DS 32: Spins in Organic Materials III (Focused Session, jointly with MA – Organisers: Salvan, Hess, Timm)

Time: Wednesday 17:00–18:30 Location: GER 37

DS 32.1 Wed 17:00 GER 37

Highly controlled deposition, environment, and surfaces in paramagnetic organic radicals — •Sabine-Antonia Savu, Indro Biswas, Mathias Glaser, Maria Benedetta Casu, and Thomas Chassé — IPTC, University of Tübingen, Tübingen, Germany

Organic radicals are a promising class of molecules which combine magnetic properties with the considerable advantages of organic molecules for example chemical and mechanical flexibility. For electronic applications, a comprehensive knowledge of the electronic, structural and morphological properties of organic magnets is indispensable. Nitpyrene is a pyrene-based nitronyl radical which belongs to a new class of organic magnets with high stability and promising magnetic properties. In this work we present a multi-technique investigation of nitpyrene thin films in order to get information on the electronic structure, growth modes, and thin film processes of this molecule. We show the results of investigations on nitpyrene thin films using X-ray based techniques, together with atomic force microscopy (AFM). Nitpyrene was deposited under ultra high vacuum conditions onto the well-characterized single crystal Au(111) surface using strictly controlled evaporation conditions. By analyzing the attenuation of the substrate core level signal, we find indications for a Stranski-Krastanov growth mode (layer plus islands). This information is also supported by AFM measurements. Furthermore, we find evidence for Ostwald ripening processes. ESR measurements confirmed the persistence of the radical nature in the thin films.

DS 32.2 Wed 17:15 GER 37

The influence of molecular orientation on triplet excitons in various oligo- and polythiophenes — •Hannes Kraus[1], Andreas Sperlich[1], Anja Keckeisen[1], Carsten Deibel[1], Vladimir Dyakonov[1,2], Hannah Ziehlke[3], Moritz Riede[3], Karl Leo[3], Roland Fitzner[4], Egon Reinhold[4], and Peter Bäuerle[4] — [1]Experimental Physics VI, Julius Maximilian University of Würzburg, D-97074 Würzburg — [2]ZAE Bayern, D-97074 Würzburg — [3]Institut für Angewandte Photophysik, TU Dresden, D-01062 Dresden — [4]Institute of Organic Chemistry II and Advanced Materials, Ulm University, D-89081 Ulm

One of the intriguing issues in oPV materials is the role of triplet excitons on photogeneration of charge carriers. Evaporated oligothiophene films and solution-processed polythiophenes have been used in high-efficiency organic solar cells. Thus the electronic properties of both material classes are of great interest. Utilizing angle resolved optically detected magnetic resonance (ODMR), we investigated the triplet excitons of thin films of the quinquethiophene DCV5T (evaporated), the polythiophene P3HT and the block copolymer PCPDTBT (both spin-cast). We found a strong dependence of the triplet signatures on the crystalline ordering, especially for oligothiophenes, and attempt to connect this dependence to the intrinsic ordering of the corresponding molecular system. In combination with structural analysis, angle resolved ODMR allows to gain new insights into the physics of triplet excited states.

DS 32.3 Wed 17:30 GER 37

Light induced spin-interacting charge-transfer states in polymer:C60-fullerene blends — •Andreas Sperlich[1], Tom J. Savenije[1,3], Magdalena Zawadzki[1], Hannes Kraus[1], Carsten Deibel[1], and Vladimir Dyakonov[1,2] — [1]Experimental Physics VI, Julius-Maximilians-University of Würzburg, D-97074 Würzburg — [2]ZAE Bayern, D-97074 Würzburg — [3]Department of Chemical Engineering, Delft University of Technology, NL-2628 BL Delft, The Netherlands

Charge-transfer states (CTS) are widely considered to be an intermediate species between the primary photo-excited singlet exciton and the formation of separate electrons and holes in organic semiconductors and their blends. We demonstrate that these CTS, being interacting e-h pairs, can be studied using electron spin resonance (ESR).

At temperatures below 100K a spin-polarized pattern (E-A-E-A) of microwave emission (E) and absorption (A) can be detected. Several microseconds after the excitation pulse this polarization pattern transforms to a purely absorptive spectrum with two peaks (A-A). This spectrum is identical to the one obtained by cw ESR, which has previously been assigned to non-interacting positive and negative charges. For lower temperatures (<20K) additional features assigned to spin-interacting persistent e-h pairs were observed.

DS 32.4 Wed 17:45 GER 37

Comparison of the magneto-optical response of different metal-phthalocyanines measured by MOKE — •Michael Fronk, Klaus Seidel, Dietrich R.T. Zahn, and Georgeta Salvan — Chemnitz University of Technology, Chemnitz, Germany

In recent years organic materials experience much attention because of their potential applications in spintronic devices predominantly due to their long spin life-times. This work focusses on the magneto-optical characterisation of paramagnetic phthalocyanines. While a part of this investigation (mainly on VOPc and CuPc) is already published [1] additional magneto-optical Kerr effect (MOKE) spectra of MnPc, FePc, and CoPc will be presented. The films in the typical thickness range between 30 nm and 100 nm were prepared by organic molecular beam deposition in high vacuum. The magneto-optical Voigt constant is obtained using optical model calculations. A fit of the Voigt data using an oscillator model was performed in order to gain more insight in the electronic origin of the features in the Voigt constant and subsequently in the MOKE spectra. For instance, the hybridisation of Co-3d states with the HOMO π-orbital of CoPc leads to additional features in the magneto-optical spectra compared to *e.g.* CuPc. This effect is much more pronounced in the magneto-optical spectra than in the dielectric function components that are commonly assessed by spectroscopic ellipsometry.

[1] M. Fronk *et al.*, *Phys. Rev. B* ***79*** (2009) 235305

DS 32.5 Wed 18:00 GER 37

Hybrid organic/inorganic heterojunctions based on rolled-up nanomembranes — •Carlos Cesar Bof Bufon[1], Juan Diego Ariaz Espinosa[1], Maria Esperanza Navarro Fuentes[1], Dominic J. Thurmer[1], and Oliver G. Schmidt[1,2] — [1]Institute for Integrative Nanosciences, IFW-Dresden, Dresden, Germnay — [2]Material Systems for Nanoelectronics, Chemnitz University of Technology, Chemnitz, Germany

We present a novel method, based on self-released strained nanomembranes, for contacting molecules by using metals and/or semiconductors as electrodes to form hybrid heterojunctions. 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 molecular layer was previously deposited. By this means, we are able to fabricate not only the standards metal-molecule-metal and metal-molecule-semiconductor heterojunctions but also the unique semiconductor-molecule-semiconductor heterojunctions. In this last case, the type of doping and its concentration can be independently for each electrode in order to tune the device electronic properties. The strained nanomembrane based electrodes provide a soft and robust contact on top of the molecular layer. Consequently, no damage to the molecules and no short circuits via possible pinholes have been observed. 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.

DS 32.6 Wed 18:15 GER 37

Degradation effect on the magnetoresistance in organic light emitting diodes — •Andreas Buchschuster, Tobias Schmidt, and Wolfgang Brütting — Institute of Physics, University of Augsburg, 86135 Augsburg, Germany

The effect of a magnetic field on the resistance and the luminance of organic light emitting diodes (OLEDs) is commonly observed but not yet fully understood. One of the recent findings was that the magnetic field effect on the resistance (OMR) as well as the effect on the luminance (OML) can be enhanced drastically by electrical stressing of the device.

To investigate both phenomena we studied OLEDs based on small molecules with tris(8-hydroxyquinoline)aluminium (Alq_3) as emitting material. Measurements were performed on two different types of hetero-layer devices which only differed in their hole injection layer

(HIL) whereat one of the devices exhibited a significantly longer lifetime. Magnetic field effects on the current and the luminance have been detected up to 100 mT while the stressing time was 500 h at the most. We found values up to 5.6 % for the OMR and about 9 % for the OML as well as a correlation of both effects with the degradation of the device. As a result we could show that the transport properties of the hole injection layer has a strong influence on the magnetic field effects.