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Modulation of the Mechanical Properties of Hydrophobically Modified Supramolecular Hydrogels by Surfactant-Driven Structural Rearrangement CHAO WANG, CLINTON WIENER, BRYAN VOGT, University of Akron, R. A. WEISS, Retired — Understanding the mechanical properties of hydrogels is critical to their use in most applications. In this work, we examine how a surfactant, sodium dodecyl sulfate (SDS), can stiffen or soften a hydrogel based on a random copolymer of N,N-dimethylacrylamide (DMA) and 2-(N-ethylperfluorooctanesulfonamido)ethyl methacrylate (FOSM) through a combination of rheology and small angle neutron scattering (SANS) for assessing the relationship between mechanical properties and structure. The copolymer forms a network crosslinked by aggregates of FOSM when immersed in water. This supramolecular network is kinetically trapped by the relatively immobile FOSM groups as they aggregate to avoid contact with water. The addition of SDS leads to the formation of effectively mixed micelles as the crosslinks to enable rearrangement of the FOSM to increase the equilibrium swelling of the hydrogel by as much as three times, while simultaneously increasing the elastic modulus of the hydrogel. However above a critical concentration, SDS sufficiently solvated the FOSM aggregate crosslinks to mechanically compromise the hydrogel through the loss of the nanodomain structure to allow the hydrogel to break-up into small pieces that eventually dissolved.

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