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In-air microfluidics: Drop and jet coalescence enables rapid multi-phase 3D printing CLAAS WILLEM VISSER, University of Twente and Harvard University, TOM KAMPERMAN, DETLEF LOHSE, MARCEL KARPERIEN, University of Twente, UNIVERSITY OF TWENTE COLLABORATION —
For the first time, we connect and integrate the fields of microfluidics and additive manufacturing, by presenting a unifying technology that we call In-air microfluidics (IAMF). We impact two liquid jets or a jet and a droplet train while flying in-air, and control their coalescence and solidification. This approach enables producing monodisperse emulsions, particles, and fibers with controlled shape and size (10 to 300 m) and production rates 100x higher than droplet microfluidics. A single device is sufficient to process a variety of materials, and to produce different particle or fiber shapes, in marked contrast to current microfluidic devices or printers. In-air microfluidics also enables rapid deposition onto substrates, for example to form 3D printed (bio)materials which are partly-liquid but still shape-stable.

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