

DY 17: Interfaces and Thin Films I (joint session CPP/O/DY)

Time: Monday 16:30–17:15

Location: ZEU 260

DY 17.1 Mon 16:30 ZEU 260

In Situ Monitoring Mesoscopic Deformation of Nanostructured Porous Titania Films Caused by Water Ingression — LIN SONG^{1,2}, MONIKA RAWOLLE¹, NURI HOHN¹, JOCHEN S. GUTMANN³, HENRICH FRIELINGHAUS⁴, and •PETER MÜLLER-BUSCHBAUM^{1,5} — ¹Lehrstuhl für funktionelle Materialien, Physik Department, TU München, 85748 Garching, Germany — ²Xian Institute of Flexible Electronics, Northwestern Polytechnical University, Xian 710072, Shaanxi, China — ³Fakultät für Chemie, Universität Duisburg-Essen, 45141, Essen, Germany — ⁴JCNS at MLZ, Forschungszentrum Jülich GmbH, 85748 Garching, Germany — ⁵MLZ, TU München, 85748 Garching, Germany

Nanostructured porous titania films are used in many energy related applications. We investigate the temporal evolution of the mesoscopic deformation of mesoporous titania films synthesized via block copolymer assisted sol-gel chemistry with in situ grazing incidence small-angle neutron scattering (GISANS) during exposure to water vapor. Two types of mesoporous titania films are compared, which have a different degree of structural stability, depending on the applied annealing temperature in nitrogen atmosphere. Water ingress causes a gradual structure deformation in terms of decreasing center-to-center distances and broadening of the size distribution of the titania nanostructures. Based on the evolution of the mesopore size obtained from in situ GISANS measurements, the results show which type of titania structure is more stable against water infiltration.

DY 17.2 Mon 16:45 ZEU 260

In situ GISAXS Investigations of Multi-responsive Block Copolymer Thin Films during Solvent Vapor Annealing — •FLORIAN A. JUNG¹, PANAYIOTA A. PANTELI², DETLEF-M. SMILGIES³, DORTHE POSSELT⁴, CONSTANTINOS TSITSILIANIS⁵, COSTAS S. PATRICKIOS², and CHRISTINE M. PAPADAKIS¹ — ¹Physics Department, Soft Matter Group, Technical University of Munich, Garching, Germany — ²Department of Chemistry, University of Cyprus, Nicosia, Cyprus — ³Wilson Laboratory, Cornell University, Ithaca, USA — ⁴Department of Science and Environment, Roskilde University, Denmark — ⁵Department of Chemical Engineering, University of Patras, Greece

Responsive block copolymer thin films are of interest for many applications, e.g. as fast sensors or switchable membranes. In the present work, we investigate a pH and temperature responsive pentablock quaterpolymer in thin films during solvent vapor annealing (SVA). The end blocks are temperature-responsive and hydrophobic while the midblock is pH-responsive and hydrophilic. Structural information was obtained by employing in situ grazing-incidence small-angle X-ray scattering (GISAXS) and by model fitting the obtained 2D patterns. We find that, varying the pH value of the solution for spin-coating as well as the nature of the solvent used for SVA gives the opportunity to tune the structures in a wide range.

DY 17.3 Mon 17:00 ZEU 260

Self-assembly of large magnetic nanoparticles in ultrahigh molecular weight linear diblock copolymer films — •WEI CAO¹, SENLIN XIA¹, XINYU JIANG¹, MARKUS GALLET², MATTHIAS OPEL³, MATTHIAS SCHWARTZKOPF⁴, STEPHAN V. ROTH^{4,5}, and PETER MÜLLER-BUSCHBAUM¹ — ¹TU München, Physik-Department, LS Funktionelle Materialien, 85748 Garching — ²Saarland University, Chair in Polymer Chemistry, 66123 Saarbrücken — ³Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, 85748 Garching — ⁴DESY, Notkestrasse 85, 22603 Hamburg — ⁵KTH Royal Institute of Technology, FPT, SE-100 44 Stockholm, Sweden

The fabrication of diblock copolymer nanocomposite films that consist of magnetic nanoparticles (NPs) with diameters (D) of more than 20 nm is a challenging task. Herein, ultrahigh molecular weight (UHMW) linear polystyrene-block-poly(methyl methacrylate) (PS-*b*-PMMA) diblock copolymer is spin-coated as a template for the self-assembly of large iron oxide NPs (D = 27 nm), and the morphology of hybrid nanocomposites is governed by the concentration of the iron oxide NPs. The NPs are functionalized with carboxylic acid groups showing an affinity to the PMMA blocks. Due to the rearrangement of the polymer chains for accommodating the NPs, well-ordered spherical nanostructures are readily generated at a NP concentration of 0.5 wt%. Most interestingly, a chain-like network appears inside the hybrid films at a high NP loading. All hybrid films show ferromagnetism at room temperature, proven with a superconducting quantum interference device magnetometer.