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Cononsolvency in Thermo-Responsive Polymeric Hydrogels

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Temperature is one of the stimuli that can be controlled in various applications and more importantly in the field of biomedicine as the human body is thermo-regulated. For this reason thermosensitive hydrogels that can respond to temperature changes have been developed and widely explored in recent years. Block copolymers of various topologies have been designed for this purpose, the common feature of which is that they bear blocks exhibiting thermosensitivity in the temperature range of interest. This thermosensitivity usually relies on the reversible thermal phase transition of polymeric aqueous solutions characterized by a critical solution temperature. There are two cases. The polymer becomes insoluble by increasing temperature above the so called lower critical solution temperature (LCST) which in fact is a coil to globule transition, or in terms of interactions with water, a hydrophilic to hydrophobic transition. In the second case reverse phenomena occur and the critical temperature is named upper critical solution temperature (UCST).

Poly(N-isopropylacrylamide) (PNIPAM) is soluble in organic solvents, such as chloroform, acetone, methanol, and various other alcohols. It is also soluble in water, as long as the solution is kept reasonably cold. Heating an aqueous PNIPAM solution past 32 ℃ (the cloud point (CP) or LCST) instantaneously converts the clear solution into a milky suspension. However, in water/methanol mixtures, the could point is decreased, and PNIPAM collapses and precipitates. In order to study this phenomenon we carry out time-resolved mall-angle neutron scattering (SANS) experiments in Institut Laue-Langevin (ILL).

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