DS 63: Organic Thin Films II

Time: Friday 12:00–13:00 Location: GER 38

DS 63.1 Fri 12:00 GER 38

Investigation of contact resistance in organic thin film transistors by channel potential mapping — •Marko Marinkovic, Sidhant Bom, Dietmar Knipp, and Veit Wagner — School of Engineering and Science, Jacobs University Bremen, Campus Ring 1, 28759 Bremen, Germany

One of the limiting factors for the commercial use of organic electronics is the limitation in high switching frequencies due to the contact resistance [1]. In this study, we investigate the contact resistance by measuring the potential distribution inside of the channel of transistors by additional buried sense electrodes. This allows the separate determination of the potential barriers at the source and drain electrode, that can be related directly to the injection and extraction of the majority carrier.

For this purpose, organic thin film transistors have been prepared on plastic (PET) substrates with P3HT as a p-type material and a similar n-type semiconductor in the top-gate bottom-contact configuration. The interface between the semiconductors and the metal electrode (Au) has been analyzed through current-voltage measurements, showing the contact resistance of less than 200 kΩcm and 300 kΩcm at source and drain electrical contacts, respectively. These results show good agreement with the transmission line method (TLM).

[1] V. Wagner et al. Appl. Phys. Lett. 89 (2006) 243515.

DS 63.2 Fri 12:15 GER 38

Trapping analysis of polythiophene based field-effect transistors with modified gate oxide — •Steve Pittner and Veit Wagner — School of Engineering, Jacobs University Bremen, Campus Ring 1, D-28759 Bremen, Germany

Organic semiconductors have proven to be suitable materials for electronic devices like organic field effect ransistors (OFET). But their charge mobility, an important parameter for technical applications, is very sensitive to the semiconductor-insulator interface, especially to unintended interface states.

We have investigated the influence of different interface state concentrations on the charge transport at the silicon oxide / poly(3-hexylthiophene) (P3HT) interface. Different surface treatments were applied to the silicon oxide layer covering a highly doped silicon wafer to modify the density of surface states. On this surface the P3HT was deposited. The carrier density in the P3HT was determined optically by charge modulation spectroscopy (CMS). This allows to map the carrier concentration spatially and energetically next to the electrodes. Parallel analysis by Impedance spectroscopy allowed to determine the doping profile of the whole semiconductor layer via analysis of the change of the depletion capacitance. This analysis allowed to correlate residual carrier density with high doping concentration close to the interface.

DS 63.3 Fri 12:30 GER 38

Electronic structure of thin spin-coated polyimide layers — •Daniel Friedrich[1], Yuri Koval[2], Paul Müller[2], and Dieter Schmeisser[1] — [1]Brandenburgische Technische Universität Cottbus, Angewandte Physik/Sensorik, K.- Wachsmann-Allee 1, 03046 Cottbus — [2]Universität Erlangen Nürnberg, Experimental Physik/Supraleitung, Erwin-Rommel-Str. 1, 91058 Erlangen

The conductivity of polyimide layers can be modified by several orders of magnitude by ion beam radiation. In order to understand the electronic structure of the pure polyimide before ion beam modification we focus in our preliminary experiments on spectroscopic investigations of thin as prepared polyimide films. The films were made by spin coating from a PMDA/ODA solution with subsequent vacuum annealing at 350°C. The layer thickness can be controlled by changing the concentration of PMDA/ODA in the solution realizing a thickness down to 3.5nm. For the characterization of the as prepared thin polyimide films the techniques NEXAFS, ResPES, XPS and CIS were applied at the U49/2-PGM2 beam line of Bessy II, Berlin. Our data including the valence band, core levels and absorption spectrum were compared with theoretical LCAO calculations. Based on these results we are able to attribute all spectral features to the specific atomic bonds in the molecule.

DS 63.4 Fri 12:45 GER 38

Locally Resolved Core-hole Screening, Molecular Orientation, and Morphology in Thin Films of Diindenoperylene Deposited on Au(111) Single Crystals — •Maria Benedetta Casu[1], Britt-Elfriede Schuster[1], Indro Biswas[1], Christoph Raisch[1], Helder Marchetto[2], Thomas Schmidt[2], and Thomas Chassé[1] — [1]IPTC, University of Tübingen, Tübingen, Germany — [2]Fritz-Haber-Institut, Berlin, Germany

By using a combination of microscopic imaging and diffraction techniques with structural and chemical sensitivity, we studied the growth of diindenoperylene (DIP) on Au(111) single crystals. Growth and structure of DIP films of different thickness were monitored in situ including real time PEEM and LEEM performed at the beamline UE49-PGM-b-SMART at BESSY. A layer-by-layer mechanism characterizes the initial growth followed by island nucleation, i.e., the growth follows the Stranki-Krastanov mode. Highly resolved spectromicroscopy reveals that electronic structure, core-hole screening, and molecular orientation depend on the local morphology of thin films. These phenomena, like different screening of the core hole, or different FWHM of the XPS lines, have been previously shown comparing different samples consisting of monolayers and multilayers. In our work we show their occurrence comparing islands versus monolayers in the same film.