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Motion of Droplets on Superhydrophobic Surfaces[1] ALEXANDER SMITH, Univ of Auckland, SHAUN HENDY, Te Punaha Matatini, KEONI MAHELONA, REBECCA SUTTON, MacDiarmid Institute of Advanced Materials and Nanotechnology — While the rolling motion of droplets on superhydrophobic (SHP) surfaces with conventional slip lengths has been investigated and observed experimentally, the existence of slip-dominated regimes on surfaces with high slip-lengths remains relatively unexplored. In this paper, we investigate the roles of droplet size and surface geometry on the average velocity of droplets travelling down SHP surfaces with molecular dynamics simulations, and compare with an extension of prior models of droplet motion on SHP surfaces, which assumes an effective slip condition at the SHP surface. This approach yields three limiting cases where the droplet velocity is dominated by viscous dissipation, surface friction or contact line friction respectively. We find a distinct size regime where the motion of small droplets is determined by frictional dissipation at the fluid-surface interface and the droplet velocity is proportional to the droplet radius. As droplet size increases beyond a slip-dependent threshold, we see the usual rolling state where droplet motion is dominated by viscous dissipation and the speed is inversely proportional to droplet radius. We also simulate the movement of droplets across a surface with a moving wettability gradient, and show that there exists a maximum velocity above which the droplet cannot keep up with the moving field.

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