

DS 1: Organic Thin Films I

Time: Monday 9:30–11:00

Location: H32

DS 1.1 Mon 9:30 H32

Anisotropic optical constants and exciton-phonon coupling of diindenoperylene thin films — •UTE HEINEMEYER¹, STEFAN KOWARIK¹, ALEXANDER GERLACH¹, REINHARD SCHOLZ², M. ISABEL ALONSO³, MIQUEL GARRIGA³, J. ORIOL OSSÓ³, and FRANK SCHREIBER¹ — ¹Institut für Angewandte Physik, Universität Tübingen — ²Walter Schottky Institut, Technische Universität München — ³Institut de Ciència de Materials de Barcelona

Diindenoperylene (DIP) has received increased attention due to its well defined ordering and promising electronic transport properties [1,2]. We investigate the optical properties of DIP thin films on Si-substrates by spectroscopic ellipsometry. Since the molecules are highly ordered, the DIP films exhibit strong anisotropic optical properties with uniaxial symmetry so that it is necessary to perform variable angle ellipsometry. The data analysis of such anisotropic systems and the results in the energy range of 1.25 to 3 eV are presented. The aggregated molecules show a pronounced vibrational progression, allowing direct access to the exciton-phonon coupling. In addition a new mode appears that does not exist in the absorption spectra of free molecules in solution. It cannot be assigned to the vibronic progression and it is probably due to intermolecular coupling. Furthermore it is possible to take the spectra sufficiently fast to follow organic molecular beam deposition in detail. The analysis of the in-situ and real-time data taken at one fixed angle of incidence will be discussed. [1] S. Kowarik *et al.*, PRL **96**, 125504 (2006) [2] A. K. Tripathi and J. Pflaum, APL **89**, 082103 (2006).

DS 1.2 Mon 9:45 H32

Influence of substrate treatment and temperature on the electronic structure of diindenoperylene (DIP) thin films on Ag(111) — •STEFAN KRAUSE, SÖNKE SACHS, ACHIM SCHÖLL, and EBERHARD UMBACH — University of Würzburg, Experimental Physics II, Am Hubland, 97074 Würzburg, Germany

Diindenoperylene (DIP) has recently attracted high interest in the organic electronics community due to the reported very high hole mobility and favorable ordering properties in thin films on SiO₂ and gold substrates.

In this work we focus on the growth of DIP on the stronger interacting Ag(111) substrate. Due to the increased interface interaction an additional influence of the substrate can be expected, giving additional possibilities to manipulate the film growth. Ultraviolet Photoelectron Spectroscopy (UPS) data show substantial differences in the valence electronic structure before and after the annealing of low temperature deposited films. The annealing is believed to increase the degree of structural order particularly in the case of film growth far from thermal equilibrium conditions. Moreover, a marked influence of the substrate treatment could also be observed in the UPS spectra. The Ag(111) sample reveals a change of the work function depending on the duration and temperature of the annealing cycle after the Ar⁺-sputter treatment which can be associated with differences in the step density. The photoemission results indicate that different structural phases with different intermolecular interaction exist on the substrate morphology and growth parameters.

DS 1.3 Mon 10:00 H32

Epitaxial Heterolayers of Quaterylene and HBC on Au(111) — •DANIEL KASEMANN, ROBERT FRANKE, ROMAN FORKER, and TORSTEN FRITZ — Institut für Angewandte Photophysik, Mommsenstr. 13, D-01069 Dresden, Germany

As growth and electronic properties of perylene derivatives [1] and other medium-sized planar aromatic molecules [2] have already been studied intensively, we have now investigated larger organic molecules, namely quaterylene (QT).

In our contribution, we will present the first results on the investigation of thin, highly ordered double layers of QT and hexa-perihexabenzocoronene (HBC). These layers were prepared on a gold single crystal (Au(111)) by Organic Molecular Beam Epitaxy (OMBE).

We were able to image these structures with molecular resolution by room temperature STM. With these real space images and an additional LEED analysis, the system could be successfully characterized. The QT was found to grow in a point-on-line mode on the HBC, the lattice vectors are relaxed compared to the growth of QT directly on

Au(111) [3].

- [1] M. Toerker *et al.*, PRB **65** (2002) 245422
- [2] H. Proehl *et al.*, PRB **63** (2001) 205409
- [3] R. Franke *et al.*, APL **88** (2006) 161907

DS 1.4 Mon 10:15 H32

Molecular chains and carpets of sexithiophenes on Au(111) — •HENDRIK GLOWATZKI¹, STEFFEN DUHM¹, KAI F. BRAUN², JÜRGEN P. RABE¹, and NORBERT KOCH¹ — ¹Humboldt-Universität zu Berlin, Institut für Physik, Newtonstrasse 15, 12489 Berlin — ²Universität Hamburg, Institut für Angewandte Physik, 20355 Hamburg, Germany

We investigated two organic semiconductors sexithiophene (6T) and dihexylsexithiophene (DH6T) adsorbed on Au(111) in the (sub-)monolayer range by scanning tunneling microscopy (STM). At low coverage, 6T formed continuous chains of single molecular width along Au step edges, facilitated by 6T conformation changes. At monolayer coverage, substantially different structures were observed for the two molecules, despite the identical conjugated core. 6T formed rows of molecules with parallel long molecular axes, whereas DH6T formed lines along these axes, where the conjugated cores were embedded in a matrix of hexyl chains (brick-wall-like). Alkylation of 6T thus led to significantly reduced inter-molecular interactions of conjugated parts in the monolayer. Consequently, 6T formed a continuous "molecular carpet" on extended Au(111) terraces, whereas DH6T resembled a patchwork-like carpet, as domain boundaries were induced by the Au(111) herringbone surface structure.

DS 1.5 Mon 10:30 H32

Combined Spectroscopic Ellipsometry and Reflectance Anisotropy Spectroscopy Measurement of Phthalocyanines on ZnO (0001) Semiconducting Surface — •SINDU JOHN LOUIS, MARION FRIEDRICH, and DIETRICH ZAHN — Chemnitz University of Technology, Semiconductor Physics, D-09107 Chemnitz, Germany

Phthalocyanines (Pcs) are important class of materials exhibiting high thermal and chemical stability and also high optical absorption in the visible range. The growth of this molecule on the wide gap (3.2 eV) semiconductor ZnO of wurtzite structure is an interesting study. Detailed information about the interaction between the Pcs and the ZnO substrate can be obtained from Spectroscopic Ellipsometric (SE) measurements and the extent of in-plane anisotropy can be detected by the Reflectance Anisotropy Spectroscopy (RAS) measurements.

Thin films of Pcs are prepared by organic molecular beam deposition method in ultrahigh vacuum conditions. Spectroscopic ellipsometric studies were carried out using Variable Angle Spectroscopic Ellipsometer (VASE) in the NIR-Vis-UV range from 0.75 eV to 5 eV. RAS is sensitive to very small anisotropies of order 10⁻³ or even smaller. The accessible range is from 1.5 eV to 5.5 eV. Both these RAS and SE measurements are performed in situ together.

Since the optical absorption of the Pcs in the Q band region (around 2 eV) is due to π to π^* transitions of the macro cycle π - system, any change in the line shape of imaginary part of the dielectric function for ultra thin layers provide insight to the interaction with the surface through π - orbitals.

DS 1.6 Mon 10:45 H32

Photochromism in thin spiropyran films — •MICHAEL KARCHER, CELINE ELSÄSSER, CHRISTOPH RÜDT, MARTIN SCHÜBBE, and PAUL FUMAGALLI — Freie Universität Berlin, Deutschland

Photochromic molecules are reversibly switchable molecules that can be both addressed and read out using light. Possible applications are optical memory devices and smart materials [1]. Thin films of 6-nitro derivatives of the spiropyrans have been prepared using thermal evaporation under high vacuum conditions on different substrates. The photochromism of the films has been studied using optical absorption spectroscopy in the UV-VIS range. Reversible switching by light irradiation between the spiropyran and the merocyanine state was observed.

Steady-state transmission spectra of 10 to 40 nm thick films on quartz and magnesium-oxide substrates will be shown for both the spiropyran ground state as well as the metastable merocyanine state. Furthermore, the switching kinetics on a time scale of seconds will be presented.

- [1] Chem. Rev. **100**, 1741-1753 (2000)