DS 5: Organic Interfaces (SYOE 1)

Time: Monday 14:30–15:45 Location: H32

DS 5.1 Mon 14:30 H32

Structural and morphological study of perylene films grown on different substrates — •Maryam Beigmohamadi, Phenwisa Niyamakom, Azadeh Farahzadi, Stephan Kremers, Christian Effertz, Thomas Michely, and Matthias Wuttig — Institute of Physics (IA), RWTH Aachen University of technology 52056 Aachen, Germany

Recently, organic semiconductors have emerged as a technologically important class of electronic materials. Of particular interest is the morphology and the growth of organic films, deposited on insulating substrates, since this configuration is used in Organic Thin Film Transistors (OTFTs). Key elements for the device performance are the structure of the functional organic layer and the charge injection from the metallic contacts. Therefore, understanding of structural properties and the morphology of organic films deposited on metallic substrate is essential for applications in future devices. Also improved internal ordering of the organic thin film, together with increased electrical conductivity and with reduced activation energy for electrical conductivity could enhance field-effect carrier mobilities. The growth of highly ordered perylene films deposited on oxidized and metallic substrates is studied. By employing Atomic Force Microscopy (AFM) and X-ray Diffraction (XRD), the structure and the morphology of the films are characterized. AFM reveals the existence of dislocation in the grains. From XRD, it has been observed that the perylene films, deposited on Al2O3/Si, have fiber texture ordering in c-axis. However, for perylene films deposited on Au layer the crystalline structure is less developed.

DS 5.2 Mon 14:45 H32

A photoemission electron microscopy investigation of diindenoperylene thin films — •Maria Benedetta Casu[1], Indro Biswas[1], Mathias Nagel[1], Peter Nagel[2], Stefan Schuppler[2], and Thomas Chassé[1] — [1]University of Tübingen, Institute of Physical and Theoretical Chemistry, Tübingen, Germany — [2]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, Karlsruhe, Germany

Organic-based displays are widely present on the market, used for HI-FI cars, mp3 player, and mobile phones, as well as in television screens, without mentioning e-paper, one of their most fascinating applications. It is very important to reach a deep general understanding of their electronic, structural, and morphological properties that despite the numerous investigations is still missing. We present the results of photoemission electron microscopy (PEEM) investigations on diindenoperylene thin films deposited on polycrystalline gold. The thin films were prepared by using organic molecular deposition and thickness-dependent investigations were performed. PEEM is a very powerful tool that can give a deep insight in in-situ growth. The opportunity to use a synchrotron radiation source allows the simultaneous investigation of morphology, structure, and electronic characteristics. All these aspects usually investigated by using separated techniques, often on differently prepared samples, are univocally related in our results with special attention to the molecular arrangement. This approach, in synergy with micro near- edge x-ray absorption fine structure, helps in gain a detailed knowledge also in case of critical phenomena like polymorphism in organic materials.

DS 5.3 Mon 15:00 H32

Molecular Orientation and Adsorption Energies of Pentacene: SiO_2 versus Metals — •Daniel Käfer and Gregor Witte — Physikalische Chemie I, Ruhr-Universität Bochum, 44780 Bochum

Having a high charge carrier mobility, pentacene is still one of the most promising organic semiconductors for the fabrication of organic thin film transistors. Of particular interest is the interaction at the interface with noble metals and SiO_2 substrates since these materials are commonly used in field-effect devices. Because of the high anisotropy of the charge carrier mobility the molecular orientation of pentacene within the first layers of thin films plays a crucial role. Moreover, the subsequent film growth depends largely on this interface structure. By combining NEXAFS and XRD to determine the molecular orientation and crystalline phase with TDS to probe the interaction strength, pentacene films grown on SiO_2, gold and silver surfaces as well as SAM covered Au substrates have been investigated in detail. Distinctly different desorption temperatures were obtained for the various crystalline phases grown on bare metal substrates and for the thin and thick film phases formed on SiO_2 and SAM covered gold.

DS 5.4 Mon 15:15 H32

Charge Transfer Across Hexyl Layers Driven by Thermodynamics — •Steffen Duhm[1], Hendrik Glowatzki[1], Jürgen P. Rabe[1], Robert L. Johnson[2], and Norbert Koch[1] — [1]Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr. 15, D-12489 Berlin, Germany — [2]Institut für Experimentalphysik, Universität Hamburg, D-22761 Hamburg, Germany

The energy level alignment of α,ω-dihexylsexithienyl (DH6T) on tetrafluoro-tetracyanoquinodimethane (F4-TCNQ) pre-covered Ag(111) and polycrystalline Au substrates was investigated with ultraviolet photoelectron spectroscopy (UPS). On both substrates DH6T exhibits a transition from flat lying molecules in the monolayer to inclined molecules in multilayers, accompanied by a shift of molecular levels. A transition from vacuum-level alignment to *molecular level pinning* - reminiscent of Fermi-level pinning - at the homo-interface between DH6T monolayer and multilayers was observed, which depended on the amount of pre-deposited F4-TCNQ. The measured shift in the vacuum level between monolayer and multilayer DH6T is direct evidence for interface dipoles and for thermodynamically driven charge transfer between molecular layers. The observed pinning behavior suggests that hexyl chains are not appropriate insulating layers for the use in *molecular electronics*, and longer chains may be needed.

DS 5.5 Mon 15:30 H32

Determination of Transport Levels in Organic Semiconductors by UPS, IPES, and 2PPE — •Sönke Sachs[1], Stefan Krause[1], Christian Schwalb[2], Ulrich Höfer[2], Achim Schöll[1], and Eberhard Umbach[1] — [1]Universität Würzburg, Experimentelle Physik II, Am Hubland, 97074 Würzburg — [2]Universität Marburg, Fachbereich Physik, Renthof 5, 35032 Marburg

The determination of the energetic position of transport levels in organic semiconductors is crucial to answer fundamental and application related questions, e.g. about transport properties and exciton binding energies, which are important for the development of organic devices.

We present a systematic approach to determine transport levels of the model system PTCDA/Ag(111) using a combination of different photoelectron-spectroscopies (UPS, IPES, and 2PPE). The applied methods differ in their excitation mechanisms and thus provide information about electron relaxation dynamics. We classify the results on the one hand with respect to the optical gap, exciton binding energy and localization. On the other hand we discuss them with respect to common models on charge carrier localization and transport. The experiments yield results that show a rather unexpected behaviour of highly delocalized charge carriers and only weakly bound excitons.