Heat Pipe Dryout and Temperature Hysteresis in Response to Transient Heat Pulses Exceeding the Capillary Limit

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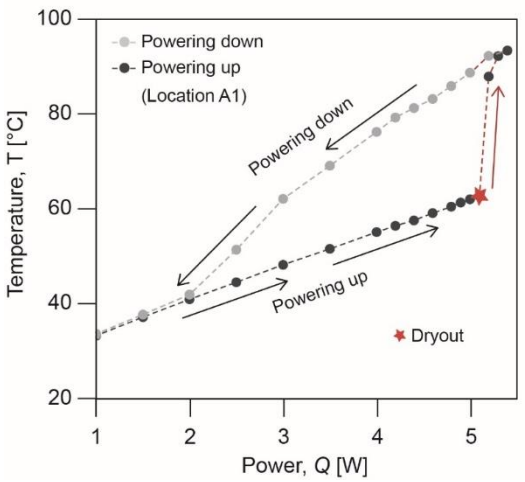
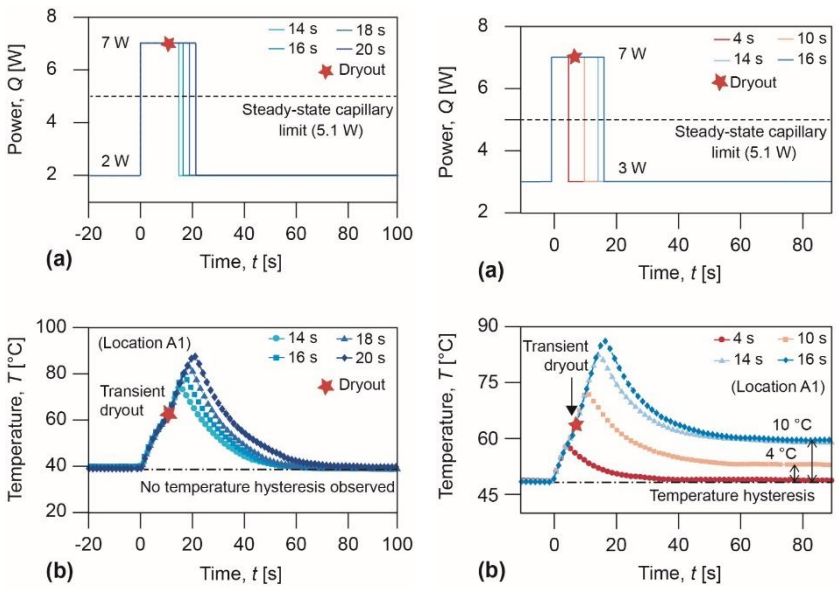
Objective

- Experimentally demonstrate the operation of a heat pipe above the capillary limit for brief time periods without the occurrence of dryout.
- Characterize the transient thermal response of a heat pipe to pulsed heat inputs higher than the capillary limit.



Maximum steady evaporator temperature during power up past the capillary limit, and then back down



Thermal response of heat pipe to pulsed heat input of increasing duration at two different steady-state baseline heat input levels

Publications

[1] K. Baraya, J.A. Weibel, and S.V. Garimella, "Experimental Demonstration of Heat Pipe Operation beyond the Capillary Limit during Brief Transient Heat Loads," ITherm 2019, Las Vegas, NV, USA: 2019.

[2] K. Baraya, J.A. Weibel, and S. V Garimella, "Heat Pipe Dryout and Temperature Hysteresis in Response to Transient Heat Pulses Exceeding the Capillary Limit," *IJHMT*, vol. 148, 2020, pp. 119135

Key Conclusions and Impact

1. A threshold time-to-dryout corresponding to the applied pulsed heat input is identified; pulse durations exceeding this time cause dryout.
2. Heat pipe operation longer than time-to-dryout at heat inputs higher than the capillary limit may lead to hysteresis in thermal response of the heat pipe.
3. A threshold heat load is identified that the heat pipe must drop below in order to fully recover performance after a dryout event.

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