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Lattice Boltzmann Simulation of a Vapor Bubble in a 2D Microchannel MICHAEL IKEDA, LAURA SCHAEFER, University of Pittsburgh

— As energy densities in electronic devices rapidly increase, improved two-phase microchannel heat exchanger designs are of great interest. However, a better understanding of flow boiling in these regimes is needed. Experimental studies have thus far shown a great deal of variety in the flow patterns and instabilities that develop at the microscale level. Thus, numerical techniques capable of simulating such conditions are desirable. To this end, the behavior of a vapor bubble in a 2D microchannel is numerically analyzed. The kinetic lattice Boltzmann method is used over traditional CFD approaches due to its ability to capture the interfacial dynamics of multi-phase flow without the need for interface tracking algorithms. The single- component, multi-phase Shan-Chen model is utilized in conjunction with the passive scalar thermal approach, whereby the temperature field is passively advected by the hydrodynamics of the system. Advanced equations of state are implemented for the reduction of spurious currents and the recovery of realistic temperatures. The bubble dynamics are analyzed with varying Reynolds numbers and thermal boundary conditions.

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