Formation of microdroplets from liquid jets

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The formation of small droplets with a well-controlled and narrow size-distribution is an important issue in a variety of industrial applications, e.g. for ink jet printing, or for the formation of medical inhaler microsprays. We use a one-dimensional approximation of the Navier-Stokes equation to study the formation of microdroplets from liquid jets[1, 2]. Above a critical velocity a stable laminar jet emanates from a nozzle. The jet rises to a certain length, and then breaks up into droplets. Droplet formation in the Rayleigh breakup regime – where the breakup is not influenced by the surrounding air – is characterized by a linear relation between the breakup length and jetting velocity. Instabilities govern, and therefore strongly influence, the controllability and reproducibility of the formation process. Here, ultra high-speed imaging at 1,000,000 frames per second is used to visualize the breakup of a 10μm liquid jet and to validate the model. We provide experimental material that supports the validity of a universal scaling law for diminutive Rayleigh jets.

References

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