Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Droplet coalescence using a microfluidic hydrodynamic trap[1]
SHWETA NARAYAN, University of Minnesota - Twin Cities, DAVIS MORAVEC, BRAD HAUSER, ANDREW DALLAS, Donaldson Company, Inc., CARI DUTCHER, University of Minnesota - Twin Cities — Coalescence of micrometer-sized droplets to form larger drops is a fundamental process leading to separation of complex emulsions. Single droplet coalescence experiments are challenging, particularly with micrometer-sized droplets, compared to bulk studies. We have shown using microfluidics that the dynamic interfacial tension equilibration timescale is orders of magnitude shorter in micrometer-scale droplets compared to large millimeter-sized drops. Here we employ a microfluidic hydrodynamic trap to trap and coalesce single micrometer-sized droplets formed on-chip using feedback pressure control. Similar to the macro-scale four-roll mill, single droplet coalescence experiments are conducted using a microfluidic trap, with precise control over droplet size and speed. The systems studied are light and heavy mineral oils with varying concentrations of SPAN 80 in the continuous phase, with water as the dispersed phase. Film drainage times are measured as a function of Capillary number, surfactant concentration and viscosity ratio.

[1]This work was funded by Donaldson Company and performed at the University of Minnesota. Portions of this work were conducted in the Minnesota Nano Center, which is supported by the National Science Foundation through the National Nano Coordinated Infrastructure Network (NNCI) under Award Number ECCS-1542202

Shweta Narayan
University of Minnesota - Twin Cities

Date submitted: 25 Jul 2019 Electronic form version 1.4