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MODELING OF WETTING AND DEWETTING PHENOMENA ON SMOOTH, ROUGH, AND PATTERNED SUBSTRATES

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ABSTRACT

Phenomena associated with the wetting/dewetting dynamics [1] have been actively studied for decades due to their presence in multiple important problems such as condensed water behavior on solid surfaces, inkjet printing, and oil/water transport in reservoirs, to name just a few. Once a gas-liquid interface comes into contact with a solid surface, depending on the physicochemical properties of the three-phase system, it tends to reach an equilibrium configuration. Upon the disturbance of this equilibrium configuration, a new configuration is attained either by further spreading of the liquid phase (wetting) or by further uncovering (dewetting) of the solid substrate. The hysteresis phenomenon [2] is rooted in the difference in the configurations observed during the wetting and dewetting processes, which are characterized by the advancing and receding contact angles, respectively. Thoroughly investigated via conducting deliberate experiments on spreading droplets and capillary flows, numerous empirical and theoretical models have been proposed that can successfully be fitted to the experimental observations. Theoretical models can be classified into two main categories; those focus at the molecular-scale, led by the molecular kinetic theory, and those developed at the continuum level, led by the hydrodynamic theory. The outcome of these two categories can also been combined to improve the modeling. Nonetheless, all the aspects of these phenomena are not yet completely revealed. In recent years, microscopic (molecular dynamic) simulations have provided a viable means to deepen our understanding of the underlying/fundamental physics. This mini-symposium is organized to convey the state-of-the-art outcome of the modeling approaches developed at the molecular-scale, continuum-level, or multi-scale.

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