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Impact, Rebound, and Deflection of High-Velocity Continuous Droplet Streams PAUL CHIAROT, JOHN DONOVAN, WILLIAM DOAK, State University of New York at Binghamton — Continuous ink jet (CIJ) systems generate streams of droplets ~30 μm in diameter at rates of up to 350 kHz and velocities in excess of 20 m/s. Diverse applications can benefit from this technology; however, reliable manipulation of the jet, including droplet steering and basic on/off control, remains difficult to achieve. We report a novel strategy to manipulate the trajectory of high-velocity CIJ droplet streams using the dielectrophoretic (DEP) force. Droplet rebound at shallow angles is a key feature of this strategy. Therefore, high-velocity droplet impact with hydrophobic and superhydrophobic surfaces was investigated. Rebound from the hydrophobic surface was governed by the Weber number and impact angle. For the superhydrophobic surface, two distinct operating regimes describe the response of the reflected droplet stream. In the first regime, the droplets remain discrete and uniform after the impact, but exhibit significant deformation and oscillation. In the second regime, the droplets coalesce into a puddle at the surface. The droplet spacing of the incoming stream determines which regime rules; with the critical value a function of the Weber number. In the first regime, an accounting of the kinetic and potential energies reveals that neither droplet oscillation nor rotation can fully account for the loss of translational kinetic energy. This suggests that significant internal circulation must occur in the droplets at impact. A simple dynamic model predicts the trajectory of the droplet streams modified by the DEP force. This work is in collaboration with Dr. Thomas Jones at the University of Rochester.

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