Effect of inclination angle and subcooling on nucleate boiling and critical heat flux of HFE-7100

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Motivation:

Measure heat dissipation from 10x10 mm chip immersed in HFE-7100 (θ = 0°, 30°,60°, 90°, 120°, 150°, and 180°, ΔT_{sub} = 0 , 10, 20, 30 K)

Contributions/Important Results:

- Correlated saturation q''_{NB} data as function θ.
- Correlated CHF data as function θ and ΔT_{sub}.
- Captured images of pool boiling at θ and ΔT_{sub}
- Determined av. D_d = 0.55± 0.07 mm at 100 Hz
- CHF increased with ΔT_{sub}, to ~ 36 W/cm^2, but decreased with θ to 4.45 W/cm^2 at 180° and sat.
- CHF ~ 36 W/cm^2 @ ΔT_{sub} = 30 K vs 24.45 at sat.

Applications:

- Immersion cooling of high performance chips

6.6 W/cm^2, ΔT_{sat}=19 K
ΔT_{Sub} = 0

3.7 W/cm^2, ΔT_{sat}= 18 K
ΔT_{Sub} = 0

10..5 W/cm^2, ΔT_{sat}=18 K
ΔT_{Sub} = 30 K

14 W/cm^2, ΔT_{sat}= 20 K
ΔT_{Sub} = 0

7.2 W/cm^2, ΔT_{sat}=18 K
ΔT_{Sub} = 0

5.4 W/cm^2, ΔT_{sat}= 6.4 K
ΔT_{Sub} = 30 K