

tanyl(IV)phthalocyanine (TiOPc) on the technically relevant substrate silicon is assessed by in situ monitoring of the Raman scattering of internal vibrational modes to study e.g. the evolution of the polymorphic modifications during the growth and/or the molecular arrangement within the organic layers. The thermal evaporation of metals like silver on the organic films under ultra-high vacuum conditions provides further information about the interface formation. In this regard the occurrence of new Raman modes, normally being infrared active, suggest the interaction of the metal with the phthalocyanine film via a charge transfer.

SYSA 5.24 Tue 14:30 Poster A

Improving electron injection in organic light emitting diodes using a thin Li₃PO₄ layer — ●ANDREA GASSMANN, CHRISTIAN MELZER, and HEINZ VON SEGGERN — Technische Universität Darmstadt, Institute for Materials Science, Electronic Materials Division, Petersenstr. 23, 64287 Darmstadt

In this contribution a novel cathode material is introduced allowing for device performances comparable to the benchmark cathode LiF / Al. A thin layer of the metal salt lithium phosphate Li₃PO₄ is deposited between the organic semiconductor and an Al cathode. In normal OLED structures it will be disclosed that both the current density and the luminance increase similarly to the characteristics of reference devices fabricated with LiF / Al cathodes. This increase can be ascribed to an enhanced electron injection.

Regarding the origin of the observed device characteristic improvement through Li₃PO₄ / Al, a field enhanced injection due to piled - up holes at the cathode side can be excluded since the improvement of device characteristics holds also true in electron-only devices. Moreover, it was observed that Li₃PO₄ is most beneficial to the device performance at a thickness of 7 Å. Concerning the doping ability of Li₃PO₄, devices with co-evaporated organic semiconductor were prepared revealing a deterioration of device characteristics. Furthermore, in capacitance/ voltage measurements no evidence of doping was found. Therefore, the focal point of Li₃PO₄ / Al research is attributed to interface properties what is the subject of current and future investigations.

SYSA 5.25 Tue 14:30 Poster A

Charge transfer doping of organic diodes: A theoretical study — ●OLIVER OTTINGER, CHRISTIAN MELZER, and HEINZ VON SEGGERN — Electronic Materials Division, Institute of Materials Science, Technische Universität Darmstadt, Petersenstr. 23, 64287 Darmstadt, Germany

Charge transfer doping is a promising concept for improving charge injection from metals into organic semiconductors. A self-consistent model of an unipolar electron-only metal/insulator/metal (MIM) diode based on drift diffusion theory was applied. It allows for the description of injection as well as space charge limited currents. The model was extended by charge transfer doping with arbitrary doping profiles. Besides modelling the steady state current density-voltage characteristics and the respective electric field- and charge carrier distributions, the response on an ac disturbance has been considered in order to model impedance measurements. Simulations were done for bulk doped and near-interface doped diodes.

It will be shown, that doping in the vicinity of the cathode results in an improved device performance. This stems from an electric field induced inherent barrier lowering promoting the electron injection. A bulk doped MIM system can be well understood as two Schottky diodes in series while one is forward and the other is reverse biased. Simulating CV characteristics it was shown that both resulting depletion capacitances determine the time dependent characteristics of the device.

SYSA 5.26 Tue 14:30 Poster A

Charge injection in light emitting organic field effect transistors — ●MARTIN SCHIDLEJA, CHRISTIAN MELZER, and HEINZ VON SEGGERN — Electronic Materials Division, Institute of Materials Science, Technische Universität Darmstadt, Petersenstr. 23, 64287 Darmstadt, Germany

Light emitting organic field effect transistors with different metals used as source and drain contacts are investigated. The transistors are built in a top-gate, bottom-contact configuration with poly(9,9-di-n-octyl-fluorene-alt-benzothiadiazole) (F8BT) as organic semiconductor and poly(methyl methacrylate) (PMMA) as gate-dielectric. For the drain and source electrodes either gold or silver is used. While gold results in balanced injection barriers for hole and electron injection

of about 1 eV, the use of silver disturbs this essential balance in the injection properties.

The drain current and the position of the recombination zone in the transistor channel at different voltages are measured for the respective transistors. It is found that the experimental data cannot be explained by the standard equations for ambipolar transistors, most probably due to large injection barriers and hence, high contact resistances. In order to evaluate the results, a numerical model is introduced, taking into account the influence of different injection-barriers on the ambipolar behaviour of organic field effect transistors by separate calculation of the injection currents at the source and drain contacts, respectively. Our results stress the importance of contact phenomena in light emitting organic field effect transistors.

SYSA 5.27 Tue 14:30 Poster A

Vacuum deposited films of dicyanovinylene-capped oligothiophenes for use in organic solar cells — ●MARIETA LEVICHKOVA¹, DAVID WYNANDS¹, MORITZ RIEDE¹, MARTIN PFEIFFER², EDUARD BRIER³, EGON REINOLD³, PETER BÄUERLE³, and KARL LEO¹ — ¹Institut für Angewandte Photophysik, TU Dresden, 01062 Dresden — ²Heliatek GmbH, 01187 Dresden — ³Institut für Organische Chemie II und Neue Materialien, Universität Ulm, 89081 Ulm

Solar cells based on oligothiophene derivatives comprising electron-accepting dicyanovinyl groups have shown high power efficiencies (up to 3.4%). Here, we study the effect of substrate temperature on the morphology and photophysical properties of DCV6T (α,ω -bis-(dicyanovenylen)-sexithiophene) films with the aim to optimize the active layer structure. The films are prepared by vapor deposition on quartz substrates covered with amorphous hole transport layer. During the evaporation of DCV6T, the substrates are kept at constant temperatures between 20°C and 100°C. AFM images show increased grain size and surface roughness of the samples grown at higher T_{sub} . The alteration of surface topography is accompanied by an enhanced and red-shifted absorption which we attribute to a more ordered molecular arrangement leading to a co-planarization of the thiophene rings within the oligomers. Also, for the samples grown at $T_{sub} \geq 80^\circ\text{C}$, the overlap between absorption and luminescence increases which suggests an increase in exciton diffusion length. Finally, we will discuss the effect of the various DCV6T morphologies on the performance of solar cells.

SYSA 5.28 Tue 14:30 Poster A

Initial growth of evaporated copper phthalocyanine thin-films - Comparison of metal and oxide substrates — ●INDRO BISWAS¹, HEIKO PEISERT¹, MATHIAS NAGEL¹, MARIA BENEDETTA CASU¹, BRITT-ELFRIEDE SCHUSTER¹, STEFAN SCHUPPLER², PETER NAGEL², MICHAEL MERZ², and THOMAS CHASSÉ¹ — ¹Institut für Physikalische und Theoretische Chemie, Universität Tübingen, Auf der Morgenstelle 8, 72076 Tübingen — ²Institut für Festkörperphysik, Forschungszentrum Karlsruhe, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen

The growth of copper phthalocyanine thin films evaporated on various substrates has been examined in detail, using near-edge x-ray absorption fine structure (NEXAFS) spectroscopy and surface-sensitive x-ray photoemission spectroscopy (SXPS). The focus is on interfaces relevant for technical applications, i.e. metals and oxide conductors as contact electrodes in OLEDs and solar cells, and insulators as dielectric materials in OFETs. The molecular orientation of thin-films in the range of 0.2 to 3.0 nm thickness was examined, with a special focus on the layers directly at the interface. Metal substrates generally lead to an interfacial layer of flat lying molecules, even on rough polycrystalline substrates. On the used oxide substrates (SiO₂) and indium tin oxide) the initial molecular orientation is not lying on rough surfaces, with the exception of a single crystalline substrate (TiO₂). The growth mode is discussed in terms of interfacial and intermolecular interactions and of preparation parameters.

SYSA 5.29 Tue 14:30 Poster A

Transparent Contacting Materials for Organic Solar Cells — ●JAN MEISS, MORITZ K. RIEDE, and KARL LEO — Institut für Angewandte Photophysik, Technische Universität Dresden, 01062 Dresden

Organic solar cells are emerging as a possible inexpensive alternative to inorganic photovoltaics. A current cost issue of organic solar cells is the high price of indium tin oxide (ITO), the most commonly used transparent contacting material. We are exploring alternatives to replace the scarce and expensive indium. Promising candidates are ZnO:Al or the highly conductive polymer PEDOT:PSS.