Experimental Research on Interfacial Flow:
(1) Role of Interface Shape on Laminar Flow through Superhydrophobic Pillars
(2) Dynamics of a Flexible Superhydrophobic Surface during a Drop Impact

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ABSTRACT:

In this talk, the presenter will first introduce how shapes of an air-water interface on the superhydrophobic surfaces affect drag reduction. A novel microfluidic device was created to incorporate an array of superhydrophobic pillars. The shape of the air-water interface varied with static pressure changes in the channel. Slip along the interface on the superhydrophobic surface resulted in significant drag reduction. However, the variation in flow geometry due to changes in the bubble shape dominated the effects of the slip. Reducing the bubble size amplified drag reduction while increasing the bubble size reduced drag reduction and even led to drag enhancement.

As a second topic, the presenter will address the coupled dynamic response of flexible superhydrophobic surfaces during a drop impact. The study identified that the elastic superhydrophobic surface was deflected twice during contact of the droplet by an impact force of the droplet as well as its reaction force during recoil. The role of the droplet reaction force on the surface dynamics was also investigated further by changing the surface vibrating frequency and the drop impact velocity. As the drop impact velocity increased, the instability of the droplet rim diminished the influence of the droplet reaction force on the surface displacement. The timing of the droplet reaction force changed the magnitude of the surface displacement and manipulated the time of surface oscillation.

This research will help us to better understand both rigid and flexible superhydrophobic surfaces. Furthermore, they will give insight into how to optimize the design of superhydrophobic surfaces for drag reduction and droplet mobility.