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Spray Atomization Using Bubbles Generated by a Two-Phase Counterflow Mixing Layer. ALISON HOXIE, ERIC JOHNSON, VINOD SRINIVASAN, PETER ROHRBACH, SUO YANG, KRISHNA BAVANDLA, HONGYUAN ZHANG, University of Minnesota — In this study, we employ the well-established phenomenon of the onset of global modes and concomitant rapid breakdown of certain shear layer configurations to design an efficient two-fluid mixer. Low-density jets and countercurrent mixing layers exhibit strong global modes and elevated turbulence levels, leading to rapid mixing, which is relatively insensitive to the viscosity-mediated mean shear stresses. By arranging a liquid and an atomizing gas (air) to satisfy the requirements for the onset of global modes, we are able to demonstrate efficient atomization. It is hypothesized that the observed droplet diameter is proportional to the diameter of bubbles that are created in a two-phase mixing layer inside the atomizer, which depends on the wavelength of the unstable global mode. The droplet data are shown to be relatively insensitive to viscosity. To partially test the hypothesis, Direct Numerical Simulations (DNS) are carried out using Eulerian-Eulerian Volume of Fluid (VOF) approach. Gas and liquid are considered as compressible fluids with perfect gas and perfect fluid equations of state, respectively. Schiller Naumann interphase drag model is used to capture the dynamics of gas bubbles in liquid, and surface tension is considered.

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