DS 18.19 Tue 14:30 Poster A

Temperature dependent measurements on perylene thin-film based OTFTs — •Christian Effertz, Moritz Schaefer, Maryam Beigmohamadi, Azadeh Farazadi, Phenwisa Niyamakom, Philip Schulz, and Matthias Wuttig — Institute of Physics (IA), RWTH Aachen University, 52056 Aachen, Germany

Organic Thin-Film Transistors (OTFTs) are promising candidates for electronic applications, e.g. as an active matrix for flexible displays. Some organic materials, such as perylene, show a high field-effect mobility, comparable to hydrogenated amorphous silicon (a-Si:H). In order to describe the mechanism of charge transport, competing models, like the grain boundary model, the small polaron model and the multiple trapping and release model have been developed in the past. However, for a wide range of organic semiconductors it is not yet understood what model has to be applied. In order to gain a deeper insight into the transport meachnisms of organic materials we present temperature dependent measurements of the electronic transport in perylene-based OTFTs. The temperature range between 213K and 418K has been investigated. The TFTs were produced employing OTS and 2-propanol modified SiO_2 dielectric layers, on top of highly doped silicon substrates, which were used as the gate contact. Thermally evaporated gold pads acted as the contacts for the source and drain of the devices. Besides electronic measurements, additional characterization techniques, including Atomic Force Microscopy (AFM) for the surface morphology and X-Ray Diffractometry (XRD) for structural analysis of the organic layer have been employed in this investigation.

DS 18.20 Tue 14:30 Poster A

LT-STM study of indivdual CuPc molecules on Cu(111) — Hatice Karacuban, •Johannes Schaffert, Sascha Koch, Thorsten Wagner, and Rolf Möller — Universität Duisburg-Essen, Fachbereich Physik, Lotharstr. 1-20, 47057 Duisburg

The interface between organic semiconductors and metals plays a key role for the electronic properties and thus for their application in devices. We present a low temperature scanning tunneling microscopy and spectroscopy study of copper phthalocyanine on Cu(111). A submonolayer of CuPc was evaporated onto a clean Cu(111) single crystal at room temperature under ultra high vacuum (UHV) conditions. Previous measurements show that at room temprature single CuPc molecules are mobile on the Cu(111) surface and can not be imaged by means of STM. The presented STM measurements have been carried in UHV at temperatures below 10K. We observe CuPc adsorbed in two different geometries, as well as the equivalent sites, rotated by multiples of 60°. One of the adsorption sites leads to an apparent reduction of the molecules four-fold symmetry in the STM image. Two opposite of four benzopyrrol rings appear brighter. First spectroscopic results show, that the brighter parts also differ electronically. Furthermore, the molecules adsorbed with reduced symmetry tend to align forming chains of molecules on the Cu(111)surface.

DS 18.21 Tue 14:30 Poster A

Ellipsometry Investigation of Pentacene Thin Films — •Marion Friedrich, Daniel Lehmann, Falko Seidel, and Dietrich R. T. Zahn — TU Chemnitz, Institut für Physik, 09107 Chemnitz, Germany

Thin pentacene layers with thicknesses ranging between 20 and 150 nm were prepared by organic molecular beam deposition on native oxide covered silicon substrates. Variable angle spectroscopic ellipsometry was applied aiming at the determination of thicknesses and dielectric function of pentacene thin films. Starting with the assumption that the optical properties are the same, the optical constants of several films with different thickness were coupled and fitted together with the film thicknesses in a multi-sample analysis procedure. For thickness determination different models are employed and discussed regarding their deviation from the measurement results. Best agreement between simulation and experiment was found for a model implying uniaxial films. As a result of further detailed data evaluation in the absorbing spectral range a difference in the dielectric functions for thin and thick layers was determined.

DS 18.22 Tue 14:30 Poster A

Spectroscopic studies of metal oxide sensitisation by self-assembling light harvesting molecules and photovoltaic applications — •Clare Dyer-Smith[1], Jenny Nelson[1], Saif A Haque[2], Peter Marek[3], and T Silviu Balaban[3] — [1]Dept of Physics, Imperial College, London SW7 2AZ, U.K — [2]Dept of Chemistry, Imperial College, London SW7 2AZ, U.K — [3]Karlsruhe Institute of Technology, Institute for Nanotechnology, Postfach 3640, D-76021 Karlsruhe

Molecular photovoltaic devices may provide a low-cost alternative to crystalline silicon solar cells with the long-term potential to displace conventional fossil fuels. Naturally occurring within green photosynthetic bacteria are metal porphyrins which self assemble to form a light harvesting antenna architecture enabling exciton transport over longer ranges. This is promising for application in organic solar cells where charge separation requires exciton diffusion to an interfacial site. Self assembly is thought to lead to improved charge transport properties and therefore improved photocurrent generation efficiency. We report studies of functionalised porphyrins acting as the donor component in molecular photovoltaic devices. We study the influence of film morphology, influenced by the porphyrin side groups, on exciton diffusion, charge separation yield and charge transport in porphyrin films on semiconducting metal oxide surfaces. Charge separation and transport properties are measured using transient optical spectroscopy and time of flight techniques and are correlated to film morphology. The structure and energetics of the donor-acceptor interface are key to maximising the potential of such systems for photovoltaic applications.

DS 18.23 Tue 14:30 Poster A

Investigation of thermally activated charge carrier transport in thin perylene layers — •Moritz Schaefer, Christian Effertz, Maryam Beigmohamadi, Phenwisa Niyamakom, Azadeh Farahzadi, Philip Schulz, and Matthias Wuttig — Institute of Physics (IA), RWTH Aachen University, 52056 Aachen, Germany

The production of organic thin-film transistors (OTFTs) is a low cost process. Therefore, they are promising for large area TFT arrays as needed in low cost electronic paper, RFID tags, etc. [1]. Recently reported characteristics of OTFTs in terms of mobility and Ion/Ioff-ratio are similar to those of the currently used hydrogenated amorphous silicon (a-Si:H) TFTs [1]. It is now possible to produce OTFTs with a comparable high performance, but the transport phenomena in the organic layer are still not completely understood.

We present the electronic characteristics of perylene based OTFTs. Transfer and output characteristics were measured in order to determine the mobility μ(T) and the threshold voltage VT(T). For this purpose, a stage was designed that can be cooled to -50°C and heat to +100°C. The active layer of the transistors was produced by vacuum thermal evaporation (VTE) via a temperature controlled substrate holder with a temperature range from -40°C to +35°C. The organic film thickness was varied between 25 nm and 500 nm. Atomic Force Microscopy (AFM) and x-ray diffraction (XRD) have been used in order to determine the crystallinity and morphology of the organic layer.

[1] D. S. Park, et. al., J. Vac. Sci. Technol. B 23(3) (2005)

DS 18.24 Tue 14:30 Poster A

Mobile Ionic Impurities in Organic Thin Film Dielectrics for Electronic Application — •Reinhard Schwödiauer[1], Martin Egginger[2], Mihai Irimia-Vladu[1], Andreas Tanda[4], Irene Frischauf[3], Siegfried Bauer[1], and Serda Sariciftci[2] — [1]Soft Matter Physics, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria — [2]Linz Institute for Organic Soloar Cells, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria — [3]Institute for Biophysics, Johannes Kepler University, Altenbergerstrasse 69, 4040 Linz, Austria — [4]Plastic Electronics GmbH, Rappetsederweg 28,4040 Linz, Austria

In the field of organic electronics organic thin film dielectrics can have a strong influence on the device performance. We present a comprehensive and comparative study of mobile ionic impurities for BCB and poly(vinyl alcohol) with traces of sodium acetate at different concentrations, ranging from below 0.004 mass% up to < 0.5 mass%. The two polymers are investigated both in a metal-insulator-metal (MIM) and a metal-insulator-(C60) semiconductor (MIS) configuration by broadband dielectric spectroscopy in the frequency-(50 *H < f < 10 kHz), dc bias voltage (-25 V < Ubias < +25 V) and temperature (20°C < T < 120°C) domain. In addition we also present measurements on OFETs of the same material combination at different temperatures between 3°C and 60°C.

The consistent results show conclusive evidence for the impact of mobile ions in organic dielectrics for the stability and reliability of organic field effect transistors.

DS 18.25 Tue 14:30 Poster A

Design and Performance of an Ion Beam Vacuum Deposition Apparatus Based on Electrospray Ionization — •Stephan