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A parsimonious hydrodynamic model for colloidal gelation ZSIGMOND VARGA, JAMES W. SWAN, Department of Chemical Engineering, Massachusetts Institute of Technology — Colloidal gels are formed during arrested phase separation. Models for microstructural evolution during gelation have often struggled to match experimental results with long standing questions regarding the role of hydrodynamics. We hypothesize that long-ranged hydrodynamic interactions between the suspended particles are key for colloidal gelation. A simplified hydrodynamic model tests this hypothesis by including only long-ranged interactions via the Rotne-Prager-Yamakawa tensor. We show simulations of gelation with and without hydrodynamic interactions between the suspended particles executed in HOOMD-blue. The disparities between these simulations are striking. The hydrodynamic simulations agree with experimental observations, however. These results suggest that long-ranged hydrodynamic interactions are sufficient for establishing the gel boundary, structure and coarsening kinetics observed in experiments and more sophisticated simulation methods. Near the gel boundary, there exists a competition between compaction of individual aggregates which suppresses gelation and coagulation of aggregates which enhances it. The time scale for coagulation is greatly accelerated, leading to a shift in the gel boundary when compared to models that neglect hydrodynamic interactions.

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