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Phase dependent surfactant transport and micro-scale droplet coalescence in liquid-liquid systems YUN CHEN, SHWETA NARAYAN, CARI DUTCHER, University of Minnesota — Emulsions are ubiquitous in various applications such as oily bilgewater and water-entrained diesel fuel. The dispersed droplets in emulsions are often stabilized by surfactants and difficult to be separated due to the lowered interfacial tension (IFT) that inhibits the droplet coalescence. The thin film drainage time between two approaching droplets is used to quantify the droplet coalescence, which is affected by the IFT. Recent studies found different IFT decaying rate when the surfactant appears inside (dispersed) vs outside (continuous), or o/w vs w/o systems, which implies phase dependent surfactant transport to curved interfaces that leads to different film drainage behavior. In addition, the film drainage is also affected by the viscosity ratio between dispersed and continuous phases, and Marangoni stress. In this work, droplet coalescence will be investigated experimentally via microfluidic Stokes trap device to understand the impact of factors on the emulsion stability. Four systems are studied: o/w and w/o systems with oil-soluble surfactant in the oil phase or the same systems with water-soluble surfactants in the water-phase. The possibility of the droplet coalescence and, for coalescing systems, the film drainage time will be discussed.

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