells (ELDSC).

Solid state PbS Quantum dots /TiO<sub>2</sub> Nanoparticles heterojunction solar cell

Optical Properties of Alloyed PbSe<sub>x</sub>S<sub>1-x</sub> Nanorods

Atomistic Simulation of Dissipative Charge Carrier Dynamics for Photocatalysis



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## Symposium I: Fundamental Processes of Solar Harvesting in Excitonic Solar Cells



- **2011 MRS Fall Meeting & Exhibit**
- **November 28 - December 2, 2011**
- **Hynes Convention Center, Boston, MA**
- **Meeting Chairs:** Cammy R. Abernathy, Paul V. Braun, Masashi Kawasaki, Kathryn J. Wahl

## SYMPOSIUM I

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November 27 - December 2, 2011

**Chairs**

Venkat BommiSETTY	South Dakota State University
Mario Leclerc	Universite Laval
Vladimir Dyakonov	Julius-Maximilians University of Wuerzburg
Garry Rumbles	National Renewable Energy Laboratory
Niyazi Serdar Sariciftci	Johannes Kepler University of Linz

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**Symposium Support**

Agilent Technologies

HORIBA Jobin Yvon, Inc.

National Science Foundation

Office of Naval Research

U.S. Department of Energy, Office of Basic Energy Sciences

\* Invited paper

## TUTORIAL

## I/H: Organic Photovoltaics—Current Challenges and Opportunities

**Sunday, November 27****8:30 am-5:00 pm****Hynes Convention Center**

The tutorial covers fundamental and device aspects of organic photovoltaics, including materials design principles, interfaces, multi-scale modeling, and novel device designs. The tutorial will begin with a general overview of organic photovoltaics. The materials session will focus on: how to change the bandgap; the acceptor strength; how to improve the stability, charge mobility; controlling the morphology, etc., with relevant examples from highly performing OPV materials. The interfaces session will detail issues such as dipole formation, alignment/bending of energy levels, challenges in predicting the energetic alignment and charge transport through OPV devices and explaining experimental methods to investigate these issues. The multi-scale modeling session will describe physical models such as charge transport and recombination and simulation principles. Methods of and challenges to implementing physical models in Monte Carlo and macroscopic device simulations will be explained. The device designs session will focus on methods to enhance the energy conversion efficiency of various device structures, optimizing process conditions, and novel device architectures.

**Instructors:****Venkat BommiSETTY**, South Dakota State University**Jianhui Hou**, Chinese Academy of Sciences, China**Selina Olthof**, Princeton University**Sean Shaheen**, University of Denver**Carsten Deibel**, University of Würzburg, Germany

## SESSION II: Recombination

Chairs: Venkat BommiSETTY and Vladimir Dyakonov

Monday Morning, November 28, 2011

Liberty (Sheraton)

**8:30 AM \*I.1**

**Lessons from Nature about Solar Light Harvesting.** Gregory Scholes, Department of Chemistry, University of Toronto, Toronto, Ontario, Canada.

**9:00 AM I.2**

**Generation and Recombination of Polaron Pairs in Low-Bandgap Copolymers for Photovoltaics.** Enrico Da Como<sup>1</sup>, Raphael Tautz<sup>1</sup>, Jochen Feldmann<sup>1</sup> and Ullrich Scherf<sup>2</sup>; <sup>1</sup>Department of Physics and CeNS, LMU Munich, Munich, Germany; <sup>2</sup>Department of Chemistry, University of Wuppertal, Wuppertal, Germany.

**9:15 AM I.3**

**Reciprocal Carrier Collection in Organic Photovoltaics.** Christopher K. Renshaw<sup>1</sup>, Cody W. Schlenker<sup>2</sup>, Mark E. Thompson<sup>2</sup> and Stephen R. Forrest<sup>1,3,4</sup>; <sup>1</sup>Physics, University of Michigan, Ann Arbor, Michigan; <sup>2</sup>Chemistry, University of Southern California, Los Angeles, California; <sup>3</sup>Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, Michigan; <sup>4</sup>Materials Science and Engineering, University of Michigan, Ann Arbor, Michigan.

**9:30 AM I1.4**

**Charge Carriers and Charge-Transfer Excitons in Realistic Organic Solar Cells Probed by Electrically Detected Magnetic Resonance.** Wolfgang Harnett<sup>1,2</sup> and Sebastian Schaefer<sup>3,2</sup>; <sup>1</sup>Institut fuer Physikalische Chemie, Johannes Gutenberg-Universität Mainz, Mainz, Germany; <sup>2</sup>Institut fuer Experimentalphysik, Freie Universität Berlin, Berlin, Germany; <sup>3</sup>Physik der Weichen Materie, Universität Potsdam, Potsdam-Golm, Germany.

**9:45 AM I1.5**

**Localized State Spectroscopy in Organic Solar Cells.** Robert Street, Katherine Song and Alexa Krakaris; Palo Alto Research Center, Palo Alto, California.

**10:00 AM BREAK**

**10:30 AM \*I1.6**

**Charge Photogeneration and Recombination in Organic Solar Cells.** James R. Durrant, Chemistry, Imperial College London, London, United Kingdom.

**11:00 AM I1.7**

**Recombination Processes in Disordered Organic Bulk-Heterojunction Solar Cells.** Alexander Wagenpfahl<sup>1</sup>, Craig H. Peters<sup>2</sup>, Eric T. Hoke<sup>2</sup>, Zach Beiley<sup>2</sup>, Michael D. McGehee<sup>2</sup>, Carsten Deibel<sup>1</sup> and Vladimir Dyakonov<sup>1,3</sup>; <sup>1</sup>Experimental Physics VI, Julius-Maximilians-University of Würzburg, Würzburg, Germany; <sup>2</sup>Department of Material Science and Engineering, Stanford University, Stanford, California; <sup>3</sup>Functional Materials for Energy Technology, Bavarian Centre for Applied Energy Research (ZAE Bayern), Würzburg, Germany.

**11:15 AM \*I1.8**

**Understanding and Affecting the Mechanisms in Excitonic Solar Cells.** Nir Tessler, Lior Tzabari, Nir Nir Yaacobi-Gross and Israel Ravia; Electrical Engineering, Technion, Haifa, Israel.

**11:45 AM I1.9**

**Studies of Transport and Recombination in Polymer:Fullerene Bulk Heterojunction Systems.** Jao van de Lagemaat<sup>1,4</sup>, Anthony J. Morfa<sup>2</sup>, Alexandre M. Nardes<sup>2</sup>, Sean E. Shaheen<sup>3,1</sup>, Nikos Kopidakis<sup>1</sup>, Brian A. Gregg<sup>1</sup>, Ziqi Liang<sup>1</sup> and Jian Li<sup>5</sup>; <sup>1</sup>Chemical and Materials Sciences Center, NREL, Golden, Colorado; <sup>2</sup>School of Chemistry & Bio21 Institute, University of Melbourne, Melbourne, Victoria, Australia; <sup>3</sup>Department of Physics and Astronomy, University of Denver, Denver, Colorado; <sup>4</sup>Renewable and Sustainable Energy Institute, University of Colorado Boulder, Boulder, Colorado; <sup>5</sup>National Center for Photovoltaics, NREL, Golden, Colorado.

SESSION I2: Morphology I  
Chairs: Venkat BommiSETTY and NiyaziSerdar Sariciftci  
Monday Afternoon, November 28, 2011  
Liberty (Sheraton)

**1:30 PM \*I2.1**

**Origin of Open-Circuit Voltage in Organic Solar Cells Elucidated by Photoconductive Atomic Force Microscopy.** Thuc-Quyen Nguyen<sup>1</sup>, Xuan-Dung Dang<sup>1</sup>, Yuan Zhang<sup>1</sup>, Sarah R. Cowan<sup>2</sup> and Chunki Kim<sup>1</sup>; <sup>1</sup>Chemistry & Biochemistry, UCSB, Santa Barbara, California; <sup>2</sup>Materials, UCSB, Santa Barbara, California.

**2:00 PM I2.2**

**The Universality of Polymer-Fullerene Miscibility and Its Implications for Organic Photovoltaics.** Harald Ade<sup>1</sup>, Brian A. Collins<sup>1</sup>, Xiaoxi He<sup>2</sup>, Eliot Gann<sup>1</sup> and Christopher R. McNeill<sup>3</sup>; <sup>1</sup>Physics, NC State University, Raleigh, North Carolina; <sup>2</sup>Cavendish Laboratory, University of Cambridge, Cambridge, CB3 0HE, United Kingdom; <sup>3</sup>Materials Engineering, Monash University, Clayton, Victoria, Australia.

**2:15 PM I2.3**

**Connecting Morphology with Dominant Recombination Mechanisms in P3HT:PCBM Based Organic Bulk Heterojunction Solar Cells.** Pavel Dutta<sup>1</sup>, Mukesh Kumar<sup>1</sup>, Monika Rathi<sup>2</sup>, Scott P. Ahrenkiel<sup>2</sup>, David Galipeau<sup>1</sup> and Venkat BommiSETTY<sup>1</sup>; <sup>1</sup>Electrical Engineering, South Dakota State University, Brookings, South Dakota; <sup>2</sup>Nanoscience and Nanoengineering Department, South Dakota School of Mines & Technology, Rapid City, South Dakota.

**2:30 PM I2.4**

**Charge Transport in Bulk Heterojunctions: The Influence of Morphology, Electric Field, and Charge Carrier Concentration.** L. Jan Anton Koster, Molecular Materials and Nanosystems, Eindhoven University of Technology, Eindhoven, Netherlands; Molecular Electronics, Zernike Institute for Advanced Materials, University of Groningen, Groningen, Netherlands.

**2:45 PM I2.5**

**Morphological Diversity in P3HT-Endohedral Fullerene Organic Solar Cells.** Lee Richter<sup>1</sup>, Andrew A. Herzing<sup>1</sup>, R. Joseph Klein<sup>1</sup>, Dean M. DeLongchamp<sup>1</sup>, Daniel A. Fisher<sup>1</sup>, David J. Gundlach<sup>1</sup>, Claudia M. Cardona<sup>2</sup>, John Wall<sup>2</sup>, Francis B. Swain<sup>2</sup> and Steve Joslin<sup>2</sup>; <sup>1</sup>NIST, Gaithersburg, Maryland; <sup>2</sup>Luna Innovations, Danville, Virginia.

**3:00 PM BREAK**

SESSION I3: Hybrid  
Chairs: Dmitri Kilin and Garry Rumbles  
Monday Afternoon, November 28, 2011  
Liberty (Sheraton)

**3:30 PM I3.1**

**Design and Characterization of Functional Materials for Highly Efficient Dye-Sensitized Solar Cells.** Eric W. Diau, Department of Applied Chemistry, National Chiao Tung University, Hsinchu, Taiwan.

**3:45 PM \*I3.2**

**Enhancing and Understanding Charge Generation in Mesoscopic Hybrid Solar Cells.** Henry J. Snaith, Oxford University, Oxford, OXON, United Kingdom.

**4:15 PM I3.3**

**Photo-Induced Dynamics of Electronic Excitations in RuO<sub>2</sub> Nano-Catalyst at a TiO<sub>2</sub> Substrate.** Talgat Inerbaev<sup>2</sup>, James Hoefelmeyer<sup>1</sup> and Dmitri Kilin<sup>1</sup>; <sup>1</sup>Chemistry, University of South Dakota, Vermillion, South Dakota; <sup>2</sup>South China Normal University, Guangzhou, China.

**4:30 PM I3.4**

**Interplay of Three-Dimensional Morphologies and Photocarrier Dynamics of Polymer/TiO<sub>2</sub> Bulk Heterojunction Solar Cells.** Chun-Wei Chen<sup>1</sup>, Shao-Sian Li<sup>1</sup>, Ching-Pin Chang<sup>1,2</sup>, Chih-Cheng Lin<sup>1</sup> and Ming-Wen Chu<sup>2</sup>; <sup>1</sup>Materials Science and Engineering, National Taiwan University, Taipei, Taiwan; <sup>2</sup>Center for Condensed Matter Sciences, National Taiwan University, Taipei, Taiwan.



**4:45 PM I3.5**

**Energy-Level Alignment at the ZnO/P3HT Photovoltaic Interface.**Feliciano Giustino and Keian Noori; Materials, University of Oxford, Oxford, United Kingdom.

SESSION I4: Excitons and Transport  
Chairs: Vladimir Dyakonov and Garry Rumbles  
Tuesday Morning, November 29, 2011  
Liberty (Sheraton)

**8:00 AM \*I4.1**

**Size-Free Electronic Tuneability and Multiple Excitons in Alloyed Colloidal Quantum Dots and Rods.**Efrat Lifshitz, Roman Vaxenberg, Evgeniy Tilchin, Georgy i. Maikov, Diana Yanover, Anna Brusilovsky, Dikla Ahitov, Alina Amel and Aldona Sashchiuk; Schulich Faculty of Chemistry, Technion IIT, Haifa, Israel.

**8:30 AM \*I4.2**

**Charge Transfer Excitons in Bulk Heterojunctions Solar Cells.**Maria Antonietta Loi, University of Groningen, Groningen, Netherlands.

**9:00 AM I4.3**

**Understanding Charge Transport Characteristics in Hybrid Photovoltaic Devices Based on Controlled Donor-Acceptor Interfaces.** Beau Richardson, John Bae, Leize Zhu and Qiuming Yu; Chemical Engineering, University of Washington, Seattle, Washington.

**9:15 AM I4.4**

**Surface Nature of Photoconductivity and Long-Range Exciton Diffusion in Rubrene.**Vitaly Podzorov, Physics, Rutgers University, Piscataway, New Jersey.

**9:30 AM \*I4.5**

**Charge Transfer States, Photovoltages and Photocurrents in Donor/Acceptor Heterojunctions.** Koen Vandewal, Kristofer Tvingstedt and Olle W. Inganäs; Biomolecular and organic electronics, IFM, Linköping University, Linköping, Sweden.

**10:00 AM BREAK**

**10:30 AM \*I4.6**

**Photoinduced Charge Separation Processes in Organic Photovoltaic Blends: High-Frequency EPR Spectroscopy.**Oleg Poluektov, Chemical Sciences and Engineering Division, Argonne National Laboratory, Argonne, Illinois.

**11:00 AM I4.7**

**Correlating Charge Creation with the Gibbs Free Energy Driving Force in Organic Photovoltaic Blends.**David Coffey<sup>1</sup>, Bryon W. Larson<sup>2,1</sup>, Olga V. Boltalina<sup>2</sup>, Steven H. Strauss<sup>2</sup> and Garry Rumbles<sup>1</sup>; <sup>1</sup>National Renewable Energy Laboratory, Golden, Colorado; <sup>2</sup>Colorado State University, Fort Collins, Colorado.

**11:15 AM \*I4.8**

**Singlet Fission in Covalent Dimers and Solid-State Polyacene Materials.**Chris Bardeen, Chemistry, U. California Riverside, Riverside, California.

**11:45 AM I4.9**

**Charge Separation and Relaxation in Phthalocyanine-C<sub>60</sub> Photovoltaic Systems.**Steven Robey and Gregory Dutton; NIST, Gaithersburg, Maryland.

SESSION I5/H5: Joint Session: Materials  
Chairs: Alex Jen and Christoph Lungenschmied  
Tuesday Afternoon, November 29, 2011  
Grand Ballroom (Sheraton)

**1:30 PM \*I5.1/H5.1**

**Charge Recombination and Transport Dynamics in Organic Solar Cells.**Alan J. Heeger, Center for Polymers and Organic Solids, Department of Physics and Materials Engineering, University of California, Santa Barbara, Santa Barbara, California.

**2:00 PM \*I5.2/H5.2**

**All-Conjugated Block Copolymers and Thiophene-Based Conjugated Polyelectrolytes for Organic Photovoltaics.**Ullrich Scherf, Bergische Universitaet, Wuppertal, Germany.

**2:30 PM \*I5.3/H5.3**

**Are We There Yet? - Design of Better Conjugated Polymers for Polymer Solar Cells.**Luping Yu, Chemistry, The University of Chicago, Chicago, Illinois.

**3:00 PM BREAK**

**3:30 PM \*I5.4/H5.4**

**Materials for Photon Harvesting in Organic Solar Cells.**Paul Burn and Paul Meredith; Centre for Organic Photonics & Electronics, The University of Queensland, Brisbane, Qld, Australia.

**4:00 PM \*I5.5/H5.5**

**Non-Fullerene Acceptors for Organic Photovoltaics.**John E. Anthony, Chemistry, Univ of Kentucky, Lexington, Kentucky.

**4:30 PM \*I5.6/H5.6**

**Solution Processable Small Molecules for High Efficiency Organic Solar Cells.**Gui Bazan, Greg Welch, Yanming Sun, Wei Lin Leong, Chris Takacs and Alan Heeger; Materials, University of California, Santa Barbara, California.

SESSION I6: Microstructure and Interfaces  
Chairs: Marc Baldo and Venkat BommiSETTY  
Wednesday Morning, November 30, 2011  
Liberty (Sheraton)

**8:00 AM \*I6.1**

**Carrier Dynamics, Fluctuations and Imaging Studies of Polymer Based Bulk Heterostructure Blends.**K.S. Narayan, Monojit Bag and Sabyasachi Mukhopadhyay; JNCASR, Bangalore, India.

**8:30 AM \*I6.2**

**The Influence of the Acceptor on the Photophysics of Organic Bulk Heterojunctions.**Nikos Kopidakis, National Renewable Energy Laboratory, Golden, Colorado.

**9:00 AM \*I6.3**

**Spin Engineering in Organic Solar Cells.** Marc Baldo, Center for Excitonics, MIT, Cambridge, Massachusetts.

**9:30 AM BREAK**

**10:00 AM \*I6.4**

**Polarizing Organic Photovoltaics.** Rui Zhu, Ankit Kumar and Yang Yang; Materials Sci and Engineering, Univ. of California Los Angeles, Los Angeles, California.

**10:30 AM I6.5**

**Controlling Recombination via Charge Transfer Excitons in Polymer:Fullerene Blends with Molecular Doping.** Elizabeth von Hauff<sup>1,2</sup>, Felix Deschler<sup>3</sup>, Enrico Da Como<sup>3</sup>, Jochen Feldmann<sup>3</sup>, Sybille Allard<sup>4</sup> and Ullrich Scherf<sup>4</sup>;

<sup>1</sup>Physics, University of Freiburg, Freiburg, Germany; <sup>2</sup>Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany;

<sup>3</sup>Photonics and Optoelectronics Group, Department of Physics and CeNS, Ludwig-Maximilians-University Munich, Munich, Germany; <sup>4</sup>Department of Chemistry and Institute of Polymer Chemistry, Wuppertal University, Wuppertal, Germany.

**10:45 AM I6.6**

**Enhancing the Efficiency of Bulk Heterojunction Solar Cells through Engineering of Metal Electrode - Active Layer Interface.** Mukesh Kumar, Chong Chen, Pavel Dutta and Venkat Bommisetty; Electrical Engineering, South Dakota State University, Brookings, South Dakota.

**11:00 AM I6.7**

**Efficiency-Limiting Processes in Bulk Heterojunction Organic Solar Cells.** Frederic Laquai<sup>1</sup>, Ian Howard<sup>1</sup>, Ralf Mauer<sup>1</sup>, Fabian Etzold<sup>1</sup>, Michael Meister<sup>1</sup>, Don Cho<sup>1</sup>, Nam Seob Baek<sup>3</sup>, Tae-Dong Kim<sup>2</sup>, Kwang-Sup Lee<sup>2</sup> and Klaus Mullen<sup>1</sup>;

<sup>1</sup>Max Planck Research Group for Organic Optoelectronics, Max Planck Institute for Polymer Research, Mainz, Germany;

<sup>2</sup>Department of Advanced Materials, Hannam University, Daejeon, Korea, Republic of; <sup>3</sup>IT Convergence Technology Research Laboratory, Electronics and Telecommunications Research Institute, Daejeon, Korea, Republic of.

**11:15 AM I6.8**

**Control of P3HT Ordering in P3HT/PCBM Photovoltaic Active Layers Formed from Initial P3HT:PCBM Bilayers.** Lesley Thompson, Mark D. Dadmun, Chris Milojevich and Jon P. Camden; University of Tennessee at Knoxville, Knoxville, Tennessee.

**11:30 AM I6.9**

**Enhanced Exciton Dissociation in Organic Photovoltaic Layers Doped with Ferroelectric Dipoles.** Kanwar S. Nalwa<sup>1</sup>, John Carr<sup>1</sup>, Rakesh Mahadevapuram<sup>1</sup>, Hari K. Kodali<sup>2</sup>, Sayantan Bose<sup>3</sup>, Yuqing Chen<sup>1</sup>, Jacob W. Petrich<sup>3</sup>, Baskar Ganapathysubramanian<sup>2</sup> and Sumit Chaudhary<sup>1</sup>; <sup>1</sup>Department of Electrical and Computer Engineering, Iowa State University, Ames, Iowa; <sup>2</sup>Department of Mechanical Engineering, Iowa State University, Ames, Iowa; <sup>3</sup>Department of Chemistry, Iowa State University, Ames, Iowa.

**11:45 AM I6.10**

**Optical T-Matrix and Kinetic Monte Carlo Modeling of Nanostructured Planar Heterojunction Solar Cells.** Geraldine L. Paulus, Moon-Ho Ham and Michael S. Strano; Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.

SESSION I7: Microstructure - Carrier Dynamics  
Chairs: Richard Friend and Serdar Sariciftci  
Wednesday Afternoon, November 30, 2011  
Liberty (Sheraton)

**1:30 PM \*I7.1**

**Singlet Fission and Interchromophore Coupling in Designed Molecular Chromophores.** Justin Johnson<sup>1</sup>, Akin Akdag<sup>2</sup>, Brian Stepp<sup>2</sup>, Millie Smith<sup>2</sup>, Josef Michl<sup>2</sup> and Arthur Nozik<sup>1,2</sup>; <sup>1</sup>National Renewable Energy Laboratory, Golden, Colorado; <sup>2</sup>Department of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado.

**2:00 PM \*I7.2**

**Coherent Spin Spectroscopy of Excitonic Precursor States of Organic Thin Film Semiconductor Devices.** Christoph Boehme, William J. Baker, Sang-Yun Lee, Seo-Young Paik, Dane R. McCamey, Kipp J. Van Schooten and John M. Lupton; Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah.

**2:30 PM \*I7.3**

**Dynamics of Light-Induced Charge Carriers in Poly(Thienothiophene) Derivatives Blended with PCBM.** Tom Savenije, Department of Chemical Engineering, Delft University of Technology, Julianalaan 136, Netherlands.

**3:00 PM BREAK**

**3:30 PM \*I7.4**

**Role of Polaron Formation in Limiting the Charge Generation Efficiency of Organic Bulk Heterojunction Solar Cells.** Richard H. Friend, A. A. Bakulin and A. Rao; Department of Physics, Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom.

**4:00 PM \*I7.5**

**Influence of Acceptor Structure on Charge Separation Dynamics in Organic Photovoltaic Materials.** John B. Asbury and Ryan D. Pensack; Department of Chemistry, The Pennsylvania State University, University Park, Pennsylvania.

**4:30 PM I7.6**

**Charge Separation in Semicrystalline Polymeric Semiconductors by Photoexcitation: Is the Mechanism Intrinsic or Extrinsic?** Francis Paquin<sup>1</sup>, Maciej Sakowicz<sup>1</sup>, Gianluca Latini<sup>2</sup>, Paul-Ludovic Karsenti<sup>1</sup>, Linjun Wang<sup>3</sup>, David Beljonne<sup>3</sup>, Natalie Stingelin-Stutzmann<sup>2</sup> and Carlos Silva<sup>1</sup>; <sup>1</sup>Department of Physics, Universite de Montreal, Montreal, Quebec, Canada; <sup>2</sup>Department of Materials, Imperial College, London, United Kingdom; <sup>3</sup>Chemistry of Novel Materials, University of Mons, Mons, Belgium.

**4:45 PM I7.7**

**Surfactant-Assisted Supramolecular Control of Poly(2,5-bis(3-tetradecylthiophen-2-yl)thieno[3,2-b]thiophene) (pBTTT): [6,6]-phenyl C61-butyric Acid Methyl Ester (PCBM[60]) Blend Microstructures.** Ester Buchaca-Domingo<sup>1</sup>, Fiona C. Jamieson<sup>1</sup>, Nikos Kopidakis<sup>2</sup>, Giuseppe Portale<sup>3</sup>, James Durrant<sup>1</sup>, Garry Rumbles<sup>2,4</sup> and Natalie Stingelin<sup>1</sup>; <sup>1</sup>Centre for Plastic Electronics (CPE), Imperial College London, London, United Kingdom; <sup>2</sup>Chemical and Materials Science Center, National Renewable Energy Laboratory, Golden, Colorado; <sup>3</sup>ESRF Grenoble, Grenoble, France; <sup>4</sup>Department of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado.

SESSION I8: Organic Photovoltaics: Materials Challenges  
Chairs: Venkat BommiSETTY and Mario Leclerc  
Thursday Morning, December 1, 2011  
Liberty (Sheraton)

**8:30 AM \*I8.1**

**Textured Donor Layers in Organic Solar Cells: Vacuum-Deposited and Solution Processed Small**

**Molecules.** Neal R. Armstrong, Diogenes Placencia, Jeremy Gantz, Xerxes Steirer, Derek Manglesdorf, Mayank Mayukh, Weining Wang, Mariola Macech and Dominic McGrath; Chemistry & Biochemistry, University of Arizona, Tucson, Arizona.

**9:00 AM \*I8.2**

**Efficient Broadband up-Conversion of near-IR Light.** Wenqiang Zou<sup>1</sup>, Cindy Visser<sup>1</sup>, Maxim S. Pchenitchnikov<sup>2</sup> and

Jan C. Hummelen<sup>1,2</sup>; <sup>1</sup>Stratingh Institute for Chemistry, University of Groningen, Groningen, Netherlands; <sup>2</sup>Zernike Institute for Advanced Materials, University of Groningen, Groningen, Netherlands.

**9:30 AM \*I8.3**

**Field- and Temperature Dependence of Charge Photogeneration in Organic Bulk Heterojunction Solar**

**Cells.** Markus Minge<sup>1</sup>, Stefan Walter<sup>1</sup>, Jens Lorrman<sup>1</sup>, Carsten Deibel<sup>1</sup>, Vladimir Dyakonov<sup>1,2</sup>; <sup>1</sup>Experimental Physics VI, Julius-Maximilian University of Würzburg, Würzburg, Bavaria, Germany; <sup>2</sup>Bavarian Centre for Applied Energy Research (ZAE Bayern), Würzburg, Bavaria, Germany.

**10:00 AM BREAK**

**10:30 AM \*I8.4**

**New Donor-Acceptor Copolymer Semiconductors for Highly Efficient Solar Cells.** Samson A. Jenekhe<sup>1,2</sup>, Selvam

Subramaniyan<sup>1</sup>, Hao Xin<sup>1</sup> and Felix Sunjoo Kim<sup>1</sup>; <sup>1</sup>Chemical Engineering, University of Washington, Seattle, Washington; <sup>2</sup>Chemistry, University of Washington, Seattle, Washington.

**11:00 AM I8.5**

**High Fill Factor and Open-Circuit Voltage in Organic Photovoltaic Cells with Diindenoperylene as Donor**

**Material.** Julia Wagner<sup>1</sup>, Mark Gruber<sup>1</sup>, Alexander Hinderhofer<sup>2</sup>, Andreas Wilke<sup>3</sup>, Andreas Optiz<sup>1</sup>, Norbert Koch<sup>3</sup>, Frank Schreiber<sup>2</sup> and Wolfgang Brütting<sup>1</sup>; <sup>1</sup>Institute of Physics, University of Augsburg, Augsburg, Germany; <sup>2</sup>Institute of Applied Physics, University of Tuebingen, Tuebingen, Germany; <sup>3</sup>Institute of Physics, Humboldt-University of Berlin, Berlin, Germany.

**11:15 AM \*I8.6**

**Organic Semiconductor Chemistry.** Seth Marder<sup>1</sup>, Lauren E. Polander<sup>1</sup>, Stephen Barlow<sup>1</sup>, Shree Tiwari<sup>1</sup>, Brian Seifried<sup>1</sup>,

Bernard Kippelen<sup>1</sup>, Chad Risko<sup>1</sup>, Jean-Luc Bredas<sup>1</sup>, Tissa Sajoto<sup>1</sup>, Sang Bok Kim<sup>1</sup>, Swagat Mohapatra<sup>1</sup>, Song Guo<sup>1</sup>, Yabing Qi<sup>2</sup>, Wei Zhao<sup>2</sup> and Antoine Kahn<sup>2</sup>; <sup>1</sup>Center for Organic Photonics and Electronics, Georgia Institute of Technology, Atlanta, Georgia; <sup>2</sup>Electrical Engineering, Princeton University, Princeton, New Jersey.

**11:45 AM I8.7**

**Harvesting near-IR Irradiation Using Electron-Accepting Conjugated Polymers Based on Aza-**

**Dipyrromethene Dyes.** Genevieve Sauve<sup>1</sup>, Lei Gao<sup>1</sup>, Cassie Daddario<sup>1</sup>, Zhenghao Mao<sup>1</sup>, Kenneth Singer<sup>2</sup>, Lei Zhu<sup>3</sup> and

Saide Tang<sup>3</sup>; <sup>1</sup>Chemistry, Case Western Reserve University, Cleveland, Ohio; <sup>2</sup>Physics, Case Western Reserve University, Cleveland, Ohio; <sup>3</sup>Macromolecular Science and Engineering, Case Western Reserve University, Cleveland, Ohio.

SESSION I9: Nanocrystals and Quantum Dots  
Chairs: Sumit Chaudhary, Svetlana Kilina and Garry Rumbles  
Thursday Afternoon, December 1, 2011  
Liberty (Sheraton)

**1:30 PM \*I9.1**

**Dynamics of Excitons and Charges in Organic Materials and Semiconductor Quantum Dots.**Laurens Siebbeles, Delft University of Technology, Delft, Netherlands.

**2:00 PM I9.2**

**Exciton Recombination in Ternary Blends of Organic Semiconductors and near-Infrared Quantum-Dots.**Grigorios Itskos<sup>1</sup>, Andreas Othonos<sup>1</sup>, Tobias Rauch<sup>2</sup>, Sandro F. Tedde<sup>2</sup>, Oliver Hayden<sup>2</sup>, Maksym V. Kovalenko<sup>3</sup>, Wolfgang Heiss<sup>3</sup> and Stelios A. Choulis<sup>4</sup>; <sup>1</sup>Physics Department, University of Cyprus, Nicosia, Cyprus; <sup>2</sup>Siemens AG, Corporate Technology, Erlangen, Germany; <sup>3</sup>Institute of Semiconductor and Solid State Physics, University of Linz, Linz, Austria; <sup>4</sup>Department of Mechanical Engineering and Materials Science and Engineering, Cyprus University of Technology, Limassol, Cyprus.

**2:15 PM I9.3**

**Solar Cells Using Quantum Funnels.**Illan Kramer, Larissa Levina, Ratan Debnath, David Zhitomirsky and Edward H. Sargent; Electrical & Computer Engineering, University of Toronto, Toronto, Ontario, Canada.

**2:30 PM \*I9.4**

**Wave Function Engineering in Core/Shell Quantum Dots for Efficient Single and Multiexciton Dissociation.**Tianquan Lian, Dept. of Chemistry, Emory University, Atlanta, Georgia.

**3:00 PM BREAK**

**3:30 PM I9.5**

**Neutron Scattering Provides a New Model for Optimal Morphologies in Organic Photovoltaics: Rivers and Streams.**Wen Yin<sup>1</sup>, Nathan Henry<sup>1</sup>, Kai Xaio<sup>2</sup>, John Ankner<sup>2</sup>, Mark Dadmun<sup>1,2</sup>; <sup>1</sup>University of Tennessee, Knoxville, TN, United States; <sup>2</sup>Oak Ridge National Laboratory, Oak Ridge, TN, United States.

**3:45 PM \*I9.6**

**Exploring Interfacial Dynamics in Colloidal Nanocrystals.**Marcus Jones, Kevin Major, Gaurav Singh, Danielle Woodall and Edward S. Williams; Chemistry, University of North Carolina at Charlotte, Charlotte, North Carolina.

**4:15 PM I9.7**

**Light Energy Conversion by Mesoscopic PbS Quantum Dots /TiO<sub>2</sub> Heterojunction Solar Cells.**Lioz Etgar<sup>1</sup>, Thomas Moehl<sup>1</sup>, Stefanie Tscharncke<sup>2</sup>, Stephen G. Hickey<sup>2</sup>, Alexander Eychmueler<sup>2</sup> and Michael Grätzel<sup>1</sup>; <sup>1</sup>Laboratory of photonics and interfaces, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland; <sup>2</sup>Physical Chemistry/Electrochemistry, TU Dresden, Dresden, Germany.

SESSION I10: Poster Session

Chairs: Venkat Bommisetty, Vladimir Dyakonov, Mario Leclerc, Garry Rumbles and NiyaziSerdar Sariciftci  
Thursday Evening, December 1, 2011

8:00 PM

Exhibition Hall D (Hynes)

**I10.1**

**Abstract Withdrawn**

**I10.2**

**Controlling Charge Transfer in Hybrid Organic/Nanocrystals Semiconductor Blends.**Neha Bansal and Saif A. Haque; Imperial College London, London, United Kingdom.

**I10.3**

**Efficient Organic Solar Cells Based on Aromatic Spacer Bridged Diketopyrrolopyrrole Derivatives.**Yoon-suk Choi, Yoonkyoo Lee and Wonho Jo; Seoul National University, Seoul, Korea, Republic of.

**I10.4****Charge Generation and Dissociation Mechanisms in PbS-ZnO Heterojunction Colloidal Quantum Dot**

**Photovoltaics.** Cheng Cheng, Shawn M. Willis, Hazel E. Assender and Andrew Watt; Department of Materials, University of Oxford, Oxford, Oxfordshire, United Kingdom.

**I10.5****Singlet Excitons in Highly Ordered Poly(3-hexylthiophene) Crystals Studied by Transient Absorption**

**Spectroscopy.** Yasunari Tamai<sup>1</sup>, Hideo Ohkita<sup>1,2</sup>, Hiroaki Bente<sup>1</sup> and Shinzaburo Ito<sup>1</sup>; <sup>1</sup>Department of Polymer Chemistry, Kyoto-university, Kyoto, Japan; <sup>2</sup>PRESTO, Japan Science and Technology, Saitama, Japan.

**I10.6****Light-Harvesting Efficiency of Polymer Solar Cells Incorporating near-IR Dye with Bulky Axial**

**Substituents.** Huajun Xu<sup>1</sup>, Takaaki Wada<sup>1</sup>, Hideo Ohkita<sup>1,2</sup>, Hiroaki Bente<sup>1</sup> and Shinzaburo Ito<sup>1</sup>; <sup>1</sup>Department of Polymer Chemistry, Kyoto University, Kyoto, Japan; <sup>2</sup>PRESTO, Japan Science and Technology Agency (JST), Saitama, Japan.

**I10.7****Synthesis and Characterization of Low-Band-Gap Poly(Thienylenevinylene) Derivatives for Polymer Solar**

**Cells.** Dong-Yu Kim<sup>1,2,3</sup>, Soo-Young Jang<sup>1,3</sup>, Bogyu Lim<sup>4</sup>, Byung-Kwan Yu<sup>1,3</sup>, Juhwan Kim<sup>1,3</sup>, Kang-Jun Baeg<sup>1,3</sup> and Dongyoon Khim<sup>1,3</sup>; <sup>1</sup>School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>2</sup>Department of Nanobio Materials and Electronics, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>3</sup>Heeger Center for Advanced Materials, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>4</sup>Department of Material Science and Engineering, Stanford University, Stanford, California.

**I10.8****Synthesis and Characterizations of TriphenylAmine Based Low Band Gap Polymer for Organic Solar**

**Cell.** Nam-koo Kim<sup>1,3</sup>, Bogyu Lim<sup>4</sup>, Jun-suk Yeo<sup>2,3</sup> and Dong-Yu Kim<sup>1,2,3</sup>; <sup>1</sup>Department of Nanobio Materials and Electronics, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>2</sup>School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>3</sup>Heeger Center for Advanced Materials, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>4</sup>Department of Materials Science and Engineering, Stanford University, Stanford, California.

**I10.9****Synthesis, Characterization, and Photovoltaic Properties of Dithienothiophene-Based Donor-Acceptor**

**Conjugated Polymers.** Dong-Yu Kim<sup>1,2,3</sup>, In-Bok Kim<sup>1,3</sup>, Byung-Kwan Yu<sup>2,3</sup> and Dongyoon Khim<sup>2,3</sup>; <sup>1</sup>Department of Nanobio Materials and Electronics, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>2</sup>School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of; <sup>3</sup>Heeger Center for Advanced Materials, Gwangju Institute of Science and Technology, Gwangju, Korea, Republic of.

**I10.10**

**Selective Deposition of CdSe Nanoparticles on Reduced Graphene Oxide to Understand Photoinduced Charge Transfer in Hybrid Nanostructures.** Kehan Yu, Ganhu Lu, Shun Mao, Kehung Chen, Haejune Kim, Zhenhai Wen and Junhong Chen; Mechanical Engineering, University of Wisconsin - Milwaukee, Milwaukee, Wisconsin.

**I10.11****Effect of Cu-In-Ga Precursor Deposited at Different Temperature for CIGS Absorption Layer.** Jae-kwan Sim,

Yong-Ho Ra, Ji-hyeon Park, Bo-ra Yeom, Ashok Karunanithi and Cheul-Ro Lee; Semiconductor Materials Processing Laboratory, Chonbuk National University, Jeonju, Korea, Republic of.



#### **I10.12**

**Redox-Active Radical Molecules for Organic Photovoltaic Devices.**Fumiaki Kato, Takumi Okuyama, Ken Muraoka, Akitomo Kikuchi, Takakazu Saito, Chihiro Hayashi, Kenichi Oyaizu and Hiroyuki Nishide; Applied Chemistry, Waseda University, Tokyo, Japan.

#### **I10.13**

**External Electric Field and Post-Annealing Induced Enhanced Efficiency in P3HT/PCBM Bulk Heterojunction Solar Cells.**Mukesh Kumar, Chong Chen, Pavel Dutta and Venkat BommiSETTY; Electrical Engineering, South Dakota State University, Brookings, South Dakota.

#### **I10.14**

**Optimizing Charge Transfer Processes between Luminescent Polymers and TiO<sub>2</sub> Nanoparticles.** Gustavo T. Valente, Angelo D. Faceto and Francisco E. Gontijo Guimaraes; University of São Paulo, São Carlos, SP, Brazil.

#### **I10.15**

**Exciton Diffusion in PbS Quantum Dot Thin Films.**David B. Strasfeld<sup>1</sup>, Gautham Nair<sup>2</sup>, Scott M. Geyer<sup>3</sup>, Liang-Yi Chang<sup>1</sup> and Mouni Bawendi<sup>1</sup>; <sup>1</sup>Chemistry, Massachusetts Institute of Technology, Cambridge, MA, Massachusetts; <sup>2</sup>Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania; <sup>3</sup>Physics, Stanford University, Palo Alto, California.

#### **I10.16**

**Conjugated Starburst Macromolecules for Optoelectronic Applications.**Feng Liu<sup>1,2,3</sup>, Chao Tang<sup>1</sup>, Hongbin Wu<sup>2</sup>, Wei Wei<sup>1</sup> and Wei Huang<sup>1</sup>; <sup>1</sup>Institute of Advanced Materials (IAM), Nanjing University of Posts and Telecommunications, Nanjing, China; <sup>2</sup>Institute of Polymer Optoelectronic Materials and Devices, South China University of Technology, Guangzhou, China; <sup>3</sup>Polymer Science and Engineering, University of Massachusetts Amherst, Amherst, Massachusetts.

#### **I10.17**

**The Organic/Inorganic Heterojunction as Model for Excitonic Solar Cells.**Pabitra K. Nayak<sup>1</sup>, Lee Barnea Nehoshtan<sup>1</sup>, Antoine Kahn<sup>2</sup> and David Cahen<sup>1</sup>; <sup>1</sup>Weizmann Institute of Science, Rehovot, Israel; <sup>2</sup>Princeton University, Princeton, New Jersey.

#### **I10.18**

**Direct near-Field Optical Imaging of P3HT Nanostructures.**Mina Baghgar<sup>1</sup>, Sibel E. Yalcin<sup>2</sup>, Joelle Labastide<sup>2</sup>, Irene Dujovne<sup>2</sup>, Kevin T. Early<sup>3</sup>, Harihara Venkatraman<sup>2</sup>, Yipeng Yang<sup>1</sup>, Michael D. Barnes<sup>1,2</sup>, Dhandapani Venkataraman<sup>2</sup> and Anthony D. Dinsmor<sup>1</sup>; <sup>1</sup>Physics, University of Massachusetts Amherst, Amherst, Massachusetts; <sup>2</sup>Chemistry, University of Massachusetts Amherst, Amherst, Massachusetts; <sup>3</sup>JILA, University of Colorado Boulder, Boulder, Colorado.

#### **I10.19**

**Size and Internal Structure Dependent Photoluminescence in Semicrystalline Polythiophene (P3HT) Nanoparticles.**Joelle Labastide<sup>1</sup>, Mina Baghgar<sup>2</sup>, Irene Dujovne<sup>1</sup>, Harihara Venkatraman<sup>1</sup>, David Ramsdell<sup>1</sup>, Dhandapani Venkataraman<sup>1</sup> and Michael D. Barnes<sup>1,2</sup>; <sup>1</sup>Chemistry, University of Massachusetts Amherst, Amherst, Massachusetts; <sup>2</sup>Physics, University of Massachusetts Amherst, Amherst, Massachusetts.

#### **I10.20**

**Efficient Multi-Electron Transfer from Multi-Exciton States in Singlet Fission.**Wai-Lun Chan, Manuel Ligges, Askat Jailaubekov and Xiaoyang Zhu; Department of Chemistry and Biochemistry, University of Texas at Austin, Austin, Texas.

**I10.21**

**Optimization of Carrier-Multiplication for More Efficient Solar Cells: The Case of  $\alpha$ -Sn Quantum**

**Dots.**Christophe Delerue and Guy Allan; IEMN - ISEN, Lille Cedex, France.

**I10.22**

**Abstract Withdrawn**

**I10.23**

**Study of Multi-Excitons in Silicon Clusters for Efficient Solar Cell.**Yi He and Taofang Zeng; M. I. T., Cambridge, Massachusetts.

**I10.24**

**The Role of Optical Waveguiding on Triplet Exciton Transport in Tetracene and Rubrene Crystals.**Jiye Lee.

Carlijn L. Mulder, Hiroshi Mendoza and Marc Baldo; Electrical Engineering and Computer Science, MIT, Cambridge, Massachusetts.

**I10.25**

**Abstract Withdrawn**

**I10.26**

**Perturbing Excited-State Dynamics Using Nanoplasmonic Substrates.**Andrew J. Ferguson<sup>1</sup>, Natalia Azarova<sup>3,1</sup>, Ross Larsen<sup>2</sup>, Christopher Chang<sup>2</sup>, Jao van de Lagemaat<sup>1</sup>, Won Park<sup>3</sup> and Justin Johnson<sup>1</sup>; <sup>1</sup>Chemical & Materials Science Center, NREL, Golden, Colorado; <sup>2</sup>Computational Science Center, NREL, Golden, Colorado; <sup>3</sup>Department of Electrical & Computer Engineering, University of Colorado at Boulder, Boulder, Colorado.

**I10.27**

**Abstract Withdrawn**

**I10.28**

**Fullerene Crystallisation as a Key Driver of Charge Separation in Polymer/Fullerene Bulk Heterojunction Solar Cells.**Fiona Jamieson<sup>1</sup>, Ester Buchaca Domingo<sup>2</sup>, Thomas McCarthy-Ward<sup>1</sup>, Martin Heeney<sup>1</sup>, Natalie Stingelin<sup>2</sup> and James Durrant<sup>1</sup>; <sup>1</sup>Chemistry, Imperial College London, London, United Kingdom; <sup>2</sup>Materials, Imperial College London, London, United Kingdom.

**I10.29**

**Hierarchical Data Mining to Link BHJ Structure with Properties of Organic Solar Cells.**Olga Wodo<sup>1</sup>, Hari K. Kodali<sup>1</sup> and Baskar Ganapathysubramanian<sup>1,2</sup>; <sup>1</sup>Mechanical Engineering Department, Iowa State University, Ames, Iowa; <sup>2</sup>Electrical and Computer Engineering Department, Iowa State University, Ames, Iowa.

**I10.30**

**Carrier Transport Behavior in Single Crystalline Rutile Nanorod Based Excitonic Solar Cell.**Mengjin Yang, Ding Bo and Jung-Kun Lee; Mech. Eng. & Mater. Sci., University of Pittsburgh, Pittsburgh, Pennsylvania.

### **I10.31**

**Low Bandgap Polymer Tailored for High Performance Tandem Polymer Solar Cells.**Letian Dou, Jingbi You and Yang Yang; Materials Science, University of California, Los Angeles, Los Angeles, California.

### **I10.32**

**Charge Carrier Generation and Transport in Hybrid P3HT/Silicon Nanocrystal Solar Cells.**Sabrina Niesar<sup>1</sup>, Daniel Herrmann<sup>2</sup>, Rui N. Pereira<sup>3</sup>, Wolfgang Fabian<sup>1</sup>, Christina Scharsich<sup>4</sup>, Anna Koehler<sup>4</sup>, Hartmut Wiggers<sup>5</sup>, Martin S. Brandt<sup>1</sup>, Eberhard Riedle<sup>2</sup> and Martin Stutzmann<sup>1</sup>; <sup>1</sup>Walter Schottky Institut, Technische Universität München, Garching, Germany; <sup>2</sup>Lehrstuhl für BioMolekulare Optik, Ludwig-Maximilians-Universität, München, Germany; <sup>3</sup>Department of Physics and I3N, University of Aveiro, Aveiro, Portugal; <sup>4</sup>Lehrstuhl Experimentalphysik II, Universität Bayreuth, Bayreuth, Germany; <sup>5</sup>Institut für Verbrennung und Gasdynamik und CeNIDE, Universität Duisburg-Essen, Duisburg, Germany.

### **I10.33**

**Abstract Withdrawn**

### **I10.34**

**Abstract Withdrawn**

### **I10.35**

**Abstract Withdrawn**

### **I10.36**

**Making Molecular Multilayers Using "Click" Chemistry: Growth, Characterization, and Applications in p-Type Dye-Sensitized Solar Cells.**Peter K.B. Palomaki<sup>1,2</sup> and Peter H. Dinolfo<sup>1,2</sup>; <sup>1</sup>Chemistry and Chemical Biology, Rensselaer Polytechnic Institute, Troy, New York; <sup>2</sup>Rensselaer Polytechnic Institute, Baruch '60 Center for Biochemical Solar Energy Research, Troy, New York.

### **I10.37**

**Study of Interfacial Processes in Dye Sensitized Solar Cells (DSSC) via Thin Film Approach: Effect of Oxygen Vacancy Concentration.** Onkar Game<sup>1</sup>, Vishal Thakare<sup>2</sup>, Abhimanyu Rana<sup>2</sup> and Satishchandra B. Ogale<sup>2</sup>; <sup>1</sup>University of Pune, Pune, India; <sup>2</sup>Physical and Materials Chemistry Division, National Chemical Laboratory, Pune, India.

### **I10.38**

**Understanding at the Atomic Scale the Microstructure of Polymer-Metaloxide Hybrid Nanomaterials for Photovoltaics.** Claudio Melis<sup>2,1</sup>, Maria Ilenia Saba<sup>1,2</sup>, Claudia Caddeo<sup>2,1</sup>, Giuliano Mallocci<sup>1</sup>, Luciano Colombo<sup>2,1</sup> and Alessandro Mattoni<sup>1</sup>; <sup>1</sup>SLACS Cagliari, CNR-IOM SLACS, Monserrato, Cagliari, Italy; <sup>2</sup>Dept of Physics, University of Cagliari, Monserrato, Cagliari, Italy.

SESSION I11/H14: Joint Session: Morphology II  
Chairs: Garry Rumbles and Natalie Stingelin  
Friday Morning, December 2, 2011  
Grand Ballroom (Sheraton)

**8:00 AM \*I11.1/H14.1**

**The Essence and Efficiency Limits of Bulk Heterostructure Organic Solar Cells.**Muhammad A. Alam, School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.

**8:30 AM \*I11.2/H14.2**

**Structure-Property Relationships to Enable Organic Photovoltaics.**R. Joseph Kline, Polymers Division, National Institute of Standards and Technology, Gaithersburg, Maryland.

**9:00 AM \*I11.3/H14.3**

**The Nanoworld of a Polymer Solar Cell.**Joachim Loos, Physics & Astronomy, University of Glasgow, Glasgow, United Kingdom.

**9:30 AM \*I11.4/H14.4**

**Nanoscale Morphology in Bulk Heterojunctions Organic Photovoltaics.**Michael F. Toney, Stanford Synchrotron Radiation Lightsource, Menlo Park, California.

**10:00 AM BREAK**

**10:30 AM \*I11.5/H14.5**

**Unveiling the Details of How Molecules Pack in Bulk Heterojunctions.**Michael D. McGehee, Materials Science & Engineering, Stanford University, Stanford, California.

**11:00 AM \*I11.6/H14.6**

**Structural Measurements of Polymer-Fullerene Blend Films for Organic Photovoltaics.**Dean M. DeLongchamp, Polymers Division, Natl Inst of Standards & Tech, Gaithersburg, Maryland.

**11:30 AM \*I11.7/H14.7**

**Processing of Macromolecular Complex Architectures.**Natalie Stingelin, Department of Materials and Center for Plastic Electronics, Imperial College London / ETH Zurich, London, United Kingdom; Materials, ETH Zürich, Zürich, Switzerland.

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