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Dynamics of Concentrated Silica Suspension under Oscillatory Shear Studied by SAXS and XPCS JONGHUN LEE, XIAO-MIN LIN, ALEC SANDY, SURESH NARAYANAN, Argonne National Laboratory, X-RAY SCIENCE DIVISION TEAM, CENTER FOR NANOMATERIALS TEAM — The viscoelastic properties of complex fluids are often obtained by applying small amplitude oscillatory shear (SAOS). In this regime, their microstructure does not change by shear, and the shear stress linearly responds to the applied strain. However, in the real application, high shear strain or rate is applied, where the viscoelastic properties are affected by the microstructural deformation by this high shear. The rheological behavior of complex fluids under large amplitude oscillatory shear (LAOS) has been widely studied, but there is a lack of studies in microscopic dynamics of complex fluids under LAOS. X-ray scattering is a suitable method to understand microscopic perspective of rheology because of its proper length scales of tens to hundreds nm and time scales of millisecond to thousands second. Here, we studied the dynamics of the concentrated silica nanoparticle suspensions in PEG under different shear strain regimes using small angle x-ray scattering (SAXS) and x-ray photon correlation spectroscopy (XPCS). With strain increasing, these suspensions showed shear thinning and shear thickening behavior, and their microstructural change was observed by SAXS. In oscillatory shear, as the original scattering volume periodically comes back to the original position, we could better study the changes in autocorrelation function by shear and diffusion than steady shear study where correlation decays by transit.

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