DS 45: Organic Thin Films II

Time: Friday 12:00–13:00 Location: H8

DS 45.1 Fri 12:00 H8

OLEDs under high current densities — •Daniel Kasemann, Hartmuth Fröb, and Karl Leo — Institut für Angewandte Photophysik, Technische Universität Dresden, 01062 Dresden, Germany

Organic solid state lasers combine the flexibility of organic materials with the technological advantages of a solid state light emitter. Various optically pumped devices have been shown, comprising different resonator types like DFB and VCSEL design. Nevertheless, direct electrical pumping has not been achieved yet. The main obstacle here is the high excitation density needed in the active layer. The inversion is easily created by pulsed optical pumping, but additional losses prevent the excitation to reach the critical point when driven electrically.

To estimate the dimensions of the additional losses, we investigate full pin-OLEDs under high current densities and compare the behaviour of singlet and triplet emitter materials. The singlet emitter system uses Alq_3 doped by DCM as emitting layer. The triplet system is an efficient OLED based on α-NPD doped by $Ir(MDQ)_2(acac)$, a red phosphorescent emitter[1]. In pulsed operation, these devices sustain current densities in the range of kA/cm^2 without the need of additional cooling of the sample. To obtain an insight in the behaviour in this operation range, we compare power dependent emission spectra as well as electro-induced absorption (EIA) measurements at high current densities.

[1] R. Meerheim et al., J. Appl. Phys. **104**, 014510 (2008)

DS 45.2 Fri 12:15 H8

Use of Phthalocyanines as Photosensitizers for Dye-Sensitized Solar Cells Based on Zinc Oxide — •Melanie Rudolph[1], Jane Falgenhauer[1], Thomas Loewenstein[1], Nkosiphile Masilela[2], Mopelola Idowu[2], Tebello Nyokong[2], and Derck Schlettwein[1] — [1]Institute of Applied Physics, Justus-Liebig-University Giessen, Germany. email:schlettwein@uni-giessen.de — [2]Department of Chemistry, Rhodes University, Grahamstown, South Africa

Thin films of porous zinc oxide were prepared by electrodeposition from aqueous precursor solutions containing a structure- directing agent. Phthalocyanines (Pcs) with different central groups and different chemical substituents in the ligand were adsorbed onto the ZnO surface as photosensitizers. The obtained hybrid thin films were investigated with respect to their applicability in dye-sensitized solar cells. Aggregation is known to be a limiting factor for the solar energy conversion efficiency of sensitized semiconductor photoelectrodes, particularly in the case of phthalocyanines. The aggregation behaviour of the adsorbed Pc molecules was therefore analyzed by means of solid state UV/VIS transmission spectroscopy. Different methods were investigated to decrease intermolecular interactions within the photosensitizer layer. The photovoltaic performance of the dye-sensitized electrodes was analyzed by time-resolved photocurrent and photovoltage measurements as well as I(V) characteristics. These results were discussed in context with the aggregation tendency concluded from the UV/VIS data and the position of dye energy levels relative to the conduction band of ZnO.

DS 45.3 Fri 12:30 H8

Optimized light harvesting in thin film organic solar cells - modeling and experimental results — •André Merten, Uwe Dirks, Mauro Furno, Jan Meiss, Ronny Timmreck, Rico Schüppel, Karl Leo, and Moritz Riede — Institut für Angewandte Photophysik, Technische Universität Dresden

Optimal light absorption in the intrinsic layers of organic thin film solar cells is one of the basics for reaching high power conversion efficiencies.

However, multilayer interference phenomena have to be taken into account when designing the solar cell stack. Especially in the case of tandem solar cells, consisting of subcells with spectral complementary absorbers, interference effects have to be considered for current matching of the both subcells.

We present results of organic solar single and tandem solar cells, based on small molecules, which are designed and optimised by means of optical simulations based on a transfer-matrix-algorithm.

The optical simulation is verified by electrical characterization of solar cells with variation in layer thickness and by determining the spectral absorption by reflectance measurements with a fiber optical set-up, which also offers a validation of the layer deposition procedure at functional devices.

In addition to well controlled film thicknesses, the optical constants of the used organic materials are crucial for the optical simulation. Therefore, particular attention has to spend when determining theses constants and we present a sensitivity analysis for the predicted current densities with respect to errors in the optical constants.

DS 45.4 Fri 12:45 H8

Bulk-Carrier Analysis in OFETs Utilizing the True Channel Potential. — •Richa Sharma, Benedikt Gburek, Torsten Balster, and Veit Wagner — School of Engineering and Science, Jacobs University Bremen, Campus Ring 1, D-28759, Germany

In an Organic Field Effect Transistor (OFET), it is found that the electrical performance with respect to mobility and on-current increases with thickness. However, as the semiconductor thickness increases, the magnitude of the current in the off state is also found to increase deteriorating the on-off ratio. This is attributed to the increasing bulk current associated with increasing thickness. Therefore, it is crucial to understand the bulk behavior in OFETs at different operating regimes.

For this purpose, potential profiling of OFET channels of different thicknesses is done by 12 sense-fingers patterned in the channel of the transistor. The source, drain and the sense fingers are patterned in one step by optical lithography on the substrate. The semiconductor and insulator are spin-coated from solution and the top-gate is deposited through a shadow mask. The transfer curve measurements along with the potential measurements in the channel are done simultaneously. The corresponding potential profile for a particular gate voltage in the bulk regime is used to obtain the true potential in the channel. This channel potential along with the corresponding bulk current obtained from the transfer curve at different gate voltages is used to analyze the decrease of bulk conductivity in the off regime with increasing gate voltage. A proper model explains the experimental data by carrier depletion of the bulk with increasing gate voltage.