Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Fluctuations of wormlike micelle fluids in capillary flow[1] PAUL SALIPANTE, NIST - Natl Inst of Stds Tech , STEPHEN MEEK, Montgomery College, STEVEN HUDSON, NIST - Natl Inst of Stds Tech, POLYMERS AND COMPLEX FLUIDS GROUP TEAM — We investigate the effect of entrance geometry on the flow stability of wormlike micelles solutions in capillary flow. These solutions exhibit strong shear thinning behavior resulting from micelle breakage and have been observed to undergo large flow rate fluctuations. We investigate these fluctuations using simultaneous measurements of flow rate and pressure drop across a capillary, and we adjust entrance geometry. With a tapered constriction, we observe large persistent fluctuations above a critical flow rate, characterized by rapid decreases in the pressure drop with corresponding increase in flow rate followed by a period of recovery where pressure increases and flow rate decreases. Flow field observations in the tapered entrance show large flow circulations. An abrupt contraction produces smaller transient fluidized jets forming upstream of the constriction and the magnitude of the fluctuations are significantly diminished. The effect of fluid properties is studied by comparing the magnitude and timescales of the fluctuations for surfactant systems with different relaxation times. The onset of fluctuations is compared to a criterion for the onset of elastic instabilities and the magnitude is compared to estimates for changes in channel resistance.

[1]NIST on a Chip

Paul Salipante
NIST - Natl Inst of Stds
Tech

Date submitted: 01 Aug 2017 Electronic form version 1.4