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Towards equilibrium in thin films from binary blends of diblock copolymers –AFM and GISAXS investigations

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The self-assembly of block copolymer thin films may have a significant impact on the emerging nanotechnologies to create, for instance, ultrahigh density storage media or nanotemplates. In this perspective, solvent vapor annealing (SVA) is considered as a practical and reliable technique for the controlled modification of the structures in block copolymer thin films. In previous work, binary blends of compositionally symmetric poly(styrene-b-butadiene) diblock copolymers differing only in overall chain length were found to feature a one-phase lamellar structure after spin coating, contrary to what is known from bulk samples. For one of these blends, SVA was carried out and indeed induces macroseparation. Interestingly, perpendicular lamellae appear near the substrate and within the film, whereas parallel ones are found near the film surface. This phenomenon was observed by using atomic force microscopy (AFM) and grazing-incidence small angle X-ray scattering (GISAXS) as tools for investigation [1]. In the present project, we are using different solvents for SVA of the same film. These differ in quality and in selectivity to investigate the structural changes of this blend and to follow its pathway to equilibrium. The surface structures before and after SVA are determined using AFM, whereas the structural changes within the film during SVA are monitored using time-resolved GISAXS at CHESS, Cornell University. The results will show, in how far the interactions of the solvent with the diblock copolymer film can be used to tailor complex nanostructures.

[1] J. Zhang, C. M .Papadakis et al., submitted

Primary author: Mr DARWEESH, Mohamed (Physics Department at Technische Universität München)

Co-authors: Prof. PAPADAKIS, Christine M. (Physics Department at Technische Universität München); Dr SMILGIES, Detlef-M. (CHESS, Wilson Lab, Cornell University, Ithaca, NY, USA); Prof. POSSELT, Dorthe (The Department of Science, Systems and Models, Roskilde University, Denmark); Dr ZHANG, Jianqi (Physics Department at Technische Universität München)

Presenter: Mr DARWEESH, Mohamed (Physics Department at Technische Universität München)

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