

Bulletin of the American Physical Society

76th Annual Meeting of the Division of Fluid Dynamics Sunday–Tuesday, November 19–21, 2023; Washington, DC

Session L12: Bubble Growth, Heat Transfer and Boiling

8:00 AM–10:36 AM, Monday, November 20, 2023
Room: 143B

Chair: Mauro Rodriguez, Brown university

Abstract: L12.00002 : Dual-Tracer Laser-Induced Fluorescence Thermometry for Understanding Bubble Growth during Nucleate Boiling on Oriented Surfaces* 8:13 AM–8:26 AM

← Abstract →

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Nucleate boiling often occurs on surfaces oriented at different angles, and therefore understanding the behavior of bubble growth on various surface orientations is important. This work aims to accurately measure three-dimensional (3D), space- and time-resolved, local liquid temperature distributions surrounding a growing bubble that quantify the heat transfer from the liquid during bubble growth on angled surfaces. The dual tracer laser-induced fluorescence thermometry technique combines high-speed imaging to capture transient 2D temperature distributions within a 0.3 °C accuracy at a 30 µm resolution. Two fluorescent dyes, fluorescein and sulforhodamine B, emit temperature-sensitive emissions in the region of interest when excited by a laser light sheet. The results show that the temperature close to the heated surface and bubble interface exhibits a radical transient behavior at the time of departure, and the bubble works as a pump to remove heat from the surface with a peak temperature difference of up to 10 °C during bubble growth and departure. The experimental results are compared with data available in the literature to validate the accuracy of the technique. Lastly, the temperature information is used to quantify time-resolved heat fluxes contributing to mass transfer near the growing bubble.

*This work was financially supported by the National Science Foundation (#1917272).