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Generation of monodisperse particle-stabilized droplets with controlled particle loading at the interface ANTHONY KOTULA, Department of Chemical Engineering, Carnegie Mellon University, CHRISTOPHER NELSON, Department of Mechanical Engineering, Carnegie Mellon University, SHELLEY ANNA, Department of Chemical Engineering & Department of Mechanical Engineering, Carnegie Mellon University — Common high-shear methods of generating particle-stablized emulsions have no direct control over the rate of droplet generation, the final droplet size distribution, or the composition of the interface, all of which are important to the interfacial and bulk rheology. In this talk, we present a method that allows for independent control over the droplet size generated and the degree of particle loading on the interface. Droplets are formed on demand at a T-junction with a desired size via a pressure-controlled generation scheme, then travel along the axis of a circular capillary containing a surface-active particle suspension. We will model the surface coverage as a function of residence time, then use light scattering methods to assess the degree of depletion of particles from the bulk and thus verify our model for two different systems: air-in-water foams stabilized by silica nanoparticles, and water droplets stabilized by silica in a continuous phase of cyclohexane. Thus, we show that by controlling channel geometry, applied inlet pressures, and residence time, we can directly control droplet size, volume fraction, and particle loading on the bubble interface, all of which are critical parameters relevant to the stability and rheology of a particle-stabilized emulsion or foam.

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