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GRK 2516 Soft Matter Seminar

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via Zoom

Research seminar of the DFG Research Training Group GRK 2516 (https://grk2516.uni-mainz.de).

Note: Link: https://zoom.us/j/98197416231?pwd=c3ZnV0V6TDhsbkkwMnVDbTVWRG41dz09

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From the LCST Transition to Aquamelts: Type-II Phase Transitions in Polymers

The lower critical solution temperature (LCST) transition is introduced as type-II transition which results in many cases from competing effects of hydrogen bonding and hydrophobic behaviour of water-soluble polymers such as PEO and PNIPAm. As a consequence of the new type of phase separation a switch-like temperature response and phase coexistence is predicted for immobilized polymers such as polymer brushes or gels. I will give an introduction to simple theoretical concepts related with the type-II transition. Furthermore, I will demonstrate that mixed solvents can lead to type-II transitions with the prominent example of so-called co-nonsolvency [1]. Computer simulations and experiments confirm the basic conclusions from the theoretical model for polymer brushes [2,3]. Moreover, this phase transition is most likely driving the formation of protein-RNA-droplets in living cells. Using atomistic simulations it is shown for the example of PEO that stretching of the conformations can induce a phase transition far below the LCST which can be explained by the release of hydrogen bonds in the stretched state of PEO [4]. An aquamelt is introduced in general as a system where stretching/flow induces phase separation and subsquent crystallization, very similar to the process of spider-silk spinning in Nature. Aquamelts break the paradigm that solution properties of polymers are independent of conformation statistics.

[1]J.-U. Sommer, Gluonic and Regulatory Solvents: A Paradigm for Tunable Phase Segregation in Polymers, Macromolecules 51, 3066 (2018); Adsorption-

Attraction Model for Co-Nonsolvency in Polymer Brushes, Macromolecules 50, 2219 (2017)
[2]A. Galuschko and J.-U. Sommer, Co-Nonsolvency Response of a Polymer Brush: A Molecular Dynamics Study, Macromolecules 52, 4120 (2019)
[3]H. Yong, E. Bittrich, P. Uhlmann, A. Fery and J.-U. Sommer, Co-nonsolvency transition of poly(N-isopropylacrylamide) brushes in a series of binary mixtures, Macromolecules 52, 6285 (2019)
[4]S. Donnets and J.-U. Sommer, J. Phys. Chem. B 122, 392 (2018)

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