Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Low-pressure driven displacement of gas-fluid-gas plugs in a capillary tube SRAVYA SASETTY, Iowa State University — This talk focuses on experiments conducted to study the effects of low-pressure driven displacement of liquid plugs in a capillary tube. Experiments were performed in a capillary tube (diameter ≈ 800 μm) by displacing liquid plugs containing aqueous glycerol solution using pressurized air with a range of 0.02 psig $\leq P \leq$ 0.1 psig (at an increment of 0.01 psig). Two CCD cameras placed in front of the set-up captured the displaced and displacing fluid interfaces simultaneously. At these low pressures, we categorized the flow behavior as following: 1) At the lowest pressure, displacement of fluid plug becomes stationary after a certain time, 2) With further increase in pressure, the residual film of the displaced fluid deforms into drops along the tube walls, and 3) At the highest pressure, a flat and thin film was left behind by the displaced fluid. Subsequently, we measure the fluid fraction left in the tube using the expression $m = 1 - U_m/U_t$, where the mean (U_m) and tip (U_t) velocities were measured by analyzing the experimental data using an in-house MATLAB code. We report the m versus Ca trends observed in our experiments and compare them against classical results for immiscible fluid displacement.

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Date submitted: 31 Jul 2020 Electronic form version 1.4