Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Acoustic Bubble Dynamics in a Yield-stress Fluid[1] BRICE SAINT-MICHEL, VALERIA GARBIN, Delft University of Technology — Yield-stress fluids naturally trap small bubbles when their buoyancy applies an insufficient stress to induce local yielding of the material. Under acoustic excitation, trapped bubbles can be driven into volumetric oscillations; they then apply an additional local strain and stress that can trigger yielding and assist their release. We explore different regimes of microbubble oscillation and translation driven by an ultrasound field in a model yield-stress fluid. We first analyze the linear oscillation dynamics of a single bubble and estimate the local, high-frequency viscosity of the fluid. We apply pressure gradients to generate a net acoustic force on the bubble, which allows us to estimate the linear shear modulus of the fluid. We then examine whether bubbles are indeed released under stronger acoustic excitation, i.e. when the stresses associated with bubble oscillation yield the fluid. For large applied pressures, we report bubble shape oscillations and bubble motion becomes erratic, which prevents their release. We compare the observed shape modes and the critical pressure with a recent model. Lastly, we briefly discuss preliminary results on the dynamics of acoustically interacting – attractive and repulsive – bubble pairs in yield-stress fluids.

[1]ERC Starting grant n639221

Brice Saint-Michel
Delft University of Technology

Date submitted: 10 Aug 2020 Electronic form version 1.4