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Neutron Scattering Analysis of the Dynamics and Structure of Semiflexible, Self-Assembled Peptide Chain Networks and WormLike Micelles N. WAGNER, M. BRANCO, D. POCHAN, J. SCHNEIDER, University of Delaware — Self assembled peptide hydrogels are formed from synthetic β-hairpin peptides that undergo triggered self assembly to form a physically crosslinked network of entangled fibrils. Upon salt addition at pH 7.4, these peptides fold into a β-hairpin self-assemble to form a rigid hydrogel stabilized by non-covalent crosslinks. A single amino acid substitution is performed to change the charge on the peptide and greatly alter the rate of assembly. As a result, faster folding and self assembly kinetics are observed leading to more rigid gels. Transmission electron microscopy (TEM) and rheology demonstrate that the resultant, rigid networks of the semiflexible fibrils are composed of a bilayer of hairpins with a cross-sectional diameter of 3 nm, corresponding to the width of a folded peptide. Neutron spin echo (NSE) measurements show that the peptides can be modeled as semiflexible chains on lengthscales shorter than the characteristic mesh size. The chain diffusivity is reduced by the peptide substitution and this can be attributed to alteration of the electrostatic interactions between peptides in the fibril. Small angle neutron scattering (SANS) measurements show a transition from a cylindrical rod-like geometry to a more branched, fractal-like network topology upon amino acid substitution. These measurements explain the large increase in gel modulus observed upon amino acid substitution. These results facilitate the rational design of self-assembling peptide materials for biomaterial applications. NSE results for semiflexible wormlike micelles will also be discussed.

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