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Effect of Microstructure and Wettability on Liquid Delivery in Structured Surfaces DIYUAN ZONG, Tsinghua University, ARIF ROKONI, Drexel University, YUANYUAN DUAN, Tsinghua University, YING SUN, Drexel University — Liquid delivery rate in structured surfaces contributes greatly to the enhancement in critical heat flux during boiling and thin film evaporation. In the present study, the effect of microstructure and wettability on the liquid delivery rate has been investigated using molecular dynamics (MD) simulations for droplet spreading on nanostructured surfaces and liquid infiltration in nanopores. The wicked volume flux, a measure of the liquid delivery rate during droplet spreading, is found to increase with Wenzel roughness ratio regardless of the microstructure and this finding is supported by existing experiments. In addition, the effects of long-range intermolecular interactions and external electric field on liquid delivery rate are investigated. Long-range intermolecular interaction has been found to have negligible effect on liquid delivery rate. Both the wicking length in droplet spreading and the infiltration length of liquid infiltration in nanopores scale with t^(1/2), consistent with the classic theory. The effects of the nanostructure depth, width-to-spacing ratio, wettability, and external electric field on the wicking coefficient have been studied and the results can be used to guide structured surface designs for enhanced liquid delivery.

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