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Droplet-Coupled Wicking in Nanochannels with Micropores[1] SAJAG POUDEL, AN ZOU, SHALABH MAROO, Syracuse University — Comprehending the dynamics of liquid spreading and subsequent evaporation on a nanostructured surface is key towards designing high heat flux dissipation devices. We performed experimental and numerical investigation of droplet-coupled wicking on a fabricated sample of cross-connected nanochannels (height ˜728 nm) having micropores (radius ˜1 m) at each intersection of channels. The overall phenomenon of droplet spreading is experimentally identified to have two distinct phases: (i) wicking dominant phase during which the liquid spread is governed by capillary pressure and viscous resistance and, (ii) evaporation dominant phase governed by thin-film evaporation from the menisci (*The J. of Phy. Chem. C*, *123*(38), 23529-23534). Computational fluid dynamics simulation of droplet wicking and evaporation is also performed on the nanochannels geometry (Langmuir, 36(27), 7801-7807) which helped estimate the spatial and temporal evaporation rate flux occurring at the menisci, as well as the wicking flux velocity and pressure gradient inside the nanochannels, thus quantifying key parameters of the evaporation dominant phase. This computational and experimental work provides a comprehensive understanding of droplet wicking mechanics and evaporation dynamics in such nanochannels.

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