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Poly(N-isopropylacrylamide) Mesoglobules under Pressure

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Upon heating through the cloud point, poly(N-isopropylacrylamide) (PNIPAM) in aqueous solution forms long-lived dispersions of mesoglobules. 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, large, water-rich aggregates are formed by PNIPAM [1]. Here, we investigate the transition between these two states by varying pressure in the two-phase state. The size and water content of the mesoglobules and the aggregates are characterized using very small angle neutron scattering (VSANS) at KWS-3, MLZ. As pressure is increased, the size of the mesoglobules increases abruptly, and they take up water. These changes occur at critical pressures, that depend on temperature. Upon decreasing pressure, not all large aggregates transform back into smaller mesoglobules, possibly due to entanglements, which demonstrates the importance of the pathway. The results are of importance for the preparation of polymer nanoparticles by nanoprecipitation.
[1] B.-J. Niebuur et al., ACS Macro Lett. 6, 1180 (2017).

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