DS 18: Optical Analysis of Organic Thin Films

Time: Thursday 17:00–17:45 Location: A 060

DS 18.1 Thu 17:00 A 060

The Impact of solution processing on the optoelectronic properties of TADF emitters — •Anatolii Kuimov — University of Bayreuth, Bayreuth, Gemany

Thermally Activated Delayed Fluorescence (TADF) emitters are crucial for achieving 100% efficiency in OLEDs, utilizing reverse intersystem crossing (RISC) to convert non-emissive triplet states into highly emissive singlet states. Our study focuses on DMAC-TRZ, showcasing promising TADF properties in diverse configurations. We explored film processing's impact on photophysical parameters and RISC rates.

Post-processing, involving temperature and solution treatments, proved instrumental in fine-tuning the RISC rate and enhancing the film's ordering* one of the pivotal factors in the photophysics of TADF materials. Moreover, our experiments on DMAC-TRZ films revealed these processes' surprising capability to adjust both parameters significantly. Additionally, the investigation demonstrated that the glass transition temperature of the emitter is less significant compared to the material's melting point during temperature annealing.

In conclusion, film processing and post-processing methodologies effectively improved film ordering and precisely adjusted RISC rates. These adjustments are critical for optimizing OLED efficiency.

This work was funded by the European Union

DS 18.2 Thu 17:15 A 060

Characterisation of thin layers of Polydopamine used as functional coatings in X-Ray optics. — •Andreas Hertwig[1], Elena Ermilova[1], Vincenzo Cotroneo[2], Eugenio Gibertini[3], Eva Stanik[4], and Thorsten Döhring[4] — [1]Bundesanstalt für Materialforschung und -prüfung (BAM) — [2]INAF - Osservatorio Astronomico di Brera — [3]Politecnico di Milano — [4]TH Aschaffenburg

Polydopamine (PDA) is a biological / biomimetic polymer which has spiked considerable interest in recent years. Its monomer is an important neurotransmitter and it is one of the strongest glues produced by biological organisms. Polydopamine is a candidate for several applications, mainly in the field of biology and medicine, but also - recently - for layer coatings with optical, electrical, and mechanical function.

In this work, we investigate PDA layers intended as reflectivity enhancers for mirror surfaces in X-ray astronomical observatories. It has previously been shown, that such X-ray telescopes can be improved by a coating of PDA in the thickness range of several nm. Accurate thickness determination is required to monitor and optimise the coating process. We use spectroscopic ellipsometry to determine first the dielectric function of the polydopamine layers using model coatings of sufficient thickness. This data is then used to accurately determine the layer thickness of much thinner PDA layers. This study resulted in data on the thickness and dielectric function of PDA layers that could lead to a better understanding of the correlation of layer thickness and layer properties depending on the process parameters.

DS 18.3 Thu 17:30 A 060

Correlating Optical Transitions and the Selective Enhancement of Vibrational Modes in the Different Crystalline Phases of Semiconducting Discrete Oligomers — •Alexander Ehm, Rukiya Matsidik, Lukas Hertling, Michael Sommer, and Dietrich R. T. Zahn — TU Chemnitz, Chemnitz D-09107, Germany

The ever-growing zoo of organic semiconductors has a great potential to provide material-efficient, low-cost, and highly versatile alternatives, or supplementation, for (opto-)electronic applications. Recently developed naphthalene diimide- (NDI) and bithiophene- (T2) based, discrete oligomers avoid the typical disadvantages of polymeric semiconductors, such as batch-to-batch variation and high dispersity, while exhibiting opto-electronic properties similar to their polymeric counterparts [1]. Excitation-dependent Raman spectroscopy of the well-studied polymer P(NDI2OD-T2) comprising the same molecular units as the discrete oligomers, indicated selective enhancement of certain Raman modes linked to polaron confinement [2].

In our studies, we investigate the selective enhancement of Raman modes using a multitude of excitations of the discrete NDI-T2-based oligomers in dependence on their annealing-induced crystallisation. The results are supported by density functional theory calculations and correlated with optical transitions as obtained from transmission spectroscopy and spectroscopic ellipsometry investigations.

[1] Matsidik et al. J. Am. Chem. Soc. 2023, 145, 8430
[2] Giussani et al. Macromolecules 2013, 46, 2658