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Droplet propulsion on a superhydrophilic wire induced by coalescence. ALLISON O'DONNELL, YOUHUA JIANG, KYOO-CHUL PARK, Northwestern University — Prior research has reported that droplets can jump from both superhydrophobic flat surfaces and hydrophobic cylindrical wires upon coalescence. As the surface area of droplets reduces after coalescence, released surface energy transitions to kinetic energy, causing the droplet to jump. Our findings indicate that droplet propulsion induced by the same surface-to-kinetic energy transition also occurs on superhydrophilic wires. In this experiment, droplets are sequentially deposited on an inclined superhydrophilic wire at a controlled rate. As the droplets wet the wire and flow downward, adjacent droplets may merge. In such cases, droplet speeds before and after coalescence are measured. This is repeated with droplets of differing viscosities and surface tensions and on wires of varying diameters. The results suggest that the ratio of increased kinetic energy to available surface energy is less than 4%. Additionally, it decreases as viscosity increases, surface tension decreases, and wire diameter increases. This trend can be attributed to the energy loss from viscous friction as droplets oscillate during coalescence. A scaling law is also provided to explain this trend. The phenomena reported in this study provide new insights into liquid transport on wires.

Allison O'Donnell
Northwestern University

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