

## DS 25: Organic electronics and photovoltaics: electronic properties II (jointly with CPP, HL, O)

Time: Wednesday 11:30–13:00

Location: H 2032

DS 25.1 Wed 11:30 H 2032

**Point of inflection in IV curves due to degradation of cathode-organic interface** — ●SIDHANT BOM, NIVEDITA YUMNAM, and VEIT WAGNER — Jacobs University Bremen, School of Engineering and Science, Campus Ring 1, 28759 Bremen, Germany

The formation of point of inflection in IV curves is very well known in the field of organic photovoltaics. However, the opinion on this matter is diverse and conflicting. In an attempt to understand this phenomenon, we carried out series of experiments in which we were able to emulate the s-shape in the IV curve. In this study P3HT:PCBM bulk heterojunction solar cells were fabricated in between ITO/PEDOT:PSS and aluminum electrodes. Storing a completely fabricated cell in different environments resulted in a remarkable difference in the degradation of device parameters. Storing in vacuum completely stopped the degradation process while storing in an air tight container with nitrogen ambient showed extreme degradation within 24 hours with a severe s-shape in the IV curve. Interface modification at the cathode by inserting an additional thin  $C_{60}$  layer resulted in a similar s-shaped curve in contrast to the standard device. The data are explained by a model introducing a variable potential barrier at the aluminum cathode.

DS 25.2 Wed 11:45 H 2032

**Dye Sensitised Solar Cells with Carotenoid Molecules** — ●GINO GÜNZBURGER<sup>1</sup>, RES JÖHR<sup>1</sup>, BILJANA BOZIC WEBER<sup>2</sup>, CATHERINE HOUSECROFT<sup>2</sup>, EDWIN CONSTABLE<sup>2</sup>, HUBERT HUG<sup>3</sup>, PETRA BUCHWALD HUNZIKER<sup>3</sup>, ERNST MEYER<sup>1</sup>, and THILO GLATZEL<sup>1</sup> — <sup>1</sup>University of Basel, Department of Physics, Switzerland — <sup>2</sup>University of Basel, Department of Chemistry, Switzerland — <sup>3</sup>DSM Nutritional Products Ltd., NRD CH, Kaiseraugst, Switzerland

We report the analysis of long time stable dye sensitized solar cells using organic carotenoid-based dyes (crocin, torularhodin and bixin). The particular properties of natural dyes require sensitisation in anhydrous solvents as well as cell assembly under inert gas atmosphere. Furthermore, the exposure to UV light, and the heat-transfer to the sensitised layers was minimized. However, a standard KI based electrolyte was still employed.

The cells were prepared and characterised by IV- and QE-measurements without any anti-reflective or light incoupling foils, or additional light-scattering titania layers. In contrast to the expectations the present cells yield relatively high efficiencies and stability (colour and efficiency was unchanged over a period of days or even weeks). The measured efficiencies under 100  $mW/cm^2$  AM1.5 simulated sun light at 25°C were 1.23%, 0.40% and 0.75% for the crocin, torularhodin and bixin cells, respectively. Comparable literature values for crocin dyes are 0.56% and thus lower by a factor of more than 2. [1].

[1]Yamakazi et al. Solar Energy 81 (2007)

DS 25.3 Wed 12:00 H 2032

**High Performance Organic Transistors and Circuits with Patterned Polypyrrole Electrodes** — ●LIQIANG LI, HARALD FUCHS, and LIFENG CHI — Physikalisches Institut, Universität Münster, Münster, Germany

Electronic circuits based on organic transistors have sparked considerable research interests due to their unique applications. One of the key prerequisites to convert the high potential to real applications is the preparation and patterning of appropriate electrode materials. Until now, a variety of electrode materials have been utilized for organic devices, among which conducting polymer electrodes have been proposed to be a promising alternative to replace metal electrodes, as they are endowed with unique features which may embody some advantages of organic circuits. However, high performance and stable devices with pure polypyrrole electrodes, especially n-type transistors and complementary circuits, are not reported.

Here we demonstrate the high performance p-/n-type organic transistors and complementary inverter circuits by using patterned PPY as pure electrode. Remarkably, both transistors and inverters with PPY electrodes show good stability under continuous operation and long-term storage conditions. Furthermore, PPY electrodes also exhibit good applicability in solution-processed and flexible devices. All

these results indicate the great potential of PPY electrodes in solution-processed, all-organic, flexible, transparent, and low-power electronics.

DS 25.4 Wed 12:15 H 2032

**Design rules for charge-transport efficient host materials for OLEDs** — ●FALK MAY<sup>1</sup>, BJÖRN BAUMEIER<sup>1</sup>, DENIS ANDRIENKO<sup>1</sup>, and CHRISTIAN LENNARTZ<sup>2</sup> — <sup>1</sup>Max Planck Institute for Polymer Research, Mainz, Germany — <sup>2</sup>BASF SE, GVC/E - B009, Ludwigshafen, Germany

The use of blue phosphorescent emitters in organic light emitting diodes (OLEDs) imposes demanding requirements on a host material. Among these are large triplet energies, the alignment of levels with respect to the emitter, the ability to form and sustain amorphous order, material processability, and an adequate charge carrier mobility. A possible design strategy is to choose a pi-conjugated core with a high triplet level and to fulfill the other requirements by using suitable substituents. Bulky substituents, however, induce large spatial separations between conjugated cores, can substantially reduce intermolecular electronic couplings, and decrease the charge mobility of the host. In this work we analyze charge transport in amorphous bis(triphenylsilyl)dibenzofuran, a typical deep-blue OLED host material, and show that mesomeric effects delocalize the frontier orbitals over the substituents recovering strong electronic couplings without inducing significant variations of local dipole moments, which otherwise would lead to additional energetic disorder, site energy correlations, and undesirable current filaments. By linking electronic structure, molecular packing, and mobility we provide a pathway to the rational design of hosts with high charge mobilities.

DS 25.5 Wed 12:30 H 2032

**Octithiophene on Au(111): Coverage dependent adsorption geometry and exciton dynamics** — ●LEA BOGNER<sup>1</sup>, ERWAN VARENE<sup>1</sup>, YAN PENNEC<sup>2</sup>, and PETRA TEGEDER<sup>1</sup> — <sup>1</sup>Freie Universität Berlin, Fachbereich Physik, Arnimallee 14, 14195 Berlin, Germany — <sup>2</sup>University of British Columbia, department of Chemistry and Physics, Vancouver, B.C. V6T 1Z4, Canada

Semiconducting organic molecules exhibit promising properties for applications in optoelectronic devices such as organic photovoltaic cells or organic light emitting diodes. In order to fully understand and improve the functionalities of organic semiconductors the investigation of adsorption properties, electronic structure and charge carrier dynamics at their interfaces with inorganic substrates plays a crucial role.

Octithiophene (8T) is the longest unsubstituted oligothiophene synthesized up to now and possesses the highest carrier mobility. Whereas several surface science studies on sexithiophene interfaces may be found in literature, little is known so far about 8T.

The adsorption geometry, electronic structure and exciton dynamics as function of 8T coverage have been investigated by means of scanning tunnelling microscopy (STM), high-resolution electron energy loss spectroscopy (HREELS) and time-resolved two-photon photoemission (2PPE). We found that 8T undergoes a change in the adsorption geometry from flat-lying in the sub-monolayer regime to a tilted configuration for the mono- and bilayer coverage. The photoemission intensities of the HOMO and HOMO-1 features as well as the exciton decay dynamics exhibit a strongly coverage dependent behavior.

DS 25.6 Wed 12:45 H 2032

**Local Investigations on Air-stable n-Channel Perylene Diimide Based OFETs on Surface Modified SiO<sub>x</sub> Dielectric** — ●FRANZISKA LÜTTICH<sup>1</sup>, DANIEL LEHMANN<sup>1</sup>, HARALD GRAAF<sup>1,2</sup>, CHRISTIAN VON BORCZYSKOWSKI<sup>1</sup>, and DIETRICH R. T. ZAHN<sup>1</sup> — <sup>1</sup>Chemnitz University of Technology, Institute of Physics, Germany — <sup>2</sup>Now at University Kassel, Institute of Chemistry, Germany

Organic semiconducting materials are interesting for low-cost and flexible applications like organic light-emitting diodes, organic solar cells, and organic field-effect transistors (OFETs). Stability and low mobilities are the most limiting properties for these applications. Surface modifications changing the surface energy of the dielectric in OFETs influences the orientation of the organic molecules and therefore the mobilities. The surface energy can be determined by water contact angle measurements.

In order to investigate the influence of the surface energy we used OFET substrates from Fraunhofer IPMS and varied the water contact angle of the 100 nm thick dielectric of thermal silicon dioxide in the range from 20° to 55°. Thereafter the air-stable Polyera ActivInk<sup>TM</sup> N1200 (PDI8-CN<sub>2</sub>) was deposited by spin coating. The topography was determined using an Atomic Force Microscope (AFM). The elec-

trical characterization was performed by DC measurements and additionally locally resolved by Kelvin Probe Force Microscopy (KPFM) to obtain an insight in the local surface potential and the contact resistances. The determined electron mobility were found to change with varying water contact angle.