Temperature driven dynamical arrest of a network fluid: the role of loops

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Low-density networks of molecules or colloids are formed at low temperatures when the interparticle interactions are valence limited. Prototypical exemples are networks of patchy colloids, where the limited valence results from highly directional pairwise interactions. We combine extensive Langevin simulations and Wertheim's theory of association to study these networks. A temperature driven crossover was observed from exponential to scale-free relaxation dynamics. The exponent of the latter is independent of temperature and initial configuration. This crossover stems from the formation of a dynamically arrested percolating gel, with a number of loops, compromising the feasibility of observing thermodynamic structures. Most notably, under conditions of equilibrium phase separation, an arrested gel of intermediate density forms and it is observed to age slowly. This contrasts with the dynamics of loopless gels, where such an arrest was not observed.