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A Bubble Reconstruction Method for Two-Phase Microchannel Flows EVELYN WANG, SHANKAR DEVASENATHIPATHY, HAO LIN, CARLOS HIDROVO, JUAN SANTIAGO, KENNETH GOODSON, THOMAS KENNY, Stanford University, STANFORD UNIVERSITY COLLABORATION — Understanding bubble dynamics is critical to the design of two-phase microchannel heat sinks. This work presents a hybrid experimental and computational methodology that reconstructs 3D bubble geometry, and that provides other important information associated with nucleating bubbles in microchannels. The reconstruction methodology combines experimental measurements with micron-resolution particle image velocimetry (uPIV) and numerical simulations with FEMLAB. Heating power was applied to the microchannel and bubbles formed via heterogeneous nucleation. 2D images and two-component liquid velocity fields during bubble growth were obtained using uPIV. The limited information from the measurements was combined with iterative numerical simulations to determine the 3D geometry of the bubble and corresponding flow field. Various trial 3D bubble shapes were used in the simulations to solve for the flow fields. By identifying the combination that yielded the best match between the computed flow field and uPIV data, a best approximating 3D geometry of the experimentally captured bubble was determined. The methodology developed to reconstruct bubble geometry and the 3D flow field provides insight to modeling bubble dynamics in microchannels.

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