Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Capillary threads and droplet-decorated streams in microchannels[1] SAMIRA DARVISHI, THOMAS CUBAUD, Stony Brook University — We investigate the evolution of high-viscosity fluid threads flowing in a sheath of immiscible liquid in a diverging/plane microchannel. A steady viscous-core annular flow is produced upstream in a square microchannel. Downstream, the fluids enter a diverging channel that causes the thread to bend and deform into a complex microstructure having a large interfacial area. Using a variety of fluids, we study the effect of interfacial tension, viscosities, and flow rates on the flow morphology and we characterize the evolution of the thread thickness, arc length, fold wavelength, and envelope amplitude in the plane and straight microchannel downstream from the divergence. In particular, we focus on the coalescence mechanism between adjacent folds that can produce small droplets embedded into a highly viscous matrix (i.e., "droplet-decorated" streams). Other original phenomena, such as capillary breakup by folding at high capillary numbers and secondary folding, are also examined.

[1]This work is supported by NSF (CBET-0932925).

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Date submitted: 05 Aug 2010 Electronic form version 1.4