Design of an Area-Scalable Two-Layer Evaporator Wick for High-Heat-Flux Vapor Chambers

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OBJECTIVE

Design a novel evaporator wick structure for vapor chambers to dissipate high fluxes (up to ~1 kW) over large heater areas (1 cm^2) during boiling.

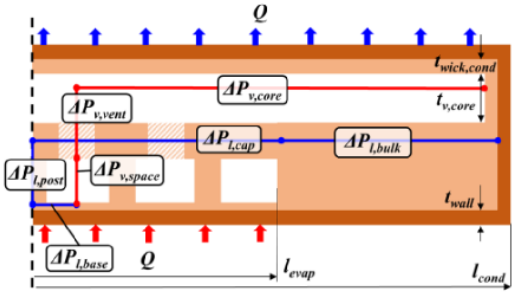
APPROACH

- Propose a hybrid two-layer wick design that separates liquid feeding from vapor escape. Use an array of vertical posts to feed liquid uniformly on the heater area, and vents to allow for preferential vapor removal.
- Develop an analytical model to calculate the pressure drops and thermal resistances in a vapor chamber with the two-layer wick at the evaporator.

PUBLICATION

S. Sudhakar, J.A. Weibel, S.V. Garimella, CPMT vol. 9, pp. 458-472, 2019.

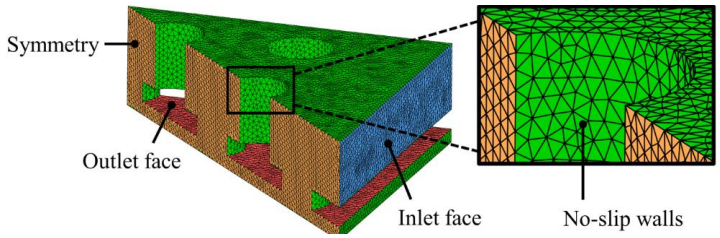
Pressure drop network



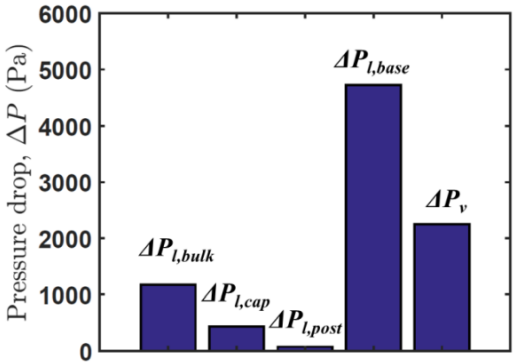
IMPACT

- Various parametric studies are conducted to identify parameters sensitive to the thermal performance of the wick.
- A design tool is developed to guide the fabrication of the wick for optimal thermal performance.

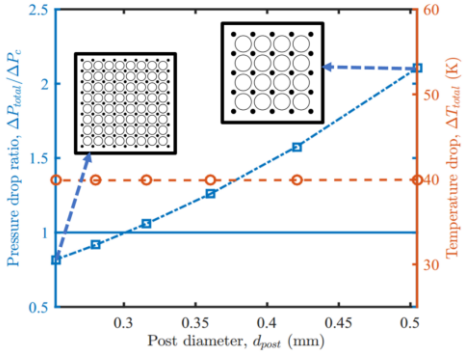
Fluid-flow simulation domain



Comparison of pressure drops



Effect of denser post arrays



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