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Co-Nonsolvency Transition of PNIPMAM-based Block Copolymer Thin Films in Water/Acetone Mixtures

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Co-nonsolvency occurs if a mixture of two good solvents causes the collapse or demixing of polymers into a polymer-rich and a solvent-rich phase in a certain range of compositions of these two solvents. The nonionic thermo-responsive polymer, poly(isopropylmethacrylamide) (PNIPMAM), which features a lower critical solution temperature (LCST) in aqueous solution, has been widely used to investigate its collapse transition behavior in a mixture of two competing good solvents. However, co-nonsolvency response of its block copolymer containing the zwitterionic poly(sulfobetaine)s, especially poly(4-((3-methacrylamidopropyl)dimethylammonio)butane-1-sulfonate)) (PSBP), which exhibits an lower upper critical solution temperature (UCST) and shows a strong swelling transition in aqueous media, is newly studied. We focus on the co-nonsolvency behavior of PSBP-b-PNIPMAM thin films in a series of deuterated binary mixtures by in situ time-of-flight neutron reflectometry (TOF-NR) and spectral reflectance (SR). Furthermore, Fourier Transform Infra-red (FTIR) spectroscopy is applied to investigate the interactions between the polymer thin film and water/co-solvent, which is closely related to their deuteration level.

Primary author: WANG, Peixi (Workgroup Polymer Interfaces, TUM Department of Physics, Technical University of Munich)

Co-authors: GEIGER, Christina (Technical University of Munich, Chair of Functional Materials); KREUZER, Lucas (TU München, Physik Department, E13); WIDMANN, Tobias (TU München, Physik Department, LS Funktionelle Materialien); VAGIAS, Apostolos (FRM2 / TUM); Dr CUBITT, Robert; Prof. LASCHEWSKY, André (Universität Potsdam, Institut für Chemie); PAPADAKIS, Christine (Technische Universität München, Physik-Department, Fachgebiet Physik weicher Materie)

Presenter: WANG, Peixi (Workgroup Polymer Interfaces, TUM Department of Physics, Technical University of Munich)

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