

DS 17: Organic Thin Films, Organic-Inorganic Interfaces II (joint session DS/CPP)

Time: Tuesday 11:15–12:45

Location: CHE 91

DS 17.1 Tue 11:15 CHE 91

Strong coupling of exciton polaritons in laterally structured organic microcavities — ●TONY HENSELEIT^{1,2}, MARKAS SUDZIUS^{1,2}, HARMUT FRÖB^{1,2}, and KARL LEO^{1,2} — ¹Dresden Integrated Center for Applied Physics and Photonic Materials — ²Technische Universität Dresden

Strong coupling in inorganic semiconductor materials has been investigated for many years with rising interest in strong coupling in organic materials. The realization of strong coupling at room temperature leads to possible applications as for example polariton lasing and enables investigation of many other interesting physics such as polariton blockade effects.

A polariton is a quasi particle comprising of a photon coupled to an exciton. We are focusing on exciton polaritons in layered resonator structures with organic active materials. We investigate organic materials at room temperature in strong coupling regime and can report to see a reasonable large splitting of the cavity mode in our spectroscopic studies. Furthermore we are especially examining the influence of lateral periodic submicrometer structures on strongly coupled polaritons. This results in an additional confinement of the particles in the system and forms for example waveguide modes in the structure.

DS 17.2 Tue 11:30 CHE 91

Electrochemical Deposition of Polyelectrolytes — ●FELIX PLAMPER¹, SABINE SCHNEIDER², and OLGA MERGEL² — ¹TU Bergakademie Freiberg, Germany — ²RWTH Aachen University, Germany

Charged polymers (polyelectrolytes) interact with oppositely charged counterions. In case of redox-active counterions, their charge can be changed by electrochemical means, allowing a solubility change of these complexes at the electrode (electrochemically-induced film formation). Hence, we address polycations of various architectures made of quaternized poly(dimethylaminoethyl methacrylate) and derivatives to assess their influence on the electrodeposition with help of hexacyanoferrates. A rotating ring disk electrode (RRDE) used during hydrodynamic voltammetry is a powerful method to learn about the interactions of polymers and electroactive species. The RRDE allows a quantification of the deposition efficiency DE. The DE assigns the ratio of charge which was used to produce the deposited electroactive species compared to the total charge. It complements Quartz Crystal Microbalance QCM measurements, which is sensitive to the deposited mass, providing information on the water contents in the films. Different linear polyelectrolytes are investigated and a comparison between other architectures, like star-shaped polymers and microgels, was obtained. The results demonstrate that linear polymers of moderate molar mass are most efficient in the deposition due to pronounced intermolecular physical crosslinking (by help of the hexacyanoferrates), while hydrophilic side groups weaken the deposition by water uptake.

DS 17.3 Tue 11:45 CHE 91

Tuning the electronic properties of graphene with periodically arranged metal-organic coordination networks — ●QIANKUN WANG, BRIAN D. BAKER CORTÉS, JORIS DE LA RIE, MICHAELA ENACHE, and MEIKE STÖHR — Zernike Institute for Advanced Materials, University of Groningen, Nijenborgh 4, 9747 AG Groningen, The Netherlands

Here, we investigate by means of scanning tunneling microscopy and photoelectron spectroscopy how the electronic properties of graphene are modified upon deposition of 5,10,15,20-tetra(4-pyridyl)porphyrin (2HTPyP) with and without coordination to Co atoms. Graphene was prepared on two different substrates, namely Cu(111) and CuOx, and it has been reported to be n-type doped on Cu(111) and quasi-freestanding on CuOx. Thereby, a comparison how the molecular adsorption changes the electronic properties of doped/undoped graphene could be done. We will discuss (i) the transition of the H-bonded self-assembled 2HTPyP network into a long-range ordered metal-organic coordination network (MOCN) upon Co deposition and (ii) the electronic level alignment at the graphene/MOCN interface and how this is influenced by the underlying substrate. Our study provides a viable possibility for the usage of graphene as a charge and spin transport material in future electronic and spintronic applications.

DS 17.4 Tue 12:00 CHE 91

Growth of Extended DNNT Fibers on Metal Substrates by Suppression of Step-Induced Nucleation — ●MAXIMILIAN DREHER, DAYEON KANG, TOBIAS BREUER, and GREGOR WITTE — Philipps-Universität Marburg, 35032 Marburg, Germany

Due to their anisotropic optoelectronic properties, crystalline organic fibers constitute an interesting class of nanoscale materials with great potential for integration into future optoelectronic devices based on organic-inorganic hybrid systems. While chemical synthesis allows for flexible tailoring of electronic molecular properties, structural control of hybrid structures is hampered by the incompatibility of traditional structuring methods. Here we examine the formation of crystalline fibers of dinaphthothienothiophene (DNNT), a recently synthesized organic semiconductor with high charge carrier mobility, upon film growth on noble metal substrates. Based on a comparison of the film growth on a regularly stepped, vicinal surface, we show by STM measurements that substrate steps affect the azimuthal molecular orientation in the seed layer. In particular, they induce a fiber orientation which competes with that of fibers formed on flat terraces and thereby strongly limits the fiber dimensions. We demonstrate a strategy to suppress this parasitical step-induced fiber nucleation by first exposing Ag(111) surfaces to oxygen, which causes a selective saturation of the active step sites, while subsequent deposition of DNNT yields strongly enlarged fibers that are epitaxially aligned on the (111) surface [1,2]. [1] M. Dreher et al., Adv. Mater. Interfaces 5, 1800920 (2018) [2] M. Dreher et al., Nanoscale Horiz. 4, 1353-1360 (2019)

DS 17.5 Tue 12:15 CHE 91

Epitaxial Growth of PEN and PFP Thin Films on hBN(0001) — ●DARIUS GÜNDER¹, TOBIAS BREUER¹, TAKASHI TANIGUCHI², and GREGOR WITTE¹ — ¹Philipps University, Marburg, Germany — ²National Institute for Materials Science, Tsukuba, Japan

Hexagonal boron nitride (hBN) has gained considerable attention because it is an insulating 2D material, which is frequently used as gate dielectric in transistor applications [1]. Combining XRD, AFM, UV/Vis spectroscopy and polarization resolved optical microscopy we demonstrate that pentacene (PEN) and perfluoropentacene (PFP) form epitaxial films on exfoliated hBN(0001) substrates where molecules adopt a lying orientation on highly ordered hBN surfaces, while they grow in an upright molecular fashion on defective surfaces. We demonstrate in particular that PEN does not crystallize in a new polymorph as reported by Zhang et al. [2]. Based on our azimuthal analyses, the epitaxial relation between PEN and PFP films and hBN substrates is resolved and compared to the similar growth behavior on graphite substrates [3,4].

- [1] M. Kratzer et al., J. Journal of Physics D 52, 383001 (2019).
- [2] Y. Zhang et al., Phys. Rev. Lett. 116, 016602 (2016).
- [3] J. Götzen et al., Phys. Rev. B 81, 085440 (2010).
- [4] R. Felix et al., Cryst. Growth Des 16, 6941 (2016).

DS 17.6 Tue 12:30 CHE 91

Organic light-emitting diodes for high-brightness operation: self-heating and switched-back regions — ●ANTON KIRCH¹, AXEL FISCHER¹, MATTHIAS LIERO², JÜRGEN FUHRMANN², ANNEGRET GLITZKY², and SEBASTIAN REINEKE¹ — ¹Dresden Integrated Center for Applied Physics and Photonic Materials (IAPP) and Institute of Applied Physics, Technische Universität Dresden, Germany — ²Weierstrass Institute Berlin, Germany

Nonlinear effects typically involve switching phenomena that can lead to abrupt catastrophic device failure. For example, organic light-emitting diodes (OLEDs) suffer from strong electrothermal feedback that arises upon Joule self-heating. The interaction between temperature-dependent conductivity and power dissipation results in a positive feedback loop that finally destroys the device by thermal runaway. The situation becomes more severe for large-area OLEDs where the operation regime can locally differ. Former modeling studies, using a network of thermistors, led to the proposal that a so-called *switched-back* region arises. In this area, the current density, as well as the brightness, decreases although the total device current still increases when running an IV scan.

Here, we experimentally prove the existence of a switched-back region. We demonstrate that its appearance agrees with the simulation

that solely uses electrothermal modeling. Our study aims to improve the long-term stability of high brightness OLED lighting tiles e.g. as applied in the automotive sector.