Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Experimental analysis of supercritical CO_2 assisted atomization

SHADI SHARIATNIA, DORRIN JARRAHBASHI, Texas AM University — Dissolution of supercritical fluids in liquids introduces gas bubbles upon depressurization due to injection and the expansion and burst of these bubbles facilitate the atomization. We experimentally study the atomization behavior of water with dissolved CO_2 above its critical pressure and temperature injected into ambient condition. To elucidate the effects of gas solubility, interfacial tension and injection parameters on the promotion of dissolved supercritical fluid atomization, we repeat the experiments with injection of water and dissolved N_2. High-speed imaging and laser diffraction are used to understand the effects of flow parameters: injection pressure, temperature, gas-to-liquid ratio and axial distance from the injector on jet breakup and droplet sizes. The CO_2 atomized droplets are smaller and distributed over a narrow span compared to that of N_2. Two combined phenomena explain the enhanced atomization of water-CO_2: the solubility of N_2 in water above its supercritical condition is substantially lower than CO_2 and the interfacial tension of CO_2-water is much lower compared to N_2-water at the same condition. A novel predictive model of droplet sizes is developed for a wide range of flow conditions.

Shadi Shariatnia
Texas A
M University

Date submitted: 10 Aug 2020 Electronic form version 1.4