Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Vortex traps to capture particles with reduced pressure loss in respiratory masks.[1] CHUN-I CHUNG, University of Illinois at Urbana-Champaign, JISOO YUK, Cornell University, ASHLEY JORGENSEN, SAIKAT BASU, South Dakota State University, SUNGHWAN JUNG, Cornell University, LEONARDO CHAMORRO, University of Illinois at Urbana-Champaign — With the rapid spread of the Coronavirus Disease 2019 (COVID-19) worldwide, highly-protective respirator masks play an important role in mitigating the likelihood of contagion and spreading. A central challenge on the design of effective masks is the capture of sufficiently small droplets with reduced pressure loss penalty. Using vortex traps with convoluted geometries or tortuous passages (passive strategy) and thermophoresis action (active strategy), we designed a series of mask filters that aim to enhance particle trapping requiring a relatively low-pressure gradient. Here, we will describe laboratory experiments on the passive strategy with selected filter geometries at various Reynolds and Stokes numbers. Three-dimensional Particle tracking velocimetry was used to characterize the Lagrangian dynamics of a large number of particles with different sizes in the vicinity of the filters, which was linked to the pressure gradient across the tortuous passages. We will also point out results from simulations and fundamental insights from the characterization of animal nasal cavities.

[1]Supported by NSF RAPID Grant 2028090

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Date submitted: 09 Aug 2020 Electronic form version 1.4