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Observations of Tipstreaming and Thread Formation in a Microfluidic Flow Focusing Device SHELLEY ANNA, Carnegie Mellon University, HANS MAYER, Department of Mechanical Engineering, Carnegie Mellon University — We present a novel method of generating sub-micron scale droplets in a microfluidic device. In particular we utilize the interaction of fluid motion and surfactant transport during the tipstreaming mode of droplet formation, which is achieved using a flow focusing microfluidic design. Tipstreaming is a mode of drop breakup in which daughter droplets, usually orders of magnitude smaller than the parent drops, are ejected from the pointed tips of parent droplets or bubbles. An attractive characteristic of tipstreaming is that droplets produced are not limited by the device feature size. In this work we observe that tipstreaming occurs within a specific range of capillary number (Ca $\sim$ 0.1 to 1, consistent with literature values for tipstreaming), flow rate ratio, and surfactant concentration, and that tipstreaming is preceded by the formation of thin threads that follow the pinchoff of larger droplets. We measure the thread diameter and length as a function of dimensionless parameters and discuss our results with respect to surfactant diffusion and kinetic timescales relative to flow timescales.

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