Co-Nonsolvency Transition of PNIPMAM-based Diblock Copolymer Thin Films in a Series of Binary Mixtures

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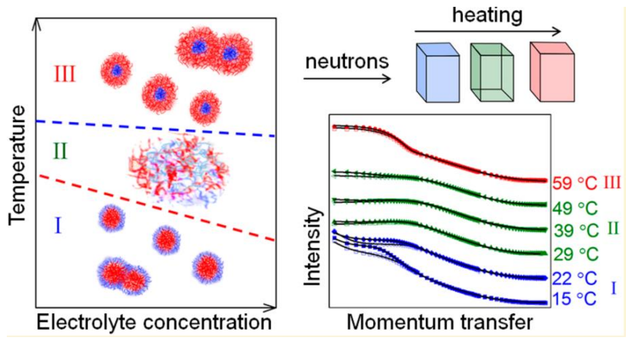
Motivation

- Desiging smart polymers for thermo sensors;
- Modeling size controlled nanoparticle precipitation;
- Realizing functional application of smart polymers.

Co-nonsolvency occurs if a mixture of two good solvents causes the collapse or demixing of polymers into a polymer-rich phase in a certain range of compositions of these two solvents. Co-nonsolvency response of PNIPMAM-based block copolymer thin films containing the zwitterionic PSBP is newly studied. We focus on the co-nonsolvency behavior of PSBP-b-PNIPAM thin films in a series of deuterated binary mixtures.

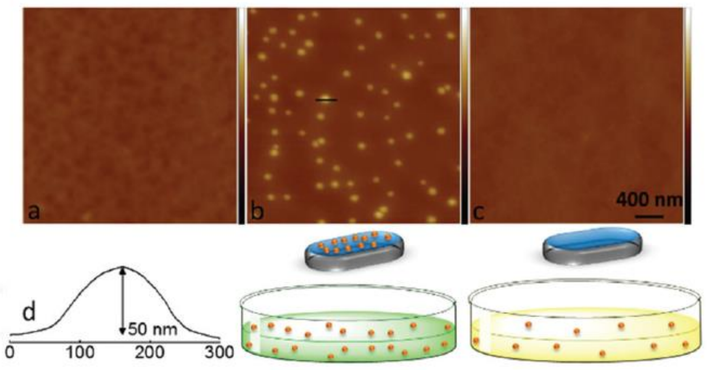
Simon Keßler, et al, Modeling size controlled nanoparticle precipitation with the co-solvency method by spinodal decomposition

Expected structures of PSBP-b-PNIPMAM in aqueous solution



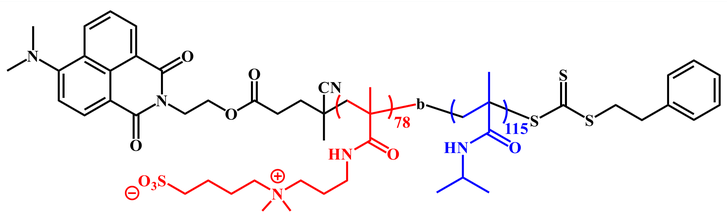
Natalya S. Vishnevetskaya *et al*, *Aggregation Behavior of Doubly Thermoresponsive Polysulfobetaine-b-poly(N-isopropylacrylamide) Diblock Copolymers*

Applicatons serving as a pick-up move and release system



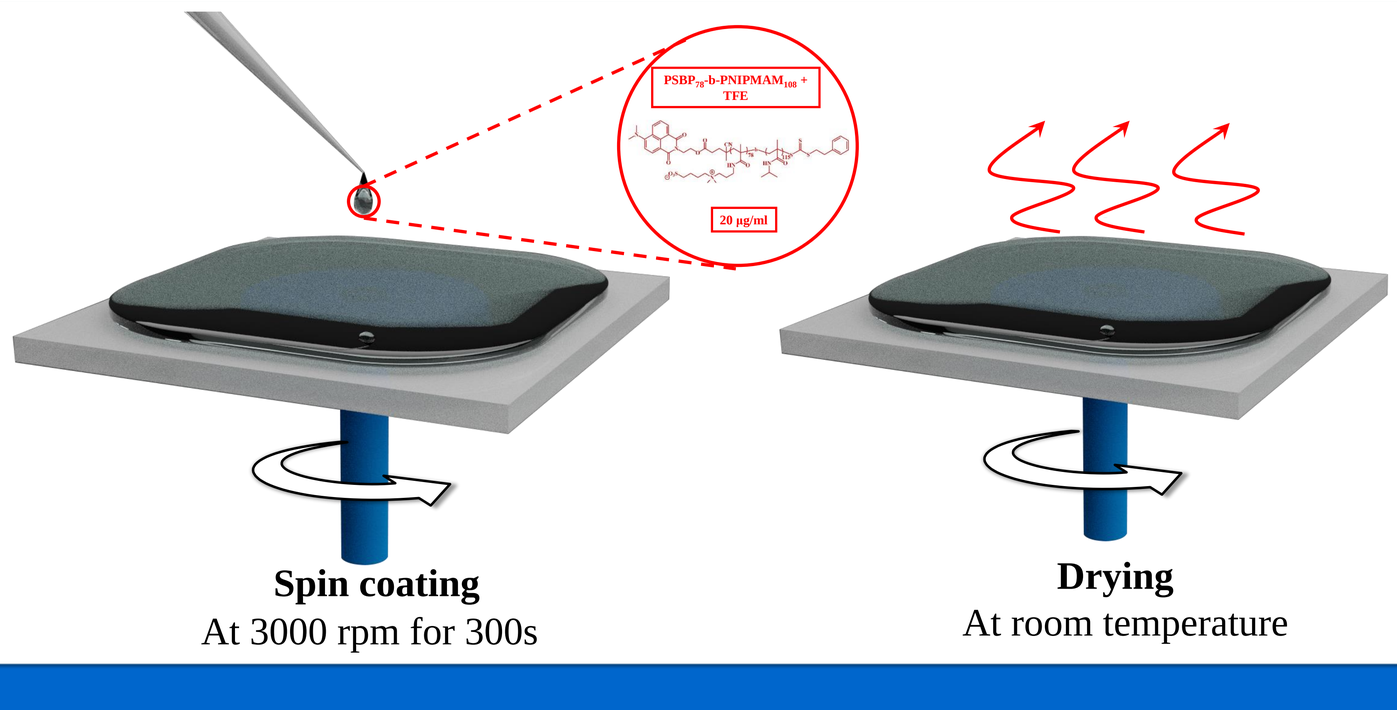
Yunlong Yu *et al*, *Pick up, move and release of nanoparticles utilizing co-non-solvency of PNIPAM brushes*

Experimental design



$PSBP_{78}$-b-$PNIPMAM_{115}$	Drying (N_2)	Swelling (H_2O or D_2O)	Swollen static	Co-solvent switch (Acetone or Acetone-d_6)	Collapsed static
A		100% H_2O		90/10% H_2O/Acetone-d_6	
B		100% D_2O		90/10% D_2O/Acetone-d_6	
C		100% D_2O		90/10% D_2O/Acetone	

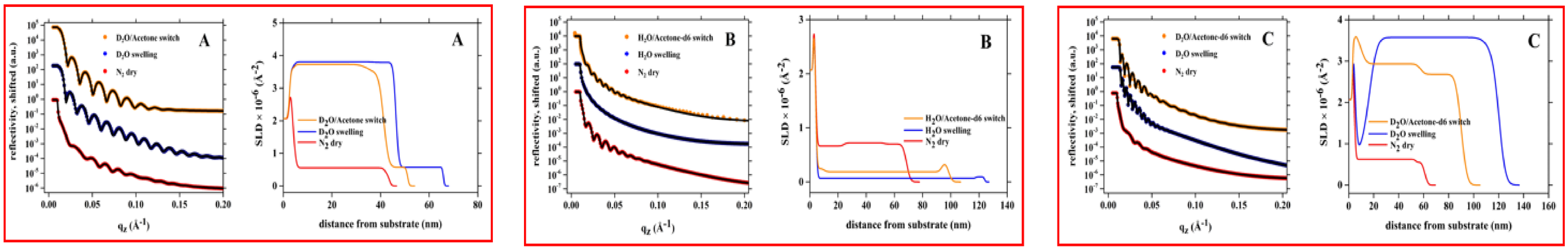
Sample preparation



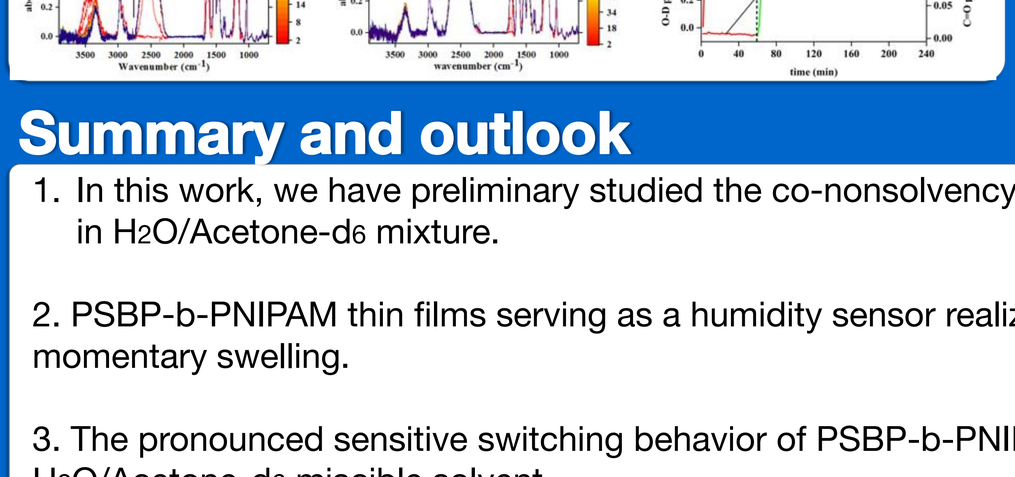
Spin coating
At 3000 rpm for 300s

Drying
At room temperature

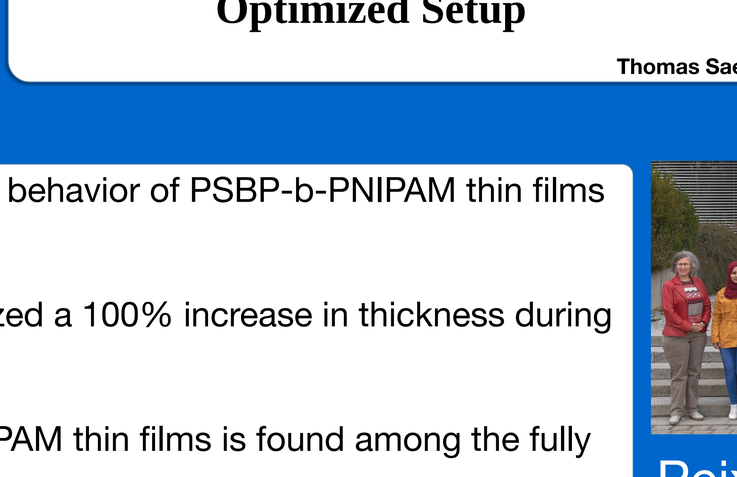
Static ToF-NR measurement



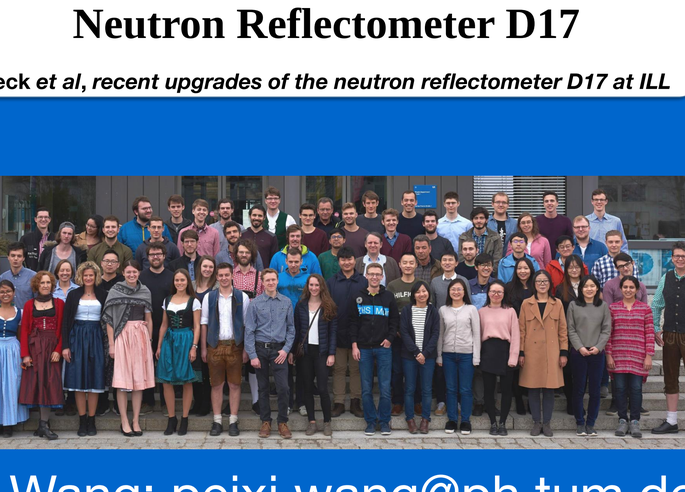
FITR spectra



Experimental set up



Optimized Setup



Neutron Reflectometer D17

Thomas Saerbeck *et al*, *recent upgrades of the neutron reflectometer D17 at ILL*

Summary and outlook

1. In this work, we have preliminary studied the co-nonsolvency behavior of PSBP-b-PNIPAM thin films in H_2O/Acetone-d_6 mixture.

2. PSBP-b-PNIPAM thin films serving as a humidity sensor realized a 100% increase in thickness during momentary swelling.

3. The pronounced sensitive switching behavior of PSBP-b-PNIPAM thin films is found among the fully H_2O/Acetone-d_6 miscible solvent.

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