

Visualization of Two-Phase Jet Impingement using Time-Resolved Stereo-PIV

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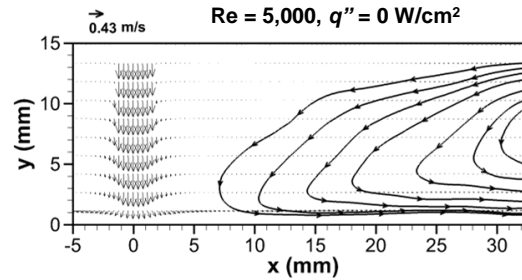
Objective

- Map the liquid flow patterns resulting from vapor motion during two-phase jet impingement cooling.
- Quantify the effect of this liquid motion on the resulting heat transfer.

Approach

- Use stereo-Particle Image Velocimetry to measure liquid velocities of jet impingement cooling with and without boiling

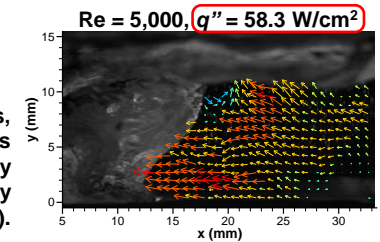
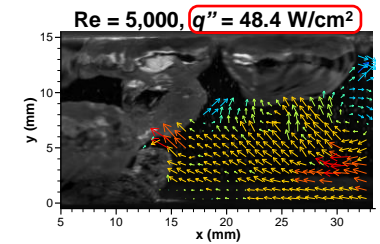
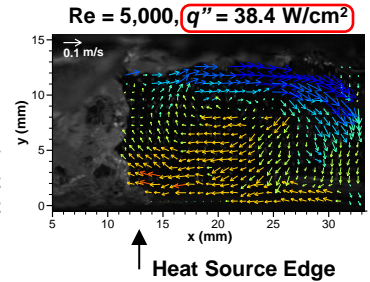
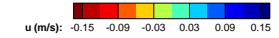
Single-Phase Flow



(LEFT) Liquid is entrained into the impinging jet and wall jet in single-phase flow

(RIGHT) As more bubbles form at higher heat fluxes, liquid is driven by vapor motion rather than jet entrainment

Two-Phase Flow



Impact

- Improved understanding of the flow in the confinement gap surrounding the boiling heater and its effect on heat transfer
- Design insight to prevent critical heat flux near the heater edge
- Targeted advancements to improve the cooling efficiency of two-phase jet impingement

As heat flux increases, liquid is drawn in towards the heat source (velocity vectors colored by horizontal velocity).

Selected Publications

- Rau, M. J., and Garimella, S. V., 2013, "Local Two-Phase Heat Transfer from Arrays of Confined and Submerged impinging jets," Int. J. Heat and Mass Transfer 67, 487-498.
- Rau, M. J., and Garimella, S.V., 2014, "Confined Jet Impingement with Boiling on a Variety of Enhanced Surfaces," J. Heat Transfer, 136(10), p. 101503.
- Rau, M. J., Dede, E. M., and Garimella, S. V., 2014, "Local Single- and Two-Phase Heat Transfer from an Impinging Cross-Shaped Jet," Int. J. Heat Mass Transfer, 79, pp. 432-436.

