

DS 7: Organic Film Aging (SYOE 3)

Time: Monday 18:00–19:00

Location: H32

DS 7.1 Mon 18:00 H32

In situ studies of gas influence on the transport properties of organic thin-film transistors — ●SVEN ISSING, MARKUS MICHELFEIT, MICHAEL LEUFGEN, JEAN GEURTS, GEORG SCHMIDT, and LAURENS MOLENKAMP — Universität Würzburg, physikalisches Institut (EP3), Am Hubland, D-97074 Würzburg, Germany

The stability of organic thin-film transistors (OTFT) remains a critical issue for applications. Especially the influence of different ambient atmospheres needs systematic investigation. Therefore, we fabricated OTFTs with dihexylquaterthiophene (DH4T) as active material by organic molecular-beam deposition in ultra high vacuum (UHV) and performed in situ electrical characterization. Afterwards the OTFTs were exposed to different gases in the UHV-chamber: ambient air, dry air, oxygen, nitrogen or argon up to $1 \cdot 10^{-2}$ mbar·s ($= 10^4$ Langmuir). The charge carrier mobility μ and the threshold voltage V_{Th} were measured vs. exposure. Furthermore, we investigated the relaxation after termination of the gas flow. The onset of a change of μ and V_{Th} is observed at ≈ 100 L. μ (initially $\approx 10^{-2}$ cm^2/Vs) shows a relative decrease between 51% (for argon) and 73% (for oxygen). In clear contrast to the other exposures, for oxygen a shift of V_{Th} towards less negative values is observed. Both μ and V_{Th} showed no reversibility after the exposure.

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DS 7.2 Mon 18:15 H32

Zinc-Tetraphenylporphyrin based field effect transistor — ●DANIEL LEHMANN and DIETRICH R.T. ZAHN — Chemnitz University of Technology, Semiconductor Physics, D-09107 Chemnitz, Germany

Porphyrin derivatives are interesting molecules for organic electronics because of their low cost and interesting light emitting and absorbing properties. While already being used in organic light emitting diodes, Zinc-Tetraphenylporphyrin (ZnTPP) has never been considered as material usable for organic field effect transistors as well. We present a ZnTPP field effect transistor in top contact configuration. On a 100 nm SiO_2 gate oxide, a 30 nm film of ZnTPP was grown using organic molecular beam deposition. Gold electrodes were grown on top by thermal evaporation through a shadow mask. The organic field effect transistor was electrically characterized *in situ*. We show the effects of different gases, introduced into the vacuum by a leak valve, on the electrical characteristics.

DS 7.3 Mon 18:30 H32

Real-time observation of oxidation and photo-oxidation of

rubrene thin films by spectroscopic ellipsometry — ●MILAN KYTKA^{1,2}, ALEXANDER GERLACH¹, FRANK SCHREIBER¹, and JARO KOVÁČ² — ¹Institut für Angewandte Physik, Universität Tübingen, Auf der Morgenstelle 10, 72076 Tübingen, Germany — ²Faculty of Electrical Engineering and Information Technology, Slovak University of Technology, Ilkovičova 3, 812 19 Bratislava, Slovak Republic

We follow in real-time and under controlled conditions the oxidation of the organic semiconductor rubrene grown on SiO_2 using spectroscopic ellipsometry. We derive the complex dielectric function $\epsilon_1 + i\epsilon_2$ for pristine and oxidized rubrene showing that the oxidation is accompanied by a significant change of the optical properties, namely the absorption. We observe that photo-oxidation of rubrene is much faster than oxidation without illumination.

By following different absorption bands (around 2.5 eV and 4.0 eV for pristine rubrene and around 4.9 eV for oxidized rubrene) we infer that the photo-oxidation of these films involves non-Fickian diffusion mechanisms.

DS 7.4 Mon 18:45 H32

Structural and desorption measurements on encapsulated rubrene thin films — ●MAXIMILIAN NOTHAFT¹, SILKE GOETTLING², GERHARD ULBRICHT³, and JENS PFLAUM¹ — ¹3. Phys. Inst., Univ. Stuttgart, 70550 Stuttgart, Germany — ²Inst. fuer Systemtheorie und Bildschirmtechnik, Univ. Stuttgart, 70569 Stuttgart, Germany — ³Max-Planck-Institut fuer Festkoerperforschung, 70569 Stuttgart, Germany

FET-measurements on the surface of rubrene single crystals yield high room-temperature hole mobilities in the order of 10 cm^2/Vs . However, it proves to be difficult to grow crystalline films by thermal evaporation because of molecular conformational changes [1]. As an approach to achieve a crystalline phase via thermal activation, structural properties of rubrene thin films capped by SiO_2 , Al_2O_3 and PPX have been investigated by x-ray diffraction. Crystallisation of amorphous rubrene capped with SiO_2 was detected at about $155^\circ C$ which is $50^\circ C$ above the desorption point of uncapped rubrene layers.

In order to obtain information about the integrity of capped organic layers during heating, we performed thermal desorption studies on capped rubrene thin films. The data indicated different desorption mechanisms depending on the capping material. Desorption of rubrene in SiO_2 or Al_2O_3 capped samples is mainly dominated by cracks. In contrast, desorption of PPX capped samples is governed by a diffusion process. Developing a suited model we could estimate the diffusion constant of rubrene in PPX to $1.2 \cdot 10^{-10}$ cm^2/s .

[1] Käfer et al., Phys. Chem. Chem. Phys. 7, 2850 (2005)