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Session M09: Emerging Trends in Soft Microscale Mechanics I

8:00 AM–11:00 AM, Wednesday, March 8, 2023

Room: Room 132

Sponsoring Unit: DSOFIT

Chair: Rae Robertson-Anderson, University San Diego

Abstract: M09.00007 : Structural rearrangement and slow dynamics near the onset of rigidity*

9:36 AM–9:48 AM

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A wide variety of amorphous soft materials, such as colloidal suspensions and crosslinked biopolymer networks, consist of a bulk fluid phase α and microscopic immersed solid components. These materials generally develop macroscopic rigidity at a critical value of some system-specific parameter. For suspensions, the relevant control parameter is the particle volume fraction; for networks, it can be the average connectivity or of applied strain. Close to the transition point, these systems share a tendency to display striking rheological signatures of critical slowing down that this slowing is quantitatively controlled by nonaffine (heterogeneous) structural rearrangements that, like critical fluctuations in other systems, exhibit a diverging correlation length as the critical point is approached. Near the onset or loss of rigidity, dissipation-limiting processes dominate the macroscopic viscoelastic response, giving rise to diverging relaxation times and power-law rheology. Here, we describe the quantitative relationship between nonaffine rearrangements and excess viscosity in fluid-immersed amorphous materials, and we verify this relationship using simulations of crosslinked networks and dense suspensions.

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