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Colloid Induced Deformation and Strain Stiffening of Biopolymer Networks ASHESH GHOSH, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — Recent experiments by Bharadwaj, Ewoldt, Braun and coworkers on colloid-biopolymer composites have shown strain stiffening of a large mesh network above a threshold value of colloid concentration and upon crossing a temperature where the particle undergoes a volume contraction. A qualitative hypothesis has been advanced that the driving force is the presence of a strong cohesive interaction between the colloid and biopolymer which induces strong filament bending upon particle shrinkage. We have formulated and studied a simple model for this phenomenon where the biopolymer is taken to be a semiflexible worm-like chain which experiences a short range square well attraction with the filament. The optimum (lowest free energy) structure of the (deformed) filament is then determined as a competition between bending and cohesive forces, which depends on particle diameter, network mesh size, and the attraction strength and range. An effective phase diagram for the emergence of a colloid-induced deformed filament contour is constructed. Model calculations are performed for the bending energy, cohesive energy and degree of modulus increase as a function of system parameters. Illustrative numerical applications to F-actin and fibrin networks will be presented.

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