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Delayed yield in reversible colloidal gels: a micro- mechanical perspective ROSEANNA ZIA, BENJAMIN LANDRUM, Cornell University, WILLIAM RUSSEL, Princeton University — We study via dynamic simulation the nonlinear response of a reversible colloidal gel undergoing deformation under fixed stress, with a view toward elucidating mechanisms of macroscopic yield at the level of particle dynamics. Under shear, such gels may flow but then regain solidlike behavior upon removal of the stress. The transition from solidlike to liquidlike behavior is a yielding process that is not instantaneous but rather occurs after a finite delay. The delay duration decreases as stress increases, but the underlying microstructural origins are not understood. Recent experiments reveal two regimes, suggesting multiple yield mechanisms. Theories advanced to link gel structure to this rheology hypothesize a competition between bond breakage and reconnection rates, but no such particle-scale dynamics have been directly observed – or reconciled with ongoing structural evolution. To study these behaviors, we impose a step stress on a gel comprising 750,000 Brownian particles for a range of volume fraction, attraction strength, and imposed stress, monitoring displacement and particle velocity over time. A detailed connection between macroscopic response, microstructure, and particle dynamics leads to a phase map predicting nonlinear response of such gels to fixed stress.

Roseanna Zia
Cornell University

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