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Investigations on the Growth Process of Poly(N-isopropylacrylamide) Mesoglobules under High-Pressure

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Poly(N-isopropylacrylamide) (PNIPAM) in aqueous solution forms stable dispersions of mesoglobules upon heating through the cloud point. At atmospheric pressure these mesoglobules are small and strongly dehydrated, and their further growth and coalescence are hindered by the viscoelastic effect. On the contrary, at high pressures, larger clusters of PNIPAM mesoglobules are formed, which are more hydrated. Here, we investigate the growth process of PNIPAM mesoglobules upon increasing and decreasing pressure using very small angle neutron scattering (VSANS) at KWS-3, FRM II. As pressure is increased, the size of the mesoglobules increases markedly at a critical pressure, which is found to depend on temperature. Upon decreasing pressure below the critical pressure, two populations of mesoglobules having sizes of the order of smaller mesoglobules and larger clusters are observed. We conjecture that the strong influence of pressure on the growth process of PNIPAM mesoglobules is due to the pressure-dependent hydration and subsequent aggregation of mesoglobules.

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