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**Self-Assembly of Magnetic Particles into Polymer Chains and Networks** JACK DOUGLAS, Polymers Division, NIST, WOLFGANG LOSERT, JUSTIN STAMBAUGH, Department of Physics, University of Maryland, KEVIN VAN WORKUM, Polymers Division, NIST — The increasing demand to manufacture structures at the nanoscale has made it necessary to pursue new fabrication strategies based on self-assembly. Although it is generally appreciated that this type of ordering process relies on the interplay of directional and isotropic interactions to guide the organization process, the theoretical principles governing this process remain uncertain. There is clearly a need for the development of *real model systems* exhibiting self-assembly and for their intensive investigation by experimental and simulation studies, in conjunction with analytic modeling. Since particle size is not an intrinsic limitation in this type of study, we investigate the self-assembly of vertically vibrated magnetic ‘beads’ (spheres with embedded magnets) into dynamic polymer chains where the effective temperature of the fluid is determined by the shaking velocity. Self-assembly is assumed to be described by equilibrium polymerization and we perform Monte Carlo simulations for this model fluid at thermodynamic equilibrium. The experiments, simulations and analytic calculations lead to a self-consistent description of the self-assembly process in this fluid. We regulate polymer branching by adding beads having relatively short embedded magnets that are characterized by appreciable *multipole* interactions in addition to the dipole interaction.

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