

O 35 Organic films III

Time: Thursday 11:15–13:00

Room: WIL B321

O 35.1 Thu 11:15 WIL B321

HREELS study of thin NTCDA/Ag(111) films upon different — ●DOMINIQUE HÜBNER¹, V. SHKLOVER¹, C. STADLER¹, R. FINK², and E. UMBACH¹ — ¹Univ. Würzburg, Exp. Phys. II — ²Univ. Erlangen, Phys. Chem. II

High Resolution Electron Energy Loss Spectroscopy is a well established tool to investigate both electronic and vibronic excitation of thin films of large organic molecules. In addition to the vibronic and electronic properties, HREELS can provide structural information due to its sensitivity to molecular orientation. We investigated thin NTCDA films on Ag(111) surface with respect to different growth conditions (i.e. film thickness, growth rate, substrate temperature). The results are compared to FTIR, NEXAFS, and SPA-LEED measurements. For room temperature a Stranski-Krastanov growth with well ordered islands is observed whereas on cooled substrates a less well ordered Frank van der Merwe growth is observed.

O 35.2 Thu 11:30 WIL B321

Morphology of Sexiphenyl thin films — ●GREGOR HLAWACEK¹, ANDREI ANDREEV¹, CHRISTIAN TEICHERT¹, PAUL FRANK², ADOLF WINKLER², ROLAND RESEL², and MICHAEL RAMSEY³ — ¹Institut of Physics, University of Leoben, 8700 Leoben, Austria — ²Department of Solid State Physics, Graz Technical University, A-8010 Graz, Austria — ³Department of Experimental Physics, University of Graz, A-8010 Graz, Austria

Understanding and controlling the growth of organic thin films is vital for the production of high quality organic devices. Small organic molecules have shown a high potential for applications like organic lasers, organic light emitting devices and organic thin film transistors.

Here, para-sexiphenyl has been grown under UHV conditions at different growth temperatures. The used substrates include Si(001), mica(001), BaF₂(111) and KCl(001). Ex-situ as well as in-situ atomic-force microscopy (AFM) has been used to characterize the film morphology. Phase imaging has shown to be a useful tool to analyse the growth of the first few monolayers. In addition, some of the films have been analysed by different X-ray methods.

The molecular orientation (upright or parallel to the substrate) can be controlled by using the right combination of substrate and growth temperature. The films formed from lying molecules usually show a higher anisotropy that is mediated by the underlying substrate.

O 35.3 Thu 11:45 WIL B321

Transition from layer-by-layer to rapid kinetic roughening in organic semiconductor DIP films on SiO₂ — ●XUE NA ZHANG¹, ESTHER BARRENA², and HELMUT DOSCH^{1,2} — ¹Max-Planck-Institut für Metallforschung, Heisenbergstrasse 3, 70569 Stuttgart, Germany — ²Institut für Theoretische und Angewandte Physik, Universität Stuttgart, 70550 Stuttgart, Germany

Over the past two decades, organic semiconductors have widely investigated, due to their exciting optical, electronic, and optoelectronic properties. Recently, thin films of diindenoperylene (DIP) have been studied showing an extraordinarily high structural order on silicon dioxide making this molecule a prospective candidate for application in electronic devices [1][2]. Here we present a study of the structure and growth in the early stages of the DIP film formation on SiO₂ by Atomic Force Microscope and in-situ x-ray diffraction. We show that a transition from perfect layer-by-layer to rapid kinetic roughening occurs at a critical thickness of about 4-5 ML. In addition, our results reveal that significant changes in the lateral structure take place during these first stages of the DIP growth. Different aspects of the growth are discussed in relationship with the observed structural data.

[1]A.C. Dürr, et al. Applied Physics Letters **81**, 2267 (2002).

[2]A.C. Dürr, et al. Physical Review Letters **90**, 016104 (2003).

O 35.4 Thu 12:00 WIL B321

Influence of the substrate morphology on the organic layer growth of PTCDA/Ag(111) — ●THOMAS SCHMIDT¹, HELDER MARCHETTO², ULLRICH GROH¹, HELMUT KUHLENBECK², RAINER FINK³, HANS-JOACHIM FREUND², and EBERHARD UMBACH¹ — ¹Experimentelle Physik II, Universität Würzburg — ²Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin — ³Physikalische Chemie II, Universität Erlangen-Nürnberg

Using UV-excited photoelectron emission microscopy (UV-PEEM) we investigated the microscopic growth behavior of organic thin films (here PTCDA) on a Ag(111) single crystal substrate. Real time observation allows to correlate the growth mode (and related kinetic parameters) with substrate properties like terrace width (step density) and step bunches for the initial film formation, i.e., from the submonolayer range up to 5 monolayers. Above room temperature PTCDA (3,4,9,10-perylene-tetracarboxylic acid dianhydride) grows in a Stranski-Krastanov like fashion: after completion of the first two stable layers three dimensional islands are formed. The nucleation density depends drastically on the substrate morphology and thus affects the structural and morphologic properties of the organic film. Funded by BMBF under contract no. 05KS4WWB/4.

O 35.5 Thu 12:15 WIL B321

Optical Evidence for Substrate Induced Growth of Ultra-thin Hexa-*peri*-hexabenzocoronene Layers on HOPG — ●ROMAN FORKER¹, THOMAS DIENEL¹, KLAUS MÜLLEN², and TORSTEN FRITZ¹ — ¹Institut für Angewandte Photophysik, TU Dresden, Germany — ²MPI für Polymerforschung, Ackermannweg 10, 55128 Mainz, Germany

We report on the influence of the substrate on the optical properties of ultra-thin hexa-*peri*-hexabenzocoronene (HBC) layers deposited by organic molecular beam epitaxy (OMBE). For that purpose, the *in situ* differential reflectance spectroscopy (DRS) was employed, providing unsurpassed sensitivity for the thickness-dependent optical analysis. From the DR spectra, the optical constants were extracted using a novel numerical algorithm [1]. It turns out that HBC films on different substrates exhibit different growth modes which could be confirmed by structural examinations.

While HBC shows polycrystalline island structures on mica and on fused quartz, layer-by-layer growth along with the formation of one-dimensional stacks on HOPG could be demonstrated optically. The observed monomer → dimer → oligomer transition was related to the well-known findings for perylenetetracarboxylicdianhydride (PTCDA) layers on mica [2, 3].

[1] R. Nitsche et al., Phys. Rev. B **70** (2004), 195432

[2] H. Proehl et al., Phys. Rev. Lett. **93** (2004), 097403

[3] H. Proehl et al., Phys. Rev. B **71** (2005), 165207

O 35.6 Thu 12:30 WIL B321

In situ study of the Growth of Titanylphthalocyanine (TiOPc) on Au(111) — ●T. DIENEL¹, S.C.B. MANNSFELD², K. WALZER¹, and T. FRITZ¹ — ¹Institut für Angewandte Photophysik, TU Dresden, Germany — ²Department of Chemical Engineering, Stanford University, USA

We present a combined optical and structural investigation of the growth of TiOPc molecules on Au(111). Many different crystallographic polymorphs are known for TiOPc, exhibiting very distinct optical properties. Highly ordered TiOPc films were prepared by means of OMBE with submonolayer to multilayer coverage. The structural analysis was done by Scanning Tunnelling Microscopy (STM) and was confirmed by Low Energy Electron Diffraction (LEED) [1].

The recently implemented Differential Reflectance Spectroscopy (DRS) in combination with Photoluminescence measurements [2] were used to observe the change of the optical properties of the molecular layer *in situ*, which means during the actual growth of the film. The influence of the substrate temperature on the formation of different crystallographic polymorphs will be discussed as well as the strong quenching of the emission properties of the TiOPc film due to the metal substrate.

[1] S.C.B. Mannsfeld and T. Fritz, Phys. Rev. B **71**, 235405 (2005).

[2] H. Proehl et al., Phys. Rev. B **71**, 165207 (2005).

O 35.7 Thu 12:45 WIL B321

Nanostructured organic templates for the directed self-assembly of gold nanoparticles into confined domains —**•DANIEL DAHLHAUS, STEFFEN FRANZKA, NILS HARTMANN, and ECKART HASSELBRINK —** Universität Duisburg-Essen, Campus Essen, Fachbereich Chemie, Universitätsstr. 5, 45141 Essen

A new procedure for the preparation of ordered arrays of gold nanoparticles is demonstrated. Octadecylsiloxane monolayers are grown on native silicon substrates. Subsequently these coatings are patterned using a focused beam of an argon ion laser [1]. The method allows for a well-confined decomposition of the monolayer with a lateral resolution which is significantly below the laser spot diameter. In particular, at a spot diameter of about 2.5 microns, structures with a width of 100 nm and below have been prepared. After patterning the remaining domains of the monolayer are chemically functionalized via amination of the hydrocarbon tails. The chemically functionalized patterns are suitable to direct the adsorption and self-assembly of citrate-coated gold nanoparticles. In particular, gold nanoparticles with an average diameter of 16 nm are shown to self-assemble into quasi one-dimensional structures.

[1] T. Balgar, S. Franzka and N. Hartmann, Appl. Phys. A, in press