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Frequency Dependence of Aging Dynamics in a Colloidal Glass
AJAY NEGI, CHINEDUM OSUJI, Yale University — The aging response of glassy particulate systems originates due to slow structural rearrangements of its constituent matter. It is reasonable to speculate that structural rearrangements on different length scales should manifest themselves in dynamical response on different timescales. Here we consider the frequency dependence of aging in a colloidal glassy system using parallel superposition bulk rheology. The aging behavior of the system is characterized by time evolution of the complex modulus in response to a sinusoidally varying probe stress of different frequencies superimposed on a steady background stress. Strikingly, the system displays more rapid aging when observed at smaller frequencies. This suggests that, by comparison, it is more arrested on shorter length scales (higher frequencies) than on the longer length scales where many-particle correlated motions are in effect. Such correlated motions are believed to be responsible for relaxation in glassy materials. The variation in the aging dynamics at different frequencies is more prominent at higher background stresses where the system is more fluidized.

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