Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Polydisperse Droplet Size Growth in a Turbulent Air Flow - Effects of Droplet Number Density and Size SHYAM KUMAR M, PhD Scholar, Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai 600036, India, S.R CHAKRAVARTHY, MANIKANDAN MATHUR, Professor, Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai 600036, India — Interaction of polydisperse droplets in a turbulent air flow features prominently in a wide range of phenomena. Here, we present an experimental study on the collective effects of droplet number density (ND) and mean droplet size (D_{10}) on the droplet size growth. For each (ND, D_{10}), we observe an optimum turbulent intensity and a corresponding maximum droplet size growth rate R^*. Interestingly, an increase (decrease) in $ND(D_{10})$ doesn't influence R^* up to some threshold values of ND and D_{10}, beyond which a sudden increase in R^* is observed. The observed trend is understood in terms of droplet pair dispersion, as observed from Long Distance Microscopy images. The dispersion of droplet pairs is negligible till the threshold conditions are reached. Surprisingly, a substantial increase in dispersion is observed beyond the threshold values, which potentially increases the collision probability, and hence R^*. The opposing effects of ND and D_{10} on collision rates cause a negligible variation of R^* up to the threshold values; however, the effect of ND overrides the effect of D_{10} beyond the threshold values, and hence causes a sudden increase in R^*.

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Date submitted: 05 Aug 2019 Electronic form version 1.4