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**Production of ultra-small ink jet drops using drop-on-demand (DOD) drop formation** HAIJING GAO, Purdue University, QI XU, BP PLC, MICHAEL HARRIS, OSMAN BASARAN, Purdue University — The formation of drops having radii that are smaller than the radii of the nozzle from which they are ejected is an active area of research in drop-on-demand (DOD) ink jet printing. In the last decade, Chen and Basaran (Phys Fluids, 2002; US patent, 2003) showed experimentally and computationally that several fold reduction in drop radius R (an order of magnitude reduction in drop volume V) is possible by judicious use of waveform modulation in which one or more intrinsic time scales such as capillary time, time for vorticity diffusion, and time for piezo actuation are varied. In this paper, we report the results of a computational study through which we have uncovered a novel method for achieving a factor of 5-10 reduction in R (about two to three orders of magnitude reduction in V). Scaling arguments are also developed which yield a simple expression for the size of the ultra-small drops formed as a function of the governing dimensionless groups. Formation of such small drops using DOD technology may prove especially attractive in applications involving direct printing of flexible electronics and solar cells.

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