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Shear-induced rejuvenation and overaging of laponite clay suspensions MICHAEL ROGERS, University of Ottawa, KUI CHEN, ROBERT LEHENY, Johns Hopkins University, JAMES HARDEN, University of Ottawa —
Disordered soft solids have elaborate shear-induced mechanical properties that are connected to their complex hierarchical structure from nano- to micrometer scales. The nonequilibrium nature of many disordered soft solids makes identifying and understanding these connections difficult: their properties depend not only on thermodynamic conditions, but also on their history. For example, laponite suspensions are well-known to exhibit characteristic mechanical aging. Above a critical concentration, they evolve into gel phases with relaxation times that grow with age. We have studied aging in laponite suspensions using X-ray Photon Correlation Spectroscopy (XPCS). This technique involves auto-correlating characteristic speckle patterns from coherent x-ray scattering to uncover collective particle dynamics. Laponite suspensions were aged between parallel plates of a shear cell that allowed for in-situ XPCS measurements. This enabled occasional disruption of the aging process by the application of controlled shear. Our results show that aging can be transiently reversed (the gel is "rejuvenated") by applying oscillatory or step shear. Moreover, we have also identified a small regime of low amplitude oscillatory shear that causes "overaging", where shear enhances the aging process.

Michael Rogers
University of Ottawa

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