

DS 24: Organic Thin Films IV

Time: Wednesday 16:30–17:45

Location: GER 38

DS 24.1 Wed 16:30 GER 38

Structure and morphology of cobalt phthalocyanine (CoPc) organic film on silicon dioxide (SiO₂) — ●MONAMIE SANYAL — Max Planck Institute for Metals Research, Heisenbergstrasse 3, Stuttgart - 70569, Germany

Phthalocyanines (Pc) are of great interest as functional molecular building blocks for organic electronics, partly on account of their enormous versatility and because of their unusually high chemical and thermal stabilities. In order to optimize their functional properties, the detailed knowledge of their film structure is a prerequisite. So far, majority of the investigations have been carried out on metal free phthalocyanine (H₂Pc) and its metal derivative (CuPc). Cobalt phthalocyanine (CoPc) is interesting for applications in optoelectronics and additionally is considered for application as a low dimensional molecular magnet due to magnetic properties of Co ion.

Here we show that CoPc on SiO₂/Si forms very well ordered multilayer films of standing molecules. By combining x-ray diffraction studies and Atomic Force Microscopy (AFM) we present results on the structure (perpendicular and parallel to the film surface) and morphology.

DS 24.2 Wed 16:45 GER 38

Model calculations on the in-plane optical anisotropy of copper-phthalocyanine films — ●MICHAEL FRONK, DIETRICH R. T. ZAHN, and GEORGETA SALVAN — Physics Department, Chemnitz University of Technology, D-09107 Chemnitz

Copper-phthalocyanine (CuPc) films prepared by organic molecular beam deposition on H-passivated silicon and Si covered with native oxide were investigated by means of ellipsometry and reflection anisotropy spectroscopy (RAS). In addition to the in-plane – out-of-plane anisotropy found from the evaluation of the ellipsometry data [1] an in-plane anisotropy in the order of 10⁻² was observed by RAS. In a first step model calculations assuming homogeneous in-plane anisotropy over the whole layer thickness were performed in order to extract the anisotropy in the optical constants n and k . While the spectral shape of the anisotropy in k indicates that each optical transition dipole has a different preferential azimuthal orientation in the CuPc film on H-Si, all transition dipoles appear to be aligned in the same direction for CuPc on Si+SiO₂. For the latter films the in-plane anisotropy was also found to increase with increasing thickness. For a detailed understanding of the azimuthal orientation of the optical transition dipoles the angle resolved RAS data were fitted. More advanced models taking into account a change in the anisotropy with film thickness were built in order to describe the spectral evolution with film thickness.

[1] O.D. Gordan et al., *Organic Electronics* 5, 2004, 291

DS 24.3 Wed 17:00 GER 38

Characterization of perfluoroalkyl-substituted phthalocyanine films, a new material for organic electronics — ●CHRISTOPHER KEIL¹, MARTIN LENER¹, STEFFI NAGEL¹, ROBERT GERDES², SERGIU GORUN², and DERCK SCHLETTWEIN¹ — ¹Justus-Liebig-Universität Gießen, Institut für Angewandte Physik, Heinrich-Buff-Ring 16, D-35392, Gießen. eMail: schlettwein@uni-giessen.de — ²New Jersey Institute of Technology, Department of Chemistry and Environmental Science, Newark, NJ 07102, USA

Octa(perfluoropropyl) octafluoro phthalocyanine complexes ($F_{64}Pc$) with different central metal groups (Cu, Zn, VO) were investigated as robust organic n-conducting semiconductor materials. Thin films were prepared by physical vapour deposition in high vacuum. The optical absorbance and electronic properties were measured in-situ during film

growth in order to reveal the formation of conducting pathways, the mechanism of film growth as well as potential microscopic intermolecular electronic coupling. The molecular energy levels of the materials were studied by potential dependent measurements of the charge transfer to the molecules in solution or in thin films. Possible applications of these new molecules as n-conducting and air stable materials in organic electronic devices like field effect transistors, chemical sensors and organic photovoltaic cells are discussed.

DS 24.4 Wed 17:15 GER 38

The morphology and optical properties of CuPc thin films on passivated Si(111) — ●LI DING¹, FALKO SEIDEL¹, MARIO ZERSON², CAMELIU HIMCINSCHI¹, MARION FRIEDRICH¹, and DIETRICH R. T. ZAHN¹ — ¹Semiconductor Physics, Chemnitz University of Technology, D-09107 Chemnitz, Germany — ²Chemistry Physics, Chemnitz University of Technology, D-09107 Chemnitz, Germany

Phthalocyanines (Pcs), chemically and thermally stable p-type organic semiconductors, are of great importance as promising materials for optical and electrical devices [1-2]. They show strong visible and UV absorption, which can be tuned e.g. by different central metal ions. Copper phthalocyanine (CuPc), one of the most intensively studied metal phthalocyanines, is deposited onto H-passivated Si(111) wafers with different offcut angles by organic molecular beam deposition (OMBD) under ultra-high vacuum (UHV) condition. The morphology of Si(111) surfaces passivated in HF of different concentrations is investigated by atomic force microscopy (AFM) before and after CuPc deposition. Variable angle spectroscopic ellipsometry (VASE) and reflectance anisotropy spectroscopy (RAS) are employed to study optical properties of CuPc thin films and their dependence on substrate surface roughness and offcut angles.

Reference

[1] N. B. McKeown, *Phthalocyanine Materials, Synthesis, Structure and Function*, Cambridge University Press, Cambridge, 1998.

[2] J. Simon, J. J. Andre, *Molecular Semiconductors*, Springer Verlag, Berlin, 1985

DS 24.5 Wed 17:30 GER 38

Long-range ordered PTCDA layers on epitaxially grown NaCl films on Ag(100) — ●ERIC LE MOAL, OLIVER BAUER, MATHIAS MÜLLER, and MORITZ SOKOLOWSKI — Institut f. Physikalische u. Theoretische Chemie, Universität Bonn, Wegelerstr. 12, 53115 Bonn

Organic thin films on insulators attract increasing attention for both fundamental properties and promising applications in optoelectronics. Structural or chemical characterization on a long-range scale generally requires measurements by electron diffraction or spectroscopy, which cannot be conducted on insulators due to charge accumulation. This can be avoided by growing the organic films on thin insulating films on metallic substrates. Here we report the ordering of perylene-3,4,9,10-tetracarboxylic acid dianhydride (PTCDA) molecules on thin NaCl films grown on Ag(100), studied by spot-profile-analysis low energy electron diffraction (SPA-LEED). We show that high structural order can be achieved at the metal/insulator and insulator/organic interfaces and that LEED is operable on NaCl films about ten atomic layers in thickness. In agreement with Burke *et al.* [PRL 100, 186104 (2008)], the first monolayer (ML) of PTCDA forms a commensurate ($3\sqrt{2} \times 3\sqrt{2}$) $R45^\circ$ superstructure with a quadratic unit cell ($a=16.95$ Å) and a T-shape in-plane molecular arrangement. This commensurate structure is metastable and can evolve to bulk-like nanocrystallites upon annealing above 273 K or exceeding 1 ML in coverage. However, growth at low temperature (223 K) yields PTCDA multilayers which are aligned with the first monolayer and exhibit an incommensurate structure. This project is financed by the A. v. Humboldt Foundation.