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Effect of nanoparticle surfactants on the Plateau-Rayleigh instability. ANJU TOOR, Univ of California - Berkeley, THOMAS RUSSELL, University of Massachusetts Amherst, Lawrence Berkeley National Lab, BRETT HELMS, Lawrence Berkeley National Lab — Nanoparticle (NP) surfactant systems consists of nanoparticles dispersed in one liquid, and polymers with a complementary functionality dispersed in another immiscible fluid. Particles and polymers interact at a liquid-liquid interface to form NP surfactants. These surfactants could enable the generation of structured fluids using microfluidic methods based on Plateau and Rayleigh instabilities. We have investigated the interfacial tension of an aqueous dispersion of carboxylated Silica nanoparticles suspended in a toluene solution of amine-terminated Polydimethylsiloxane. The interfacial tension undergoes significant reduction due to the formation of NP surfactants. The effect of NP surfactants on the breakup of a laminar water jet in oil phase is investigated. As the aqueous suspension of nanoparticles is drawn from an orifice into a solution of amine-terminated polymer, NP surfactants will form at the oil-water interface. Experiments with water-oil systems with and without NP surfactants have been performed, varying fluid flow rate, jet diameter, and NP surfactant concentration. NP surfactants were found to significantly affect the breakup of laminar liquid jets resulting in longer jet breakup lengths and dripping to jetting phase transitions.

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