CPP 47: Electrical, Dielectrical and Optical Properties of Thin Films II

Time: Wednesday 12:00–13:00 Location: C 230

CPP 47.1 Wed 12:00 C 230

Aligned in-plane polarization and large piezoelectricity in P(VDF-TrFE) films on graphite — •Robert Roth[1], Martin Koch[1], Jakob Schaab[2], Martin Lilienblum[2], Thomas Thurn-Albrecht[1], and Kathrin Dörr[1] — [1]Institute of Physics, Martin Luther University Halle-Wittenberg, 06099 Halle, Germany — [2]Department of Materials, ETH Zürich, 8093 Zürich, Switzerland

Ferroelectric polymers are attractive candidates for functional layers in electronic devices like non-volatile memories, piezo- and magnetoelectric sensors. However, thin films often reveal reduced di- and piezoelectric responses due to crystalline disorder and resulting non-aligned electrical dipoles leading to compensation effects. One of the best characterized and often applied ferroelectric polymers is poly(vinylidene fluoride-co-trifluoroethylene) (P(VDF-TrFE)). We will present results on aligning both in-plane and out-of-plane ferroelectric polarization in P(VDF-TrFE) films on graphite in a force microscope. Within written micron-sized domains, strong enhancement of both, lateral and vertical piezoresponses have been achieved. Polarization alignment in as-prepared films of several 10 nm thickness is controlled using a combined procedure of electrical poling and mechanical tip pressure. Micron-sized domains with uniform polarization orientation, within the resolution limit, allow one to overcome compensation effects which would be beneficial for various device applications.

CPP 47.2 Wed 12:15 C 230

Optoelectronic properties of Ag clusters on polymer thin films during sputter deposition — •Marc Gensch[1,2], Matthias Schwartzkopf[1], Bjoern Beyersdorff[1], Wiebke Ohm[1], Calvin Brett[1,3], Deniza Checkrygina[2], Pallavi Pandit[1], Andreas Stierle[2], and Stephan Roth[1,3] — [1]DESY, Notkestr. 85, D-22607 Hamburg — [2]University of Hamburg, Luruper Chaussee 149, D-22761 Hamburg — [3]KTH, Teknikringen 56-58, SE-100 44 Stockholm

Nanostructured polymer-metal-composites demonstrate great perspectives for optoelectronic applications [1], e.g. as sensors or photovoltaics. To enhance properties of such devices the self-assembly process needs to be understood. We studied the insulator-metal transition during sputter deposition of silver on co- and homopolymers by grazing incidence small-angle X-ray scattering (GISAXS) in combination with surface differential reflectance spectroscopy (SDRS) [2]. As templates, solvent annealed highly ordered PS-b-PMMA diblock copolymers and their corresponding homopolymers were used. Our study reveals the selective wetting of silver on one of the polymer blocks and the influence of the template on the percolation behavior of the silver layer. In situ GISAXS measurements indicate a difference in the embedding of silver clusters depending on the polymer template. [1] S. V. Roth et al., ACS Appl. Mater. Interfaces 7, 12470 (2015). [2] M. Schwartzkopf et al., ACS Appl. Mater. Interfaces 7, 13547 (2015).

CPP 47.3 Wed 12:30 C 230

Ultra-sensitive guided-mode resonance refractive index sensor — •Swagato Sarkar[1], Tobias A. F. König[2,3], Andreas Fery[2,3,4], and Joby Joseph[1] — [1]Dept. of Physics, Indian Institute of Technology Delhi, New Delhi, India-110016 — [2]Leibniz-Institut für Polymerforschung Dresden e.V., Institute of Physical Chemistry and Polymer Physics, Hohe Str. 6, 01069 Dresden, Germany — [3]Cluster of Excellence Centre for Advancing Electronics Dresden, Technische Universität Dresden, 01062 Dresden, Germany — [4]Department of Physical Chemistry of Polymeric Materials, Technische Universität Dresden, Hohe Str. 6, 01069 Dresden, Germany

In this work, an extremely sensitive refractive index (RI) sensor employing phase detection in a guided mode resonance (GMR) structure is presented where the GMR structure is introduced to one of the arms of a Mach-Zehnder Interferometer to detect RI change through phase measurement via fringe shift. The sensitivity comes out to be 0.608π phase shift per 10^{-4} RI change in water medium which is more than 100 times higher than the other reported GMR based phase detection method. Using the experimental set up, a minimum phase shift of (1.94 x 10^{-3}) π can be measured that corresponds to a RI change of 3.43 x 10^{-7}, outperforming the sensitivity of any of the reported optical sensors. Finally, an alternative lithography free approach is considered using directed self-assembly method. Due to the high optical quality of the novel metal building blocks and the up-scalability of the self-assembly method, an outlook towards fabrication of cost efficient GMR ultra-sensitive refractive index sensor will be discussed.

CPP 47.4 Wed 12:45 C 230

Optoelectronic properties of functionalized diamondoids: sensing DNA-nucleotides — •Chandra Shekar Sarap[1], Partovi-Azar Pouya[2], and Maria Fyta[1] — [1]Institute for Computational Physics, University of Stuttgart, Allmandring 3, 70569 Stuttgart, Germany — [2]Institute of Chemistry, Martin Luther University, Halle-Wittenberg, Von-Danckelmann-Platz 4, 06120 Halle (Saale), Germany

Diamondoids, the small nanometer-sized hydrogen-terminated hydrocarbon cages or diamond-like structures with sp3 carbon, are complementary to sp2 carbon nanomaterials such as graphene, carbon nanotubes, and fullerenes. Due to their unique molecular framework, these molecules have recently gained a lot of interest that possess high thermal stability, superior chemical resistance, and negative electron affinity making them good candidates for electron emitting devices. Herein, we investigate the performance of functionalized diamondoids as a probe to sense DNA using density functional theory (DFT). We focus on the optical properties of functionalized diamondoids interacting with different nucleotides by considering the hydrogen-bond strength. Moreover, the corresponding charge-transfer time scales between the diamondoids and the nucleotides reveals that the interaction of the diamondoids with different nucleotides results in different optical and charge-transfer properties which in turn can be exploited for detection of the nucleotides. The studies are motivated by the high potential of diamond-based materials for optoelectronic applications as well as sensors for DNA detection.