Polymers under Multiple Constraints

Polymer- & Soft-Matter-Seminar

Tuesday,
7th January
2014

at: 5.15 pm

VSP1 1.26,
Von-Seckendorff-Platz 1,
06120 Halle

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"Mechanical and structural instabilities around the demixing transition of PNIPAM solutions"

Certain thermo-responsive polymer solutions possess a demixing transition, which is of the lower critical solution temperature type. This phase transition is particularly sharp in case of aqueous poly(N-isopropyl acrylamide) (PNIPAM) solutions. Upon heating a homogeneous PNIPAM solution across its demixing temperature Tc, the polymer molecules undergo a coil-to-globule transition and gel-like PNIPAM-rich domains develop with time. This segregation is accompanied by a partial dehydration of the PNIPAM molecules, which spreads over a temperature range of at least 4 °C above Tc.

The evolution of the thermal expansion coefficient and the isothermal compressibility versus temperature indicates that the macroscopic order parameters of this liquid-liquid demixing transition also saturate in the same temperature interval above Tc [1-3]. Remarkably, nonlinear mechanical properties determine the mechanical instability accompanying the demixing transition [4]. The relationship between this mechanical instability and the underlying mesoscopic structure formation and the molecular dynamics will be discussed for semi-dilute PNIPAM solutions.

1. S. Hirotsu, Phase Transitions 47, 183-240 (1994)
2. M. Philipp, U. Müller, R. Aleksandrova, R. Sanctuary, P. Müller-Buschbaum and J. K. Krüger, Soft Matter 8, 11387-11395 (2012)
3. M. Philipp, U. Müller, R. J. Jiménez Riobóo, R. Sanctuary, P. Müller-Buschbaum, J. K. Krüger, Soft Matter 9, 9887-9896 (2013)
4. M. Philipp, U. Müller, R. Aleksandrova, R. Sanctuary, P. Müller-Buschbaum and J. K. Krüger, Soft Matter 9, 5034-5041 (2013)