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Mixed films consisting of two different organic semiconductors were studied that were prepared by physical vapour deposition on electrode structures on glass. A planar perfluorinated phthalocyanine ( $F_{16}PcCu$ ) absorbing in the red was used as an electron acceptor and a cone-shaped subphthalocyanine ( $SubPcBCL$ ) absorbing in the green as electron donor. Electrical conduction measurements revealed the development of the conductivity in different phases of the experiment. Further, the change of the photocurrent in dependence on different wavelengths of illumination was measured. The observed photocurrents showed light-induced charge transfer and even the direction of the photocurrent changed in different parts of the solar spectrum. A photovoltaic effect even across the electrode gap was indicated and the applicability of such films in organic bulk heterojunction solar cells is discussed.

SYOP 4.8 Thu 16:30 P1A

**Mixed films of phthalocyanines and perylene imids as bulk heterojunction materials** — ●ANDRÉ DRAGÄSSER<sup>1</sup>, ROBIN KNECHT<sup>1</sup>, CHRISTOPHER KEIL<sup>1</sup>, GÜNTER SCHNURPFEL<sup>2</sup>, and DERCK SCHLETTWEIN<sup>1</sup> — <sup>1</sup>Justus-Liebig-Universität Gießen, Institut für Angewandte Physik, Heinrich-Buff-Ring 16, D-35392, Gießen. eMail: schlettwein@uni-giessen.de — <sup>2</sup>Institut für Organische und Makromolekulare Chemie, Universität Bremen, D-28334 Bremen.

The formation of evaporated blends of organic donor and acceptor molecules has gained interest recently for active interlayers in organic photovoltaic cells and organic field effect structures. In this contribution we report about the combination of phthalocyanines as electron donors absorbing in the red part of the spectrum and perylene imids as electron acceptors absorbing in the green part of the spectrum providing almost perfect coverage of the visible range. Mixed films were successfully created by simultaneous physical vapour deposition of the molecules to create an evaporated organic bulk heterojunction. The films were studied for their potential as materials in organic photovoltaic devices. Using transmission spectroscopy, structure analysis and photoconductivity measurements electronic and optical properties were investigated and compared with the properties of the pure films and solution spectra. The observed spectral dependence of the photoconductivity indicates a potential use of such materials in organic photovoltaic cells. First attempts to create a sandwich structure with indium tin oxide, the mixed organic layer and a metal contact will be discussed.

SYOP 4.9 Thu 16:30 P1A

**Dye-sensitized solar cells based on nanostructured zinc oxide** — ●JONAS CONRADT<sup>1</sup>, JĘDRZEJ SZMYTKOWSKI<sup>1,2</sup>, FLORIAN MAIER-FLAIG<sup>1</sup>, JANOS SARTOR<sup>1</sup>, JOHANNES FALLERT<sup>1</sup>, MANUEL REINHARD<sup>4</sup>, ALEXANDER COLSMANN<sup>4</sup>, ULI LEMMER<sup>2,4</sup>, TEODOR SILVIU BALABAN<sup>2,3</sup>, and HEINZ KALT<sup>1,2</sup> — <sup>1</sup>Karlsruhe Institute of Technology (KIT), Universität Karlsruhe (TH), Institute of Applied Physics, Karlsruhe, Germany — <sup>2</sup>Center for Functional Nanostructures (CFN), Karlsruhe, Germany — <sup>3</sup>Karlsruhe Institute of Technology (KIT), Forschungszentrum Karlsruhe, Institute for Nanotechnology, Karlsruhe, Germany — <sup>4</sup>Karlsruhe Institute of Technology (KIT), Universität Karlsruhe (TH), Lichttechnisches Institut, Karlsruhe, Germany

Hybrid solar cells represent a promising (cost-efficient) alternative to pure inorganic solar cells. We present dye-sensitized solar cells (DSSC) which are based on a zinc oxide (ZnO) electrode covered with a ruthenium dye. Our work focuses on the morphology of the ZnO electrode and its impact on the photovoltaic performance of the solar cell. Nanocrystalline ZnO powder layers and arrays of nanorods are incorporated into the DSSCs. The ZnO nanorods are grown by vapor transport deposition. The morphology and doping concentration of the rods can be controlled by the choice of substrate material, growth condition and catalytic metal layers. The nanorod arrays are expected to fasten the electron transport towards the anode and thereby improve the solar cell efficiency. In addition, novel self-assembling (porphyrin) dyes are tested as sensitizer within a DSSC.

SYOP 4.10 Thu 16:30 P1A

**Photoinduced absorption studies on dicyanovinyl-oligothiophene thin films for application in small molecule organic solar cells** — ●HANNAH ZIEHLKE<sup>1</sup>, RICO SCHÜPPEL<sup>1</sup>, MORITZ RIEDE<sup>1</sup>, EGON REINOLD<sup>2</sup>, PETER BÄUERLE<sup>2</sup>, and KARL LEO<sup>1</sup> — <sup>1</sup>Institut für Angewandte Photophysik, Technische Universität Dresden — <sup>2</sup>Institut für Organische Chemie II und neue Materialien, Universität Ulm

Oligothiophenes capped with electron-withdrawing dicyanovinyl groups are promising candidates for applications in small molecule organic solar cells with reached efficiencies of 3.4% [1]. In blend layers with fullerene  $C_{60}$  as acceptor material, the dicyanovinyl-oligothiophenes (DCVnT) act as donor material. The variation of the HOMO energies along the series  $n = 3..6$  have significant influence on the charge separation process at the donor acceptor interface.

The energetic and dynamic properties of the long lived photoexcitations present at this interface can be obtained by photoinduced absorption (PIA) spectroscopy. We here present the characterisation of DCVnT with varying chain length via PIA spectroscopy. By analyzing recombination dynamics of the triplet excitons and cation states with respect to the existing models of mono- and bimolecular recombination processes, lifetimes and generation efficiencies can be compared. Likewise the temperature dependence of the lifetimes of triplet excitons and cations is evaluated.

[1] K. Schulze, M. Riede, E. Brier, E. Reinold, P. Bäuerle, and Karl Leo, J. Appl. Phys. **104**, 074511 (2008)

SYOP 4.11 Thu 16:30 P1A

**Theoretical study of morphology and charge transport in amorphous Alq3** — ●ALEXANDER LUKYANOV<sup>1</sup>, CHRISTIAN LENNARTZ<sup>2</sup>, and DENIS ANDRIENKO<sup>1</sup> — <sup>1</sup>Max Planck Institute for Polymer Research, Mainz — <sup>2</sup>Department of Scientific Computing, BASF, Ludwigshafen

A force-field for tris(8-hydroxyquinoline) aluminium (Alq3) - a compound widely used in organic light emitting diodes [1] - is developed and verified by comparing classical and first principles (DFT, B3LYP functional) molecular dynamics simulations. This force-field is then used to simulate large scale morphologies of amorphous Alq3. Given the realistic morphology, charge transport in thin films of amorphous Alq3 is analyzed within the framework of high temperature non-adiabatic Marcus' theory [2].

1. J.J. Kwiatkowski, J. Nelson, H. Li, J.-L. Bredas, W. Wenzel, and C. Lennartz, Phys. Chem. Chem. Phys. **14**, 1852 (2008)

2. J. Kirkpatrick, V. Marcon, J. Nelson, K. Kremer and D. Andrienko, Phys. Rev. Lett. **98**, 227402 (2007)

SYOP 4.12 Thu 16:30 P1A

**Charge transport in carbazole-based crystals** — ●THORSTEN VEHOFF<sup>1</sup>, JAMES KIRKPATRICK<sup>2</sup>, ALESSANDRO TROISI<sup>3</sup>, and DENIS ANDRIENKO<sup>1</sup> — <sup>1</sup>Max Planck Institut für Polymerforschung, Mainz — <sup>2</sup>Imperial College London, London, UK — <sup>3</sup>Department of Chemistry and Center of Scientific Computing, University of Warwick, UK

We compare two descriptions of charge transport in organic semi-conducting crystals. The first approach is based on a semi-classical Hamiltonian with the non-local electron-phonon coupling. The second is the variable range hopping model based on the Marcus' charge transfer theory. Molecular dynamics (MD) simulations of the crystalline phase of 6,12-dimethoxy-5,11-dihydroindolo[3,2-b]carbazole are performed. The transfer integrals for nearest neighbor pairs are calculated with the molecular orbital overlap method. Charge dynamics is simulated using kinetic Monte Carlo technique with rates calculated from Marcus' theory [1]. Based on the same MD trajectory, the mobility is calculated by monitoring the spread of a wave function over a few neighboring molecules using numerical integration of the small polaron model Hamiltonian [2]. Both results are compared to time of flight measurements.

1. J. Kirkpatrick, V. Marcon, J. Nelson, K. Kremer and D. Andrienko, Phys. Rev. Lett. **98**, 227402 (2007)

2. A. Troisi, Adv. Mater. **19**, 2000-2004, (2007)

SYOP 4.13 Thu 16:30 P1A

**Investigation of the Nanomorphology and Device Performance of Organic Solar Cells based on Polymer:Fullerene Bulk Heterojunctions** — ●THOMAS MADENA, ULI WISCHNATH, ACHIM KITTEL, JÜRGEN PARISI, and INGO RIEDEL — Energy- and Semiconductor Research Laboratory, Department of Physics, University of Oldenburg, Carl-von-Ossietzky-Strasse 9-11, D-26111 Oldenburg

The coherences between structural layout of P3HT:PCBM bulk heterojunction (BHJ) solar cells and the electrical properties are not fully understood so far. The morphology of such BHJ-thin films determines