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Investigation on the Structure of Temperature-Responsive N-isopropylacrylamide Microgels Containing a New Hydrophobic Crosslinker

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Abstract : Temperature-responsive poly(N-isopropyl acrylamide) PNIPAM microgels crosslinked with a new hydrophobic chemical crosslinker was prepared by surfactant-mediated precipitation emulsion polymerization. The temperature-responsive property of the microgel and the influence of the crosslinker on the swelling behaviour was studied systematically by light scattering and small-angle X-ray scattering (SAXS). The radius of gyration (Rg) and the hydrodynamic radius (Rh) of the microgels decreased with increase in temperature due to the volume phase transition from a swollen to a collapsed state. The ratio of Rg/Rh below the transition temperature was lower than that of hard-spheres due to the lower crosslinking density of the microgels. The SAXS data was analysed by a model in which the microgels were modelled as core-shell particles with a graded interface. The model at intermediate temperatures included a central core and a more diffuse outer layer describing pending polymer chains with a low crosslinking density. In the fully swollen state, the microgels were modelled with a single component with a broad graded surface. In the collapsed state they were modelled as homogeneous and relatively compact particles. The polymer volume fraction inside the microgel was also derived based on the model and was found to increase with increase in temperature as a result of collapse of the microgel to compact particles. The polymer volume fraction in the core of the microgel in the collapsed state was about 60% which is higher than that of similar microgels crosslinked with hydrophilic and flexible cross-linkers.

Keywords : microgels, SAXS, hydrophobic crosslinker, light scattering
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