

In this study, the influence of substrate temperature on the growth and morphology of thin perylene films deposited on gold substrates was studied. The films have been deposited at different substrate temperatures and film thicknesses by vacuum thermal evaporation (VTE), have been investigated. Atomic force microscopy (AFM) has been performed to study film morphology as the surface roughness and evolution of perylene film growth. The structural properties and molecular vibrations of perylene thin films have been studied by X-ray diffractometry (XRD) and Fourier transform infrared spectroscopy (FTIR). Finally, a model for the perylene thin film growth is presented.

SYSA 5.18 Tue 14:30 Poster A

**Strong screening in photoemission at interfaces between organic semiconductors and gold: polarization effects versus charge transfer** — •DANIEL KOLACYAK<sup>1</sup>, HEIKO PEISERT<sup>1</sup>, ANDRÉ PETERSHANS<sup>2</sup>, and THOMAS CHASSÉ<sup>1</sup> — <sup>1</sup>Universität Tübingen, Institut für Physikalische Chemie — <sup>2</sup>Forschungszentrum Karlsruhe, Institut für Technische Chemie

We studied electronic polarization effects at organic/metal interfaces using combined photoemission spectroscopy (PES) and x-ray excited Auger electron spectroscopy (XAES) as a function of the organic layer thickness. As a model system, sandwich structures of metal-phthalocyanines (e.g. consisting of PcMg and PcZn) were deposited on gold. It was found, that the screening of the photohole is remarkably increased for molecules directly at the interface whereas further layers are affected weakly. This may be caused by a fast charge transfer across the interface as a result of the photoionization due to the overlap organic/metal wave functions. Furthermore, differences in the screening were found for buried molecules and molecules on the surface of the organic film ascribed to different polarization energies. The influence of the morphology and orientation was studied by comparing different substrates: polycrystalline gold foil and single crystalline Au(100).

SYSA 5.19 Tue 14:30 Poster A

**An Infrared Spectroscopy and X-ray Diffraction Study of the medium length *n*-Hexadecanol solidified in mesoporous silicon** — ANKE HENSCHEL, •RENÉ BERWANGER, ROLF PELSTER, KLAUS KNORR, and PATRICK HUBER — Saarland University, Saarbruecken, Germany

The conformation and arrangement of the *n*-alcohol C<sub>16</sub>H<sub>33</sub>OH confined in tubular pores of porous silicon (mean pore diameter 10nm, pore length 70 μm) is investigated by combined Infrared Spectroscopy and X-Ray Diffraction measurements. The phase behaviour is reminiscent of the one found for the linear *n*-alkanes confined in mesoporous silicon<sup>1</sup>: the long axes of the molecules are oriented perpendicular to the pore axes. About the long axes of the pores we find a four-fold symmetry of the diffraction pattern, coinciding with the symmetry of the silicon matrix. The confined alcohol exhibits six dominant domains.

We find distinct changes in the vibration characteristics, in the structure factor as well as the phase transition temperatures of the confined alcohol as compared to the bulk phase. The phase sequence in the pores is liquid, Rotator and crystalline. The melting and freezing transitions are reduced by 20K.

<sup>1</sup>A. Henschel, T. Hofmann, P. Huber, K. Knorr, Phys. Rev. E 75, 021607 (2007)

SYSA 5.20 Tue 14:30 Poster A

**NTCDA as transparent electron transport material in organic p-i-n solar cells** — •CHRISTIANE FALKENBERG<sup>1</sup>, CHRISTIAN UHRICH<sup>1</sup>, SELINA OLTROF<sup>1</sup>, BERT MÄNNIG<sup>1,2</sup>, MORITZ RIEDE<sup>1</sup>, and KARL LEO<sup>1</sup> — <sup>1</sup>Institut für Angewandte Photophysik, Technische Universität Dresden, 01069 Dresden, Germany, <http://www.iapp.de> — <sup>2</sup>Now at Heliatek GmbH, Liebigstr. 26, 01187 Dresden, Germany

In organic p-i-n-solar cells, the active layer where light is absorbed and free charge carriers are generated is sandwiched between two doped charge carrier transport layers which are preferentially electron or hole conducting. In order to increase the efficiency of organic photovoltaic devices, the properties of those doped layers play a crucial role: high conductivities and charge carrier mobilities, thermal and morphological stability, and a good energy level alignment relative to the neighboring active layers are required. We investigate here the electron transport materials and successfully substitute the standard system consisting of n-C<sub>60</sub> by the wide-gap material NTCDA (naphthalenetetracarboxylic dianhydride). Unlike C<sub>60</sub>, it does not absorb in the visible range and therefore blocks the excitons which were created in the active layer. Combined photoelectron spectroscopy (PES)

and absorption determine HOMO and LUMO energies of -8.01eV and approximately -4.5...-4.0eV, respectively. Furthermore, the electronic structure of the aluminum/NTCDA-contact and the morphology of thin evaporated layers are analyzed via PES and AFM, respectively. The power conversion efficiency of simple p-i-n-cell structures is improved by 10% upon substitution of C<sub>60</sub> in electron transport layers by NTCDA.

SYSA 5.21 Tue 14:30 Poster A

**Surface modification for improved charge injection in copper electrode/ organic semiconductor interfaces of p-type OFET applications** — •JOHANNES FRISCH<sup>1</sup>, NORBERT KOCH<sup>1</sup>, and SILVIA JANIETZ<sup>2</sup> — <sup>1</sup>Humboldt-Universität zu Berlin, Department of Physics, Newtonstrasse 15, D-12489 Berlin, Germany — <sup>2</sup>Fraunhofer-Institute of Applied Polymer Research, Department Polymer Electronics, Geiselbergstr. 69 D-14476 Potsdam, Germany

Very important for the development of practical applications in organic field effect transistors (OFETs) are high On-current and ON/Off ratio. The On-current in p-type OFET devices is limited by the hole injection density. One way to modify charge injection properties is to introduce a monolayer of the strong electron acceptor tetrafluorotetracyanoquinodimethane (F4-TCNQ) at the Cu-electrode/ organic hole transport layer (OHTL) interface. The adsorbed monolayer of F4-TCNQ results in an increase in work function and consequently in a reduction of the hole injection barrier. XPS analysis showed a significant difference between untreated and modified surfaces. Top gate structure OFETs with bottom contact and flexible substrates were produced to evaluate the influence of the modified Cu-electrode/ OHTL interface. The OFET-performance was evaluated in comparison to the conventional device structure without F4-TCNQ. The results of the Transfer-measurements and Output-characteristics corroborate the advantages of the modification with respect to high On-current, lower threshold voltage and operational stability.

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**Effect of blending ratio and internal order on the optical properties of P3HT:PCBM bulk heterojunction films** — •THOMAS MADENA, MARTIN KNIPPER, INGO RIEDEL, and JÜRGEN PARISI — Energy- and Semiconductor Research Laboratory, Department of Physics, University of Oldenburg, Carl-von-Ossietzky-Strasse 9-11, D-26111 Oldenburg

Organic solar cells represent thin film devices comprising a multilayer system of planar semiconductor films finished with a metal electrode. Internal reflections of the incident light and the resulting coherent superposition of electromagnetic waves travelling in opposite directions cause a spatially nonuniform light intensity distribution. Calculation of the intensity pattern along the cross section of the device is an essential step for optimizing the photocurrent in single junction and in particular multispectral tandem devices. Provided that thickness and optical constants of individual layers of the device are known optical simulation of the light propagation can be carried out via the transfer matrix formalism. In this work we investigated the absorber of solution-processed organic solar cells based on conjugated polymer-fullerene (P3HT: PCBM) bulk heterojunctions. Variation of the blending ratio and thermal annealing of the films have strong impact on the device performance. Ellipsometry was applied together with structural analysis of P3HT: PCBM films in order to relate their optical response to the film composition and thermally induced internal ordering. The results are correlated with the measured photocurrent and spectral response of solar cells with respective active layer composition.

SYSA 5.23 Tue 14:30 Poster A

**Monitoring the growth of thin metal phthalocyanine films via Raman scattering** — •BRITT-ELFRIEDE SCHUSTER<sup>1</sup>, CAMELIU HIMCINSCHI<sup>2</sup>, MARIUS TOADER<sup>2</sup>, HEIKO PEISERT<sup>1</sup>, THOMAS CHASSÉ<sup>1</sup>, and DIETRICH R. T. ZAHN<sup>2</sup> — <sup>1</sup>Institute of Physical and Theoretical Chemistry, University of Tübingen; Auf der Morgenstelle 8, 72076 Tübingen, Germany. — <sup>2</sup>Semiconductor Physics, Chemnitz University of Technology; Reichenhainer Straße 70, 09126 Chemnitz, Germany.

Due to their unique properties, (metal) phthalocyanines (MPc) are highly attractive materials and promising candidates for various applications e.g. in fields of organic light emitting diodes or organic field effect transistors. Since device efficiency and performance are significantly influenced by the physical properties of the thin organic films, intensive studies of the growth and the influence of preparation parameters are very important for thin film technology. In this work the growth of copper(II)phthalocyanine (CuPc) and ti-