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Textured superhydrophobic surfaces: Reducing contact time of an impinging drop

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Abstract content
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Discovery and understanding of novel mechanisms of drop repellence from hydrophobic and super-hydrophobic surfaces is of profound interest in many applications including self-cleaning, water resistance, anti-icing etc. The recent surge of interest on this topic [Bird et al., Nature 2013, Liu et al., Nature Physics 2014, Nature communications 2015, Schutzius et al., Nature 2015] has been predominantly experimental in nature. Apart from the demanding process of surface fabrication and coating, these investigations provide little insights into the associated flow phenomena (especially inside the droplet) mainly due to the hierarchy of scales involved in surface texture - from millimeter to sub-micron scale.

We present here an entropic lattice Boltzmann model for multiphase flows that is capable of qualitatively and quantitatively capturing the flow physics involved in such droplet wall interactions, especially in presence of complex surface texturing. Apart from thorough validation and analysis (including contact time, droplet shapes and energy budget analysis) of droplet wall interactions, we propose novel surface textures that are capable of reducing the contact time of the droplet with the surface. These novel surface structures are then validated with experiments thus demonstrating the predictive capabilities of the underlying simulation technique.

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