Active microrheology in an emulsion glass

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Abstract

Active microrheology is an important phenomenon to understand the rheological properties of complex fluids. In our experiments we use a laser tweezer to drag a tracer particle through a dense oil-in-water emulsion. Emulsion particles with diameter of 2 micron and 10% polydispersity are prepared applying shear using a homemade couette cell[1]. The refractive index and density of the emulsion droplets are matched to the solvent, and tracer particles, the same size as emulsion particles, are added to the sample. Using centrifugation the sample is quenched slightly above jamming transition. By careful dilution the experiments are then run at a point right below jamming transition, i.e. in the glass. To this end the sample is diluted in small steps to determine where the jamming transition occurs using dynamic light scattering. Applying constant force with optical tweezer we determine probability distribution of the tracer particle position and compare it to the theoretical model of Fuchs et al[2]. Our results are important to understand non-equilibrium systems and useful for transport phenomena in biological systems.

References

[1] Zhang, C., et al., *Structure of marginally jammed polydisperse packings of frictionless spheres.* Physical Review E, 2015. **91**(3): p. 6.

[2] Gazuz, I., et al., *Active and Nonlinear Microrheology in Dense Colloidal Suspensions.* Physical Review Letters, 2009. **102**(24): p. 4.