Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Dimensionless groups and regime maps in atomization by gas jetting on bubbles on a liquid surface[1] MAKSIM MEZHERICHER, HOWARD STONE, Princeton University — In our recent work we presented a novel liquid atomization process capable of generating aerosols of submicron-diameter droplets for various liquids, including pure solvents, suspensions and solutions with wide ranges of viscosity and surface tension. The atomization process is based on disintegration by gas micro-jets of thin liquid films formed as bubbles on a liquid surface. In our previous work we demonstrated that the new atomization process is governed by several nondimensional groups including three dimensionless numbers that were not described before in the literature. Here we investigate the interpretation of our results in terms of the dimensionless parameters. We show that the diameters of the droplets are governed by the interplay of process timescales including capillary Rayleigh breakup, liquid viscosity and gas jet pressure, and those timescale ratios can be converted into ratios of specific energies provided by the gas jets and dissipated by the atomized liquid. We also demonstrate that a flow rate of droplets of a given diameter is governed by the ratios of energy rates corresponding to the above timescales. Finally, we develop two regime maps for prediction of the droplet diameters and flow rate of droplets in the new process.

[1]This work was partially supported by New Jersey Health Foundation

Maksim Mezhericher
Princeton University

Date submitted: 02 Aug 2020 Electronic form version 1.4