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Session S01: Poster Session & Refreshment Break IV (3:22 - 4:10 p.m.)

3:22 PM, Monday, November 21, 2022

Room: Hall HI

Abstract: S01.00088 : Dual-Tracer Laser-Induced Fluorescence Thermometry for Understanding Bubble Growth during Nucleate Boiling*

[← Abstract →](#)

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Boiling heat transfer associated with bubble growth is perhaps one of the most efficient cooling methodologies due to its large latent heat during phase change. Despite significant enhancement of heat removal rates, numerous questions remain regarding the fundamentals of bubble growth mechanisms, a major source of enhanced heat dissipation. This work aims to accurately measure three-dimensional (3D), space- and time-resolved, local liquid temperature distributions surrounding a growing bubble that help better explain the heat transfer to bubble growth. An artificial cavity of in diameter is fabricated on a rectangular-shape heat sink as nucleate sites. The dual tracer laser-induced fluorescence (LIF) thermometry technique is combined with a high-speed imaging method to capture transient temperature distributions of the single bubble. This technique successfully provides fluid temperatures with unprecedented accuracy at micrometer resolution. It measures two-dimensional (2D) bulk fluid temperature fields within 0.3 °C at a 30 μm resolution. Two temperature-sensitive fluorescent dyes, Fluorescein (FL) and Sulforhodamine B (SRB) are used as temperature indicators in the LIF technique to have an accurate measurement. A laser light sheet scanned across the entire measurement volume excites the fluorescent dye, and an optical system involving a color beam splitter gives the intensity distribution of the individual fluorescent dyes on a high-speed camera. The temperature data is used to quantify time-resolved heat fluxes contributing to mass transfer near the growing bubble.

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