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The structural, thermal and dynamic behavior of the thermoresponsive polymer poly(N-isopropylmethacrylamide)

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Poly(N-isopropylmethacrylamide) (PNIPMAM) is a thermoresponsive polymer, exhibiting lower critical solution temperature (LCST) behavior in aqueous solution. Compared to the well-investigated poly(N-isopropylacrylamide) (PNIPAM), which has similar chemical structure, PNIPMAM has a higher transition temperature (43 °C [1] instead of 32 °C). This may be due to the presence of the additional methyl groups on the vinyl backbone, which lead to steric hindrance and weaken the intramolecular interactions [2,3]. In order to understand how these effects along with the hydrophobic interactions influence the phase behavior of aqueous solutions of PNIP-MAM, we investigate the temperature-dependent phase behavior of PNIPMAM in D2O using turbidimetry, differential scanning calorimetry (DSC), small-angle neutron scattering (SANS) and dynamic light scattering, covering a large concentration range. We find that the phase transition consists of two steps, namely (i) hydrophobic aggregation at ~39 °C, as evident from turbidimetry, DLS and SANS and (ii) the chain collapse and water release at ~44 °C, as evident from DSC and SANS.

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