O 11: [DS] Organic electronics and photovoltaics I (jointly with CPP, HL, O)

Time: Monday 15:00–16:15 Location: H 2032

Invited Talk O 11.1 Mon 15:00 H 2032

Three-dimensional hybrid organic/inorganic heterojunctions based on rolled-up nanomembranes — •Carlos Cesar Bof Bufon[1], Dominic J. Thurmer[1], Christoph Deneke[1], and Oliver G. Schmidt[1,2] — [1]Institute for Integrative Nanosciences, IFW Dresden, Helmholtzstrasse 20, 01069 Dresden, Germany — [2]Material Systems for Nanoelectronics, Chemnitz University of Technology, Reichenhainerstrasse 70, 09107 Chemnitz, Germany

In this work we present a method based on self-released strained nanomembranes (metallic and/or semiconducting) for electrically contact single molecular layers [1]. During release of the nanomembrane, the strain relaxation gives rise to a self-rolling process in which the membrane bonds back to substrate top surface where the thin organic layer was previously deposited. By this means, we are able to fabricate semiconductor-molecule-semiconductor heterojunctions. In this last case, the type of doping and its concentration can be independently and precisely set for each electrode in order to tune the device electronic properties. Such a novel hybrid devices was observed to display completely different electric characteristics which are not expected or possible to be demonstrated by using their elements separately. In addition, the strained nanomembrane based electrodes provide a soft and robust contact on top of the organic film. Furthermore, applying the self-rolling phenomenon, we achieve an approach that is fully integrative on a chip, and several components can be fabricated in parallel using well-established semiconductor processing technologies. [1] Bufon,C.C.B., Nano Lett.11,3727(2011)

O 11.2 Mon 15:30 H 2032

Transport properties of hybrid organic/ferromagnetic metal heterojunctions based on strained nanomembranes — •Maria Esperanza Navarro Fuentes, Carlos Cesar Bof Bufon, Daniel Grimm, and Oliver G Schmidt — Institute for Integrative Nanosciences, IFW-Dresden, Helmholtz Strasse 20, 01069 Dresden, Germany

In this work we investigated the transport properties of organic/inorganic hybrid heterojunctions formed by rolled-up nanomembranes. This method allowed us to create soft metallic contacts on self-assembled monolayers (SAM) of phosphonic acids. As previously reported, the metal/SAM contact can be accomplished regardless the presence of pinholes in the thin organic layer [1]. By comparing the field-emission plots of hybrid heterojunctions formed by the combination of noble and ferromagnetic metals we were able to evaluate the influence of the interfacial oxide layer in transport properties of such heterojunctions. Moreover, the evaluation of the current-voltage curves allow us to clearly distinguish whether the tunneling behaviour is due to the native oxide of the ferromagnet or to the SAM layer behaving as an ultra-thin insulating material. In this particular case, the capability of understanding the nature of the organic/inorganic interface and their influence on the transport properties is an essential step in the creation organic spin valves.

[1] Bufon, C.C.B. et.al.; Nano Lett., 2011, 11 (9), 3727.

O 11.3 Mon 15:45 H 2032

Contact property tailoring by SAM treatment of the Au/P3HT interface — Shahidul Alam, •Torsten Balster, and Veit Wagner — School of Engineering and Science,Jacobs University Bremen, Campus Ring 1, 28759 Bremen

The properties of the contact between the organic semiconductor and the metal not only influence the injection behaviour and limit the switching speed of an organic field effect transistor, they also determine the rectification in a Schottky diode. In this study, vertical Au/P3HT/Au structures on PET foils has been prepared and investigated by means of I-V measurements.
Due to the asymmetry in the deposition of the top and bottom metal electrode the devices showed diode, i.e. rectifying behaviour. To change the contact properties, especially the barrier heights self-assembled monolayers by 1-hexanethiol and nonafluoro-1-hexanethiol on top of the bottom electrode have been prepared prior to the P3HT and top electrode deposition.
The overall current density was reduced in comparison to the untreated sample due to the tunneling barrier introduced. However, the rectification ratio of the 1-hexanethiol has been increased by more than a factor of 2. The influence of the SAMs on the barrier height was analyzed using the Fowler-Nordheim tunneling model.

O 11.4 Mon 16:00 H 2032

Organic Field Effect Transistor Studies on Contact Phenomena and Charge Carrier Injection in Bottom Contact Devices — •Christopher Keil, Dominik Klaus, and Derck Schlettwein — Justus-Liebig-Universität Gießen, Institut für Angewandte Physik, Heinrich-Buff-Ring 16, D-35392, Gießen.

Thin films of the perfluorinated phthalocyanine $F_{16}PcCu$ were prepared under high vacuum conditions. As substrate a SiO_2 insulating layer on a Si gate was chosen. Different metal contacts were evaporated as bottom contacts before the organic layer deposition. Organic thin film transistors of the molecular semiconductors were thereby achieved. The electrical contact behaviour of the organic semiconductor to electrodes of different metals (Au, Ag, Al) was investigated. The contact characteristics and the formation of an injection barrier will be discussed. Modelling of transistor characteristics and charge carrier injection are shown and their influence on the calculation of the intrinsic charge carrier mobility in the semiconductor channel is shown.