Quantitative Visualization of Vapor Bubble Growth in Diabatic Vapor-Liquid Microchannel Slug Flow

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**Objective**

Demonstrate the ability to generate archetypal diabatic microchannel slug flow and perform quantitative characterization of vapor bubble dynamics using a novel experimental test facility.

**Impact**

This novel experimental facility can ultimately be used to provide benchmark experimental data of diabatic microchannel slug flow, which is not currently available in the literature, enabling numerical flow boiling models to be validated.

**Approach**

- Vapor and liquid are independently injected into a T-junction, creating a diabatic microchannel slug flow.
- A uniform heat flux is applied using an electrically conductive, optically transparent ITO layer on the microchannel.
- High-speed quantitative visualization was performed to determine the percentage change in each vapor bubble length.

**Selected Results**

Selected images at 0.002 s increments for (a) $q'' = 0.68 \text{ W/cm}^2$ and (b) $q'' = 0.92 \text{ W/cm}^2$

Selected images showing the nose of the vapor bubble positioned at the first ($x_1$) and second ($x_2$) measurement locations at respective time instances $t_1$ and $t_2$.

Percentage change in each vapor bubble length and a box plot illustrating the variation at each heat flux.

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[Selected Publication]