

O 46: Poster: Molecular Films - Photovoltaics, Electronics and Morphology

Time: Tuesday 18:15–20:30

Location: Poster A

O 46.1 Tue 18:15 Poster A

Control of Polymorphic Phases of an Anilino Squaraine by Organic Molecular Beam Deposition — TOBIAS BREUER¹, FRANK BALZER², MATTHIAS SCHULZ³, ARNE LÜTZEN³, •MANUELA SCHIEK⁴, and GREGOR WITTE¹ — ¹University of Marburg, D — ²University of Southern Denmark, Sønderborg, DK — ³University of Bonn, D — ⁴University of Oldenburg, D

Squaraines are small molecular quadrupolar donor-acceptor-donor (D-A-D) chromophores absorbing in the red spectral range considered for application as photovoltaic materials [1, 2]. A prototypical anilino squaraine with branched alkyl side chains (SQIB) crystallizes at least into two polymorphic bulk structures. In spin-casted thin films these two phases emerge with a strongly preferred out-of-plane and rather random in-plane orientation upon thermal post-annealing directed by the annealing temperature [3]. Now we investigate the surface induced growth of thermally vapor deposited SQIB on varying dielectric and conductive substrates and correlate the observed polymorphs to the substrate properties. We approach a complete picture of molecular orientation relative to the substrate geometry for instance by X-ray diffraction and polarized light microscopy. [1] Appl. Phys. Lett. 111 (2017) 183502. [2] Langmuir 32 (2016) 8533. [3] Cryst. Growth Des. (2017) DOI: 10.1021/acs.cgd.7b01131.

O 46.2 Tue 18:15 Poster A

single molecule study of ClAlPc on Au(111) Surface with low temperature scanning tunneling microscopy — •HAO ZHU, WENHUI ZHAO, HUANJUN SONG, and KAI WU — CCME, Peking University, No.5 Yiheyuan Road Haidian District, Beijing, 100871

Chloroaluminum phthalocyanine (ClAlPc), a non-planar molecule with a Cl atom outside of the phthalocyanine plane, presented constant dipole moment. The adsorption behavior of ClAlPc single molecule deposited on Au(111) surface was studied with the technique of STM, STS and dI/dV mapping. ClAlPc adsorbed on Au (111) with three type of conformation, including Cl atom pointing towards the vacuum (U1 and U2) and Cl atom pointing towards the substrate. Different adsorption orientations were observed between the two types of molecules. Moreover, we measured the orbital states of each type of molecules using STS at the center and dI/dV mapping at various sample bias.

O 46.3 Tue 18:15 Poster A

All-carbon nanocapacitors from graphene and carbon nanomembrane heterostructures — •XIANGHUI ZHANG¹, EMANUEL MARSCHIEWSKI¹, PAUL PENNER¹, THOMAS WEIMANN², PETER HINZE², and ARMIN GÖLZHÄUSER¹ — ¹Faculty of Physics, University of Bielefeld, 33615 Bielefeld, Germany — ²Physikalisch-Technische Bundesanstalt, 38116 Braunschweig, Germany

Molecular self-assembly allows a precise control of material structure and chemical composition. Here we show the fabrication of all-carbon nanocapacitors composed of multilayer stacks of carbon nanomembranes (CNMs) as dielectrics and graphene as conducting electrodes. CNMs were formed from a series of aromatic self-assembled monolayers of phenylthiol homologues, i.e. biphenylthiol, p-terphenylthiol, and p-quaterphenylthiol. The frequency response of nanocapacitors was measured with an LCR meter and the impedance spectra were analyzed with a simple equivalent circuit, in which the graphene strips were modeled as resistors and the CNM dielectric as a dissipative capacitor.

A dielectric strength of up to 4 MV/cm and a capacitance density of up to 0.4 $\mu\text{F}/\text{cm}^2$ were determined for multilayer carbon nanomembranes. The heterostructures possess an interfacial capacitance of 0.5 $\mu\text{F}/\text{cm}^2$. These results show the potential of carbon nanomembranes to be used as dielectric components in next-generation molecular electronics.

O 46.4 Tue 18:15 Poster A

Growth morphologies of dipolar nitrogen based oligoacene derivatives on (0001) sapphire — •AYDAN ÇİÇEK¹, ALEKSANDAR MATKOVIĆ¹, MARKUS KRATZER¹, ZHONGRUI CHEN², OLIVIER SIRI², CONRAD BECKER², and CHRISTIAN TEICHERT¹ — ¹Institute of Physics, Montanuniversität Leoben, Franz Josef Strasse 18, 8700 Leoben Austria — ²Aix Marseille Université, CNRS, CINaM UMR 7325, 13288 Marseille, France

Oligoacenes (as pentacene) and their derivatives are promising candidates for applications in organic electronics, due to molecular packing that favours charge transport and thus high field-effect mobilities. This study explores growth morphologies of thin-films and sub-monolayers of dihydro-tetraaza-acenes on the surface of sapphire, a technologically relevant gate dielectric. In particular, dihydro-tetraaza-pentacene (DHTA5) and -heptacene (DHTA7) molecules are considered, both exhibit a similar dipolar momentum. The molecules are deposited using a hot wall epitaxy system. As substrate, vicinal (0001) sapphire is used with an average step distance of 50 nm, and step height of 0.2 nm. The morphology of the grown films is investigated ex-situ by atomic force microscopy. Coverages from sub-monolayers to several layers are analysed, and evolution of needle-like and island-like crystallites is examined as a function of the deposition temperature. Moreover, stability of the crystallites is investigated under prolonged exposure to ambient conditions. Our results show that ambient stability, π - π stacking, and layer-by-layer growth all favor DHTA7 for organic field effect transistor applications.

O 46.5 Tue 18:15 Poster A

Advanced ion optics for Controlled Electro Spray Ion Beam Deposition — •ANDREAS WALZ, KAROLINA STOIBER, HARTMUT SCHLICHTING, and JOHANNES BARTH — Physics Department E20, Technical University of Munich, Germany

The world of nanostructures requires precise control of growth of atomically clean films of particles or molecules on well defined surfaces. Most state of the art techniques to produce such layers like Organic Molecular Beam Epitaxy (OMBE) are limited to small and sublimable particles or molecules. Controlled Ion Beam Deposition (CIBD) gives access to more reactive, fragile and thermolabile species including many biomolecules. One approach is the generation of an ion beam via Electro Spray Ionisation (ESI) at near ambient conditions, its subsequent transfer to Ultra High Vacuum (UHV) and the Soft-Landing on a surface. The challenge using CIBD is to effectively overcome pressure differences of several orders of magnitude while preserving a high ion flux for appropriate preparation times. Here we present some advanced ion optics including a modified high-flux stacked ring ion guide, as well as a square wave driven multipole. To guarantee for a highly purified ion beam with precise control over the deposited species a sophisticated Square-Wave Quadrupole Mass Spectrometer with adjustable frequency and nearly unlimited mass range was established. The construction was assisted by a multitude of simulations done with SIMION.