Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The effect of droplet internal circulation on droplet vaporization YUSHU LIN, PALMORE JOHN, Virginia Tech — The current study investigates the effect of droplet internal circulation on droplet vaporization by using direct numerical simulations. Classical models neglect this effect due to assumptions of quiescent environment and spherical symmetry. However, in applications like gas turbine engines, the density ratio of the droplet to the air is not as great as that in atmospheric conditions. In such conditions, the classical assumptions are invalidated, and changes in droplet vaporization characteristics can be significant. To reveal the relation between vaporization and internal circulation, we will examine the vaporization of a single droplet falling at its terminal velocity. Parameters relevant to internal circulation in both atmospheric and engine conditions will be investigated, by varying the density and the viscosity ratios. In addition, Weber numbers ranged from 0 to 12 will be investigated, which includes the full range of droplet shapes from spheres to the critical point of breakup. Reynolds numbers less than 100 will be examined, which cover the range of flows from fully attached flow to the onset of unsteady vortex shedding. An in-house code developed for DNS of vaporizing multiphase flows will be employed for the computation.

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Date submitted: 30 Jul 2020 Electronic form version 1.4