CPP 26: Electrical, Dielectrical and Optical Properties of Thin Films

Time: Tuesday 14:00–14:45 Location: MER 02

CPP 26.1 Tue 14:00 MER 02

Electronic and optical properties of thin film P3HT-based thermoelectrics — •Simon Schraad[1,2], Benedikt Sochor[1], Constantin Harder[1,3], Peter Müller-Buschbaum[3,4], Tim Laarmann[1,2], and Stephan Volkher Roth[1,5] — [1]Deutsches Elektronen Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]University Hamburg, Mittelweg 177, 20148 Hamburg, Germany — [3]MLZ, TUM, 85747 Garching, Germany — [4]Research Neutron Source Heinz Maier-Leibnitz, Lichtenbergstraße 1, 85747 Garching, Germany — [5]KTH Royal Institute of Technology, Teknikringen 56-58, Stockholm, Sweden

The polymer Poly(3-hexylthiophen-2,5-diyl) (P3HT) is widely considered in research of organic electronics. If doped with metal chlorides or nanoparticles, P3HT shows thermoelectric properties. Deposition of small gold domains inside the polymer films optimizes the charge transport properties and thermoelectric Seebeck-coefficient and hence the so-called figure of merit zT. There is usually an AU, P3HT intermixing layer near the surface, but implanting the dopant deep inside the organic films results in higher thermoelectric coefficients. P3HT and Poly(3-hexylthiophen-2,5-diyl)-block-poly(methyl methacrylate) (P3HT-b-PMMA) diblock copolymer derivates were prepared by spray deposition and doped via chloroauric acid. Here, structural, optical and (thermo-)electrical properties were determined using AFM, ellipsometry as well as conductivity measurements. The results are a first step towards sprayed organic thermoelectric device, with great scalability potential in future industrial applications.

CPP 26.2 Tue 14:15 MER 02

On the way to sustainable photoluminescent tags — •Heidi Thomas, Shuaifei Zhu, Sebastian Schellhammer, and Sebastian Reineke — IAPP, TU Dresden

Recently, by using amorphous purely organic systems, we have been able to develop transparent programmable luminescent tags (PLTs) which can be used for labelling application or data storage [1,2]. So far the system consists of a phosphorescent organic emitter embedded in poly(methyl methacrylate) on quartz substrate or flexible foil. An oxygen-blocking layer allows for the spatial control of the phosphorescence of the system. The demand for sustainable solutions is high motivating the design of ecofriendly information storage. Here we present the investigation of suitable biocompatible and/or biodegradable polymers and emitters for their use in PLTs.

[1] Gmelch, M.; Thomas, H.; Fries, F.; Reineke, S. Programmable Transparent Organic Luminescent Tags. Sci. Adv. (2019).

[2] Gmelch, M.; Achenbach, T.; Tomkeviciene, A.; Reineke, S. High-Speed and Continuous-Wave Programmable Luminescent Tags Based on Exclusive Room Temperature Phosphorescence (RTP). Adv. Sci. (2021).

CPP 26.3 Tue 14:30 MER 02

Programmed Assembly of Dipolar Precursors into Porous, Crystalline Molecular Thin Films — •Alexei Nefedov[1], Ritesh Haldar[1], Zhiyun Xu[1], Hannes Kühner[1], Dennis Hofmann[2], David Goll[2], Benedikt Sapotta[1], Stefan Hecht[3], Marjan Krstić[1], Carsten Rockstuhl[1], Wolfgang Wenzel[1], Stefan Bräse[1], Petra Tegerer[2], Egbert Zojer[4], and Christof Wöll[1] — [1]Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany — [2]Universität Heidelberg, Heidelberg, Germany — [3]RWTH Aachen University, Aachen, Germany — [4]Graz University of Technology, Graz, Austria

Liquid-phase, quasi-epitaxial growth has been used to stack asymmetric, dipolar organic compounds on inorganic substrates, permitting porous, crystalline molecular materials which lack inversion symmetry. This allows material fabrication with built-in electric fields. We describe a new programmed assembly strategy based on metal-organic frameworks (MOFs) that facilitates crystalline, non-centrosymmetric space groups for achiral compounds. Electric fields are integrated into crystalline, porous thin films with an orientation normal to the substrate. Changes in electrostatic potential are detected via core-level shifts of marker atoms on the MOF thin films and agree with theoretical results. The integration of built-in electric fields into molecular solids creates possibilities for band structure engineering to control the alignment of electronic levels in organic molecules and it may also be used to tune the transfer of charges from donors loaded via programmed assembly into MOF pores.