DS 3: Organic Thin Films, Organic-Inorganic Interfaces (joint session DS/CPP)

Time: Monday 11:30–12:45 Location: SCH A 315

DS 3.1 Mon 11:30 SCH A 315

Thickness dependency of the critical dose for beam-sensitive two-dimensional polymers

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For organic materials the achievable resolution in a TEM is limited by their resilience against electron irradiation. Due to that, increasing the critical dose of these sensitive materials is of highest importance. For layer stacked materials, where the thickness is easily controllable, the thickness dependency of the critical dose is a key feature. Aimed at gathering a better understanding of this effect, in our study this dependency was examined in more detail. To achieve this, the critical dose of a triazine-based 2D polymer[1] was measured for a wide thickness range. The polymer samples, obtained by mechanical exfoliation, ranged from 15 nm to 85 nm thickness. To obtain the critical dose of the polymer, sequences of electron diffraction patterns with a dose of only 0.5 e^-/A^2 where obtained. The measurements revealed, that the critical dose for amorphization of this polymer is only 1-2 e^-/A^2, independent of sample thickness.

References

1. F. Hu, et al. J. Am. Chem. Soc. 143, 5636-5642 (2021).

DS 3.2 Mon 11:45 SCH A 315

Determining Anisotropic Effects in Strongly Coupled Metal Organic Hybrid Structures

— •Maximilian Rödel[1], Jinhong Kim[2], Matthias Stolte[2], Luca Nils Philipp[3], Matthias Lehmann[2], Frank Würthner[2], Roland Mitric[3], and Jens Pflaum[1,4] — [1]Experimental Physics VI, University of Würzburg — [2]Institut für Organische Chemie and Center for Nanosystems Chemistry, University of Würzburg — [3]Institut für Physikalische und Theoretische Chemie, University of Würzburg — [4]Bavarian Center for Applied Energy Research, 97074 Würzburg

Coupling phenomena in metal organic hybrid structures enable unique possibilities to tune the properties of opto-electronic devices. Furthermore, the strong coupling between surface plasmons and excitons in organic semiconductors leads to novel hybrid states, which are termed plexcitons[1]. By means of a Kretschmann Set Up we investigate these plexcitonic states in oriented liquid crystalline perylene bisimide (PBI) thin films deposited via off-centered spin coating on gold surfaces which exhibiting J-type coupling [2]. The Alignment of the hydrogen-bonded PBI molecules and, thus, their transition dipoles results in long-range ordered films with a pronounced spatially anisotropy of structural and optical characteristics. These new states show a characteristic coupling strength of ≈27 meV. Understanding this directional correlation between molecular order and optical properties will enable new device concepts utilizing the presented opto-electronic directionality.

[1] Maximilian Rödel et al. J. Phys. Chem. C 2022, 126(8), 4163-4171

[2] Stefanie Herbst et al. Nat. Commun. 2018, 9(1), 2646-2654.

DS 3.3 Mon 12:00 SCH A 315

Long-term degradation in Blatter radical derivative thin films

— •Ewa Nowik-Boltyk, Tobias Junghöfer, and Maria Benedetta Casu — Universität Tübingen, Institut für Physikalische und Theoretische Chemie, Auf der Morgenstelle 18, D-72076 Tübingen,GERMANY

Materials with a radical site are strong candidates for ground-breaking applications from energy storage to quantum computing. In this framework, Blatter radical derivatives are very attractive due to their chemical stability. We focus on the latest insights regarding the fundamental mechanisms of radical thin film long-term degradation, by comparing two Blatter radical derivatives, using X-ray-based techniques, such as photoelectron spectroscopy and absorption spectroscopy. Our findings indicate that air exposure affects the chemical and magnetic properties of the thin films.

DS 3.4 Mon 12:15 SCH A 315

Controlled Thermal Deposition of Organic Diradicals

— •Tobias Junghöfer and Maria Benedetta Casu — Institut für Physikalische und Theoretische Chemie, Eberhard Karls Universität Tübingen, Germany

Using X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM) we demonstrate that it is possible to evaporate diradicals in a controlled environment obtaining thin films in which the diradical character is preserved. However, evaporation represents a challenge. The presence of two radical sites makes the molecules more reactive also in the case of very stable single radicals. We have explored the parameters that play a role in this phenomenon. We found that the higher the formation energies of the crystal, the more difficult is the evaporation of intact radicals. Large delocalization of the unpaired electrons helps the diradical to stand evaporation. The evaporation of different diradicals can be successfully addressed considering our findings.

DS 3.5 Mon 12:30 SCH A 315

Interaction of cyanoacrylate thin films with copper (oxide) in different processing atmospheres

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The adhesive class of fast-curing cyanoacrylates plays an increasingly important role, especially in hybrid composites. However, the adhesion mechanism at the interface to the metal (oxide) substrates is not sufficiently understood.

To study the interactions, cyanoacrylate films of a few nm thickness are spin-coated onto metallic copper and copper oxide in (i) a normal air atmosphere and in (ii) an oxygen-free environment (O_2 partial pressure $< 10^{-20}$ mbar). The natively oxidized copper is deoxidized with a dielectric barrier discharge (DBD plasma) directly before the coating process.

Spectroscopic and microscopic methods are used to understand the underlying molecular interactions at the interface between cyanoacrylate and copper (oxide). The formation of hydrogen bonds as well as an ionic interaction can be observed. In addition, an influence of the oxide layer and the effects of the surrounding atmosphere can be seen.

Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 394563137 – SFB 1368