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SUPERCOOLED WATER IN SUPRAMOLECULAR HYDROGELS CLINTON WIENER, BRYAN VOGT, R.A. WEISS, University of Akron — The suppression of water crystallization with appreciable water supercooling is challenging due to its large enthalpy of fusion. A common theme to supercool water is to confine the water in the pores of microporous/mesoporous solids where mechanical confinement prevents water crystallization. Nature takes a different approach with crystallization suppression through a combination of preferential adsorption on ice nuclei and confinement between hydrophobic residues using organic components only. Here, we demonstrate that mechanically robust confinement within a hard material is not necessary to significantly supercool water. In this case, a supramolecular hydrogel, based on a random amphiphilic copolymer, is used to provide soft confinement of water between the hydrophobic aggregates with an interdomain spacing <8 nm. Small angle neutron scattering (SANS) provides insight into the structural evolution of the supramolecular structure of the hydrogel on supercooling. The structural changes are sensitive to the composition of the copolymer as determined by contrast variation SANS. Similarly, the dynamics of both the copolymer and water are probed using quasielastic neutron scattering (QENS). Using QENS, a highly mobile water phase (tau ≈23 ps) is identified to be present even when slowly cooling to as low as 220K.

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