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X-ray speckle measurements of concentrated nanoemulsions under shear SAMY ABIDIB, MICHAEL ROGERS, University of Ottawa, ROBERT LEHENY, KUI CHEN, Johns Hopkins University, THOMAS MASON, UCLA, JAMES HARDEN, University of Ottawa — We present in situ X-ray Photon Correlation Spectroscopy (XPCS) measurements of a set of concentrated nanoemulsions subjected to oscillatory shear. The nanoemulsion set contained samples with varying packing fractions of oil droplets (r 20nm) above the jamming transition. In order to study their elasticity, yielding, and flow at various shear amplitudes, we employed stroboscopic coherent X-ray scattering measurements triggered at the maximums of the shear cycle. The degree of correlation between speckle in images taken a full period apart is a direct measurement of particle rearrangements during cycling. A comparison of such XPCS echo measurements with rheological measurements shows an onset of irreversible particle motion at shear strains below the crossover of the storage and loss moduli, which is typically used to indicate the transition to viscoplastic flow. Moreover, the XPCS echo measurements indicate that particle irreversibility increases rapidly with shear amplitude, in contrast to the comparably smooth transition to yielding shown in bulk rheology measurements. However, the macroscopic yield strain observed in rheology and the microscopic yield strain identified from XPCS, which were strong functions of droplet packing fraction, tracked each other closely.

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