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Gelation And Mechanical Response of Patchy Rods.[1] NAVID KAZEM, Carnegie Mellon Univ, CARMEL MAJIDI, Carnegie Mellon University, CRAIG MALONEY, Northeastern University — We perform Brownian Dynamics simulations to study the gelation of suspensions of attractive, rod-like particles. We show that details of the particle-particle interactions can dramatically affect the dynamics of gelation and the structure and mechanics of the networks that form. If the attraction between the rods is perfectly smooth along their length, they will collapse into compact bundles. If the attraction is sufficiently corrugated or patchy, over time, a rigid space spanning network forms. We study the structure and mechanical properties of the networks that form as a function of the fraction of the surface that is allowed to bind. Surprisingly, the structural and mechanical properties are non-monotonic in the surface coverage. At low coverage, there are not a sufficient number of cross-linking sites to form networks. At high coverage, rods bundle and form disconnected clusters. At intermediate coverage, robust networks form. The elastic modulus and yield stress are both non-monotonic in the surface coverage. The stiffest and strongest networks show an essentially homogeneous deformation under strain with rods re-orienting along the extensional axis. Weaker, clumpy networks at high surface coverage exhibit relatively little re-orienting with strong non-affine deformation. These results suggest design strategies for tailoring surface interactions between rods to yield rigid networks with optimal properties.

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