Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Effect of Non-Uniform Circumferential Heat Fluxes and Orientation on Microchannel Flow Boiling – A Numerical Investigation MARIUS VERMAAK, MOHAMMAD MOGHIMI, JOSUA MEYER, University of Pretoria, KHELLIL SEFIANE, PRASHANT VALLURI, University of Edinburgh — Flow boiling in microchannels exhibits incredibly high heat transfer characteristics, which could be revolutionary for multiple industries. However, the underlying physical phenomena that cause these characteristics are not well understood, especially the 3D effects of flow boiling in non-circular channels and the influence of confinement on bubbles. In this study, single bubble growth is considered in a high aspect ratio microchannel, hydraulic diameter 909 μm and aspect ratio 10, at varying gravitational orientations with only 1 face heated. While common microchannel theory neglects gravitational effects, at large aspect ratios gravity affects the hydrothermal characteristics of the flow. In particular, if microchannels are rotated along the axial direction. Bubble behavior after nucleation and its effect on heat transfer is investigated until slug formation. This investigation found that the heat transfer characteristics of the bottom heated case are the highest. In addition, the thermofluidic interaction between two sequential slugs moving down a microchannel is also presented. The results of this study have been validated against past numerical and current experimental work, some of which is being performed at the University of Edinburgh.

Jarryd Potgieter
University of Pretoria

Date submitted: 31 Oct 2019 Electronic form version 1.4