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## Hydration Water Dynamics in a Thermoresponsive Polymer Solution Under Pressure

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The water dynamics is key to functionality and phase behavior of synthetic and biological polymers. Responsive polymers react strongly to external stimuli such as temperature and pressure triggering chain collapse and phase separation. We investigate the dynamic behavior of hydration water in a 25 wt% aqueous poly(*N*-isopropyl acrylamide) (PNIPAM) solution in dependence on temperature (25 –50 °C) and pressure (0.1 –130 MPa) employing quasi-elastic neutron scattering (QENS) at TOFTOF [1]. The susceptibility spectra reveal the relaxation peak of the hydration water near 10 GHz, in addition to the known dynamic processes of bulk water. At atmospheric pressure, the relative population of (bound) hydration water sharply decreases upon heating from the one-phase to the two-phase state, i.e. the chains dehydrate strongly at their coil-to-globule transition. In contrast, at 130 MPa, no sharp decrease is observed, i.e. the dehydration takes place over a much broader temperature range, in consistency with recent molecular dynamics simulations [2]. This suggests an enhanced hydrophobic hydration at high pressure. Using perdeuterated PNIPAM along with QENS at TOFTOF and SPHERES allowed us to suppress the signal of the chain segments and to identify and characterize the behavior of the different types of bound water at the transition.

1. B.-J. Niebuur, A. Schulte, C. M. Papadakis et al., *Macromolecules* 2019, 52, 1942.
2. L. Tavagnacco et al., *Phys. Chem. Chem. Phys.* 2021, 23, 5984.

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