Investigating Viscoelastic Properties of Oil-in-water Emulsion Systems below the Glass Transition Using Microrheology Techniques

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The goal of this thesis is to study viscoelastic properties of dense emulsions mimicking hard sphere suspensions below the jamming transition. We study magnetic fields induced driven motion of probe particles, also called *active microrheology*. This was done by embedding magnetic beads into the emulsions and by measuring their trajectory in the presence of an external field. With the measured displacement the average velocity and with that the viscosity of the mixture can be calculated.
The motion of the particles in two dimensions was monitored. Because of the limited forces produced by the magnet we only considered volume fraction in the liquid regime below the glass and jamming transition. As expected, we observed slower motion of the magnetic beads in the emulsions with higher volume fraction and for lower forces applied. We observe driven motion along the x-axis along the magnetic field gradient direction and stochastic, random motion along the y-axis. Form the measured particle velocities we could confirm that the viscosity grows strongly with increasing volume fraction and that the effective viscosity drops with increasing applied force and particle velocity, corresponding to a type of shear thinning which is also observed in conventional rheology studies of emulsions and hard sphere suspensions.

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