

## DS 46: Thin Film Properties: Structure, Morphology and Composition IV

Time: Friday 11:15–12:45

Location: CHE 89

DS 46.1 Fri 11:15 CHE 89

**Noble metal nanoparticles in organic matrix** — ●OLGA MOLODTSOVA<sup>1,2</sup>, IRINA ARISTOVA<sup>3</sup>, SERGEY BABENKOV<sup>4</sup>, IGOR KHODOS<sup>5</sup>, DMITRII POTOROCHIN<sup>1,2,6</sup>, SERGUEI MOLODTSOV<sup>2,6,7</sup>, and VICTOR ARISTOV<sup>1,3</sup> — <sup>1</sup>Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — <sup>2</sup>ITMO University, 197101 Saint Petersburg, Russia — <sup>3</sup>Institute of Solid State Physics of Russian Academy of Sciences, 142432 Chernogolovka, Russia — <sup>4</sup>Institut für Physik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany — <sup>5</sup>Institute of Microelectronics Technology and High-Purity Materials of Russian Academy of Sciences, 142432 Chernogolovka, Russia — <sup>6</sup>Institut fuer Experimentelle Physik, TU Bergakademie Freiberg, 09596 Freiberg, Germany — <sup>7</sup>European XFEL GmbH, 22869 Schenefeld, Germany

The structure and morphology of nanocomposites created by silver NPs which are self-organize in a thin organic film CuPcFx, x=0; 4, depending on the amount of deposited metal, were studied in UHV using HR-TEM and HR-PES measurements. Metallic atoms deposited on the surface of an organic substrate diffuse into the substrate, forming NPs with a narrow size distribution. With HR-TEM the distance between the atomic planes of individual silver nanoparticles was determined and the steady gathering of individual nanoparticles into agglomerates and then into nanocrystals with inter-crystallite boundaries was observed. PES revealed a generally weak interaction between silver NPs and the organic matrix. However, a strong band bending in the organic film at small coatings with metal atoms was observed.

DS 46.2 Fri 11:30 CHE 89

**Morphological and electrical characterization of mixed valence coordination polymers containing rhodium paddle wheels** — ●DANIEL STEINBACH, RENÉ SCHMIDT, and FLORIAN MERTENS — Institut für Physikalische Chemie, TU Bergakademie Freiberg

To overcome one of the disadvantages of most MOFs being isolators, conjugated coordination polymers are investigated regarding their electrical conductivity. Therefore paddle-wheel structures with a documented metal-metal bond, here rhodium derivatives, were linked via conjugated organic molecules like pyrazine. Coordination polymers of this type were first synthesized as bulk materials, characterized using XRD, BET and XPS and then deposited as coatings on gold surfaces. Subsequently the topography of the deposited layers was measured. Different morphologies mainly determined by AFM were obtained by using spin coating and dip coating. Depending on the composition of the coordination polymer well distributed crystals or network like structures were found. The surface layers were further investigated by XPS and XRD. Direct current measurements were carried out on these systems by conductive AFM. The conductivity of our coordination polymers could be altered by oxidizing or reducing some metal atoms of the paddle-wheel structure, either via chemical or electrochemical oxidation, resulting in mixed valences. The dependency of the conductivity of the coordination polymer on the degree of oxidation was determined.

DS 46.3 Fri 11:45 CHE 89

**Suitability of the solid electrolyte LiPSON with respect to solid electrolyte interphase formation in battery systems** — ●FABIAN MICHEL<sup>1,2</sup>, MARTIN BECKER<sup>1,2</sup>, FLORIAN KÜHL<sup>1,2</sup>, JÜRGEN JANEK<sup>2,3</sup>, and ANGELIKA POLITY<sup>1,2</sup> — <sup>1</sup>Institute of Experimental Physics I, JLU Giessen, 35392 Giessen — <sup>2</sup>Center for Material Research (ZfM/LaMa), JLU Giessen, 35392 Giessen — <sup>3</sup>Institute of Physical Chemistry, JLU Giessen, 35392 Giessen

Solid electrolytes play an upcoming role in future battery cell concepts. Therefore, the physical and electrochemical properties of the lithium-based solid electrolyte LiPSON are investigated with regard to an use in energy storage systems. An additional XPS in-situ experiment is performed to gain knowledge about the so-called solid-electrolyte-interphase (SEI) between metallic lithium and the electrolyte used. Similar investigations were carried out on the LiPSON-based material system LiPON. There a positive effect of the SEI was shown so the comparison and the possible substitution of LiPON by LiPSON is of importance for future cell concepts.

DS 46.4 Fri 12:00 CHE 89

**Solution-based thin films of bridged triarylamines: Unravelling the self-assembly** — ●TIM HAWLY<sup>1</sup>, FABIAN STRELLER<sup>1</sup>, MANUEL JOHNSON<sup>1</sup>, SANDRA MÍGUEZ-LAGO<sup>1</sup>, MILAN KIVALA<sup>2</sup>, and RAINER FINK<sup>1</sup> — <sup>1</sup>Department Chemie und Pharmazie, Friedrich-Alexander Universität Erlangen-Nürnberg, Erlangen, Germany — <sup>2</sup>Centre of Advanced Materials, Universität Heidelberg, Germany

Columnar (1D) triarylamine thin films from a dip-coating approach have been discussed in literature as potential candidates for functional n-type semiconducting layers and regarding both their solution processability and crystal structure. Herein, we report on the growth behavior and realization of upstanding 2D-extended films of a series of bridged triarylamines via a solution-based processing method.

Film preparation is inspected at different length scales by optical microscopy (OM) and atomic force microscopy (AFM). Long-range order, crystallinity and layer thickness appeared to decisively depend on the nature of the peripheral substituents attached to the polycyclic aromatic backbone with flat core structures being preferred over non-planar ones. Electron diffraction (SAED) confirmed the crystalline structure of the obtained ultrathin films. Additionally, first steps to clarify the molecular orientation within prepared structures were taken via angle-resolved near edge x-ray absorption fine structure (NEXAFS) spectroscopy. Our work presents a fine tool ensemble for unambiguous design and structure elucidation of high-quality, 2D heterotriangulene systems aiming at potential application fields such as layered organic electronics. This research is funded by the DFG within GRK1896.

DS 46.5 Fri 12:15 CHE 89

**Investigation of the interaction of an organic electron donor with graphene** — ●JORIS DE LA RIE<sup>1</sup>, QIANKUN WANG<sup>1</sup>, KATHRIN MÜLLER<sup>1</sup>, WENBO LU<sup>1</sup>, MIHAELA ENACHE<sup>1</sup>, MILAN KIVALA<sup>2</sup>, and MEIKE STÖHR<sup>1</sup> — <sup>1</sup>Zernike Institute for Advanced Materials, University of Groningen, Netherlands — <sup>2</sup>Institute for Organic Chemistry, University of Heidelberg, Germany

Among others, graphene is widely known for its excellent electronic properties making it an extremely appealing candidate for usage in future (nano)electronic devices. Such applications often require modification of graphene's electronic properties to ensure compatibility with other device components. Deposition of a molecular layer has been shown to controllably modify graphene's work function as well as charge carrier type and concentration.

Here, we report on the self-assembly of the organic donor molecule 2,3,6,7,10,11-hexakis-alkoxytriphenylene (HAT) on graphene on Ir(111). Previous study of this molecule on Ag(111) identified it as a suitable candidate for use in organic electronics[1]. Employing scanning tunnelling microscopy and low energy electron diffraction, we found that these molecules assembled in a hexagonal network at up to monolayer coverages. We used X-ray and ultraviolet photoelectron spectroscopy to investigate the intermolecular and molecule-graphene interactions as well as to monitor changes of the electronic properties of graphene.

[1] Müller et al., Small 2019, 15, 1901741

DS 46.6 Fri 12:30 CHE 89

**Dewetting assisted MWCNT ring formation** — ●SURITA BASU<sup>1</sup>, PRABIR PATRA<sup>2</sup>, and JAYATI SARKAR<sup>1</sup> — <sup>1</sup>Department of Chemical Engineering, Indian Institute of Technology Delhi, India — <sup>2</sup>Department of Biomedical Engineering, University of Bridgeport 126 Park Avenue, Bridgeport, CT 06604

The fabrication of finite arrangement with nanoscale materials is key to current technology and self-assembly and self-organization are considered efficient and cost-effective and so a preferred process for building ordered structure of nanoparticles. Carbon nanotubes are very interesting material for their properties and molecular structures. Carbon nanotubes can assemble in different morphologies depending on its physical synthesis method. The different morphologies of CNT are coiled CNTs, CNT junctions, and toroidal CNTs. Thin polymer film < 100 nm also undergoes self-organization resulting in the formation of arrays of droplets. These spontaneously formed ordered patterns or structures on the surface has a wide range of technological applications. The retraction of fluid from the surface that it was supposed to cover leads to the phenomenon of dewetting causing the arrangement of droplets which act as a template for the self-assembly of the carbon

nanotubes. The self-organized patterns on the thin PS film along with Marangoni flow are the driving force behind the circular ring formation of the carbon nanotubes without any external physical method.