ANOMALOUS DROPLET MOTION INSIDE SUPERHYDROPHOBIC CAPILLARIES

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Water droplets on extremely water repellent (lotus leaf like) surfaces are characterized by a high contact angle, as caused by a high surface roughness that supports an air layer between the solid and the liquid. This leads to low droplet friction and high droplet velocities inversely proportional to the droplet viscosity. Here we demonstrate that superhydrophobic surfaces also enable surprisingly slow velocities for liquid droplets inside a sealed superhydrophobic capillary. We report on a new counter-intuitive physical phenomenon in which the liquid droplet velocities increases with increasing liquid viscosity. We describe the physics underlying this interesting phenomenon by introducing the concept of air flow through the micrometer plastron. The fundamental understanding of our experimental system allows for promising applications in designing novel microfluidics devices, microfluidic reactors, and electricity-free fluid mixing devices.