Abstract Submitted
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Nozzle flow characterization and motion of entrained bubble in industrial inkjet printer[1] YOGESH JETHANI, Physics of Fluids Group, University of Twente, Netherlands, ROGER JEURISSEN, Department of Applied Physics, Eindhoven University of Technology, Netherlands, MARC VAN DEN BERG, YOURI DE LOORE, HANS REINTEN, HERMAN WIJSHOFF, Canon Production Printing Netherlands B.V., Netherlands, DETLEF LOHSE, MICHEL VERSLUIS, TIM SEGERS, Physics of Fluids Group, University of Twente, Netherlands — Piezo-acoustic inkjet printing allows highly controlled deposition of droplets at picoliter volumes. However, sometimes jet stability is compromised by the entrainment of a bubble, which has been shown to occur in conjunction with dirt particle trapping in the printhead, in the vortex ring above the oscillating meniscus (Fraters et al. Phys. Rev. Appl. 12(6) 2019). In this experimental and numerical study, we explore the destabilizing conditions of the flow inside the ink channel that lead to the diffusive growth of the entrained bubble and thereby to complete nozzle failure. We model the unsteady flow inside the channel using a Helmholtz oscillator model for the driving channel acoustics coupled with Navier-Stokes equations for the flow which we validate through time-resolved fluorescent particle tracking velocimetry measurements. Furthermore, bubble dynamics and translation are modeled using the Rayleigh-Plesset equation coupled to a point-particle force balance. We study the flow, particle trapping, and bubble motion for different nozzle geometries and driving conditions, revealing pathways of bubble entrainment and growth, thereby enabling identification and quantification of parameters that ultimately influence the inherent stability of the jetting process.

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