CPP 10: Electrical, Dielectrical and Optical Properties of Thin Films

Time: Monday 15:00–16:00 Location: H 0111

CPP 10.1 Mon 15:00 H 0111

Highly Electrically Conductive PEDOT:PSS films via Layer-by-Layer Electrostatic Self-Assembly — •Muhammad Khurram, Sven Neuber, Annekatrin Sill, and Christiane A. Helm — Institute of Physics, University of Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald, Germany

The surface coating of an implant should be an adequate bio-interface and promote cell adhesion and proliferation. To support health, the implant should be able to transport electrical impulses. The Layer-by-Layer (LbL) method - the sequential adsorption of oppositely charged macromolecules or nanoparticles - has proven effective in coating a surface. Polyelectrolytes are poor at conducting charges; therefore, electrically conductive nanoparticles are required. PEDOT:PSS nanoparticles are used. LbL films are built from polyanion PEDOT:PSS and polycation poly-diallyldimethylammonium (PDADMA) by dip coating and a flow cell. The film prepared with flow cell exhibits lower roughness, and constant electrical conductivity (230 kS/m), regardless of the number of PEDOT:PSS bilayers deposited. Films prepared with dip-coating have lower conductivity (26 kS/m), and greater roughness. However, the electrical conductivity is constant (230 kS/m) and independent of the number of deposited PEDOT:PSS/ PDADMA bilayers. The coating exhibits ohmic behavior. By clever choice of the coating method and the number of bilayers, the sheet resistance can be tuned by two orders of magnitude.

CPP 10.2 Mon 15:15 H 0111

Optimizing the thermoelectric properties of conjugated polymer thin films by dip coating induced alignment — •Andrey Butkevich, Morteza Shokrani, Imanuel Gross, and Martijn Kemerink — Im Neuenheimer Feld 225, 69120 Heidelberg

Organic semiconductors are of great current interest for thermoelectric applications due to their inherently low thermal conductivity and good Seebeck coefficient. However, reaching competitive figures of merit has proven difficult due to the common trade-off between conductivity and Seebeck coefficient. Here, we used dip coating to align the molecules during the deposition from solution and analyzed the effect of deposition parameters on the thermoelectric performance. We used P3HT thin films which were sequentially doped with F4TCNQ as model system. Dip coated films were characterized for different doping concentrations and dip coating velocities. Clearly separated evaporation and Landau-Levich regimes were established via film thickness measurements. Morphologies with aligned polymers were formed, as confirmed by X-ray diffraction and optical spectroscopy. A beneficial effect of alignment was measured both in conductivity and Seebeck effect, leading to a clear increase in the power factor compared to non-aligned spin coated films.

CPP 10.3 Mon 15:30 H 0111

In-situ GISAXS study on the correlation of strain and photoluminescence in PbS quantum dot superlattice films on flexible substrates — •Julian E. Heger[1], Wei Chen[1,2], Huaying Zhong[1], Tianxiao Xiao[1], Constantin Harder[1,3], Fabian A. C. Apfelbeck[1], Alexander F. Weinzierl[1], Regine Boldt[4], Lucas Schraa[4], Eric Euchler[4], Anna K. Sambale[4], Konrad Schneider[4], Matthias Schwartzkopf[3], Stephan V. Roth[3,5], and Peter Müller-Buschbaum[1,6] — [1]TUM School for Natural Sciences, Chair for Functional Materials, Garching, Germany — [2]SZTU, Shenzhen, China — [3]DESY, Hamburg, Germany — [4]IPF, Dresden, Germany — [5]KTH, Stockholm, Sweden — [6]MLZ, TUM, Garching, Germany

PbS quantum dots (QDs) show high potential as active materials in diverse optoelectronic devices, such as solar cells and photodetectors. When organized into thin films, ligand-capped PbS QDs form a superlattice structure, greatly impacting their optoelectronic properties, since the interaction among adjacent PbS QDs relies significantly on their proximity. This study examines how the superlattice arrangement of PbS QDs alters when subjected to external strain. To conduct this exploration, PbS QD thin films are fabricated on flexible PDMS substrates. In-situ grazing-incidence small-angle X-ray scattering (GISAXS) alongside photoluminescence (PL) examines how these samples deform under different levels of strain. The primary objective of this study is to correlate the structural modifications induced by strain and the consequent alterations in optoelectronic performance.

CPP 10.4 Mon 15:45 H 0111

Emission characteristics of thermally evaporated Zinc Phthalocyanine molecules in a Tetratetracontane matrix — •Gunilla W. Harm[1], Uta Schlickum[2], and Tobias Voss[1] — [1]Institute of Semiconductor Technology, Technische Universität Braunschweig, Braunschweig, Germany — [2]Institute of Applied Physics, Technische Universität Braunschweig, Braunschweig, Germany

Due to their chemical and thermal stability, Phthalocyanine molecules are promising candidates for the use as molecular quantum emitters. To investigate their potential for optoelectronic devices, we studied the emission characteristics of thermally evaporated Zinc Phthalocyanine (ZnPc) molecules on semiconductor surfaces, such as GaN. When in a crystalline phase, intermolecular coupling can influence their optical properties. To reduce this effect, the molecules are diluted by embedding them into a matrix formed by the alkane Tetratetracontane (TTC). Our results indicate that the thickness of the ZnPc film, ranging from multilayers to sub-monolayers, affects the excitonic coupling between the ZnPc molecules. The absorption band between 690 nm to 800 nm shows a reduced intensity with decreasing thickness. In addition to the typical emission in the NIR range, we see another emission band around 675 nm, which is similar to that of molecules in solution. This allows us to control the intensity ratio between the two emission bands by changing the film thickness of the ZnPc in TTC.