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Droplet generation at the critical Weber number LAURENT TANGUY, University of Freiburg - IMTEK - Department of Microsystems Engineering, DONG LIANG, HSG-IMIT, ROLAND ZENGERLE, PETER KOLTAY, University of Freiburg - IMTEK - Department of Microsystems Engineering — The ejection of liquid droplets from a nozzle is highly important for physics of fluid. The Weber number describes how much kinetic energy is needed to overcome the surface tension and create a free-flying droplet. According to literature Weber numbers above 12 assure the creation and safe break up of a liquid droplet. However, even when this number goes down below 8, it is still possible to observe droplet break-up but with particular effects. We present here experimental results and CFD simulations for droplet break-up at low Weber number where the droplet is generated with negative kinetic energy. Such droplet generation is characterized by the droplet breaking up and then returning back into the nozzle. This is due to the fact that during the droplet formation the surface tension begins to slow down the flow velocity inside the droplet and then finally inverts the flow direction, while the droplet tail still breaks off from the nozzle. Thus after the break up the droplet momentum is oriented toward the nozzle. It is therefore possible to observe the droplet returning into the bulk fluid. High-speed images of this particular phenomenon are shown and simulation results are presented to illustrate the break up dynamics and the local velocities in the droplet.

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