Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Fiber alignment in oscillating confined shearing flows[1] SCOTT STREDNAK, JASON BUTLER, University of Florida, LAURENCE BERGOUGNOUX, Aix-Marsielle University, ELISABETH GUAZZELLI, University of Paris — Rigid, non-colloidal fibers suspended at high concentration in a Newtonian fluid were aligned in the flow-gradient plane (vorticity direction) by an oscillatory shearing flow. Measurements of the alignment were performed over a range of strain amplitudes, fiber aspect ratio, concentrations, and confinement using a custom flow cell; simulations that account for the hydrodynamic drag and excluded volume of the fibers predict the alignment, largely in agreement with the measurements. The vorticity alignment of fibers was influenced by the confinement, and the orientation of fibers was spatially dependent. For some conditions, nearly perfect alignment of fibers with the vorticity direction occurs adjacent to the bounding walls, while fibers in the center of the gap are significantly more aligned in the flow direction. Overall, the alignment is a complicated function of the particle concentration, confinement, and fiber aspect ratio.

[1]National Science Foundation (grants nos 1511787 and 1362060)

Scott Strednak
University of Florida

Date submitted: 03 Aug 2020 Electronic form version 1.4