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Peptide Folding and Consequent Self-assembly for Shear Thinning Hydrogels with Immediate Recovery¹

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The local nano- and overall network structure, and resultant viscoelastic properties, of hydrogels that are formed via beta-hairpin self-assembly will be presented. The 20 amino acid peptides have been shown to intramolecularly fold and intermolecularly self-assemble into a rigid hydrogel based on environmental cues such as pH, salt, and temperature including physiological conditions. The hydrogel is composed of a network of fibrils that are 3 nm wide that physically crosslink (i.e. entangle and branch) with no covalent crosslinking required. Slight design variations of the peptide sequence allow for tunability of the self-assembly/hydrogelation kinetics. In turn, by controlling hydrogel self-assembly kinetics, one dictates the ultimate stiffness of the resultant network. This physical assembly process allows the encapsulation of desired payloads into the gel network such as large macromolecules or living cells. Importantly, once formed into a solid, the self-supporting gel network can be disrupted by the introduction of a shear stress. The system can shear thin but immediately reheel to a stiff solid on the cessation of the shear stress. This shear thinning and recovery behavior makes them interesting candidates for injectable delivery in vivo.

¹In collaboration with Joel Schneider, University of Delaware.