Capillary-Driven Boiling Heat Transfer on Superwetting Microgrooves

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Figure S1. Laser trajectory

Figure S2. Capillary rise measurement system
Figure S3. Drawing of copper base of the flat heat pipe.

Figure S4. Photograph of the fabricated wicks in the flat heat pipe
Figure S5. Demonstration of 3D profiles of the microgrooves
Figure S6. The temperature distribution at the bottom of the heat pipe without wicks at the along-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 5 ℃ (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S7. The temperature distribution at the bottom of the inclined heat pipe without wicks at heating power of 50 W. The outlet of the thermostatic for the copper sink was 5 ℃ (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.
Figure S8. The temperature distribution at the bottom of the heat pipe without wicks at the anti-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 5 ℃ (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S9. The temperature distribution at the bottom of the heat pipe with 100 μm wide
and 120 μm deep microgroove wicks at the along-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 5 °C (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S10. The temperature distribution at the bottom of the inclined heat pipe with 100 μm wide and 120 μm deep microgroove wicks at heating power of 50 W. The outlet of the thermostatic for the copper sink was 5 °C (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.
Figure S11. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 120 μm deep microgroove wicks at the anti-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 5 °C (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S12. The temperature distribution at the bottom of the heat pipe without wicks and not filled at the anti-gravity working condition with different heating power input.
The outlet of the thermostatic for the copper sink was 5 °C (high cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S13. The temperature distribution at the bottom of the inclined heat pipe with 100 μm wide and 120 μm deep microgroove wicks at heating power of 70 W. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S14. The temperature distribution at the bottom of the inclined heat pipe with
100 μm wide and 120 μm deep microgroove wicks at heating power of 70 W. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 20%.

Figure S15. The temperature distribution at the bottom of the inclined heat pipe with 100 μm wide and 120 μm deep microgroove wicks at heating power of 70 W. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 40%.
Figure S16. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 60 μm deep microgroove wicks at the along-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S17. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 120 μm deep microgroove wicks at the along-gravity working condition with
different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S18. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 300 μm deep microgroove wicks at the along-gravity working condition with different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.
Figure S19. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 60 μm deep microgroove wicks at the horizontal working condition with different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S20. The temperature distribution at the bottom of the heat pipe with 100 μm
wide and 120 μm deep microgroove wicks at the horizontal working condition with different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

Figure S21. The temperature distribution at the bottom of the heat pipe with 100 μm wide and 300 μm deep microgroove wicks at the horizontal working condition with different heating power input. The outlet of the thermostatic for the copper sink was 20 °C (low cooling power) and the mass flow rate was 0.65 L·min⁻¹. The volume filling ratio is 10%.

**Movie Captions:**

Movie S1. Boiling and drying out at 300 heating power input.

Movie S2. Comparison of boiling between plain copper and microgroove wicks with 50 W heating power input at the inclination of 30°.

Movie S3. Boiling in the visualized flat heat pipe.

Movie S4. Comparison of boiling between plain copper and microgroove wicks with
50 W heating power input at the along-gravity working condition.