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Gel formation and aging in weakly attractive nanocolloid suspensions JAMES HARDEN, Department of Physics, University of Ottawa, HONGYU GUO, Department of Physics, University of California, San Diego, SUBRAMANIAN RAMAKRISHNAN, Department of Chemical and Biomedical Engineering, Florida State University, ROBERT LEHENY, Department of Physics and Astronomy, Johns Hopkins University — We present combined x-ray photon correlation spectroscopy (XPCS) and rheometry studies of the evolution of concentrated suspensions of nanometer-scale colloids undergoing thermoreversible gelation and aging. After a quench through the gel point, suspensions display a protracted latency period in which they remain fluid followed by a gelation regime in which the shear modulus grows rapidly. The XPCS intermediate scattering function displays two features, a plateau value that provides information about constrained local dynamics and a terminal decay related to relaxation of residual stress. From the wave-vector dependence of the plateau value, a localization length can be extracted. At intermediate colloidal volume fractions ($\phi \simeq 0.20$), the relationship between the localization length and the shear modulus agrees quantitatively with a prediction based on a simplified mode coupling theory, while deviations from the predicted scaling at a higher volume fraction ($\phi \simeq 0.43$) are observed near the gel point. While some features of slow strain from stress relaxation correlate with the evolving rheology, others appear decoupled from the macroscopic behavior.

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