Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Flow Boiling in a Horizontal Microchannel with high Aspect Ratio for Non-Uniform (One-Sided) Heating at Different Rotational Orientations[1] MARIUS VERMAAK, JACO DIRKER, University of Pretoria, KHELLIL SEFIANE, DANIEL OREJON, PRASHANT VALLURI, University of Edinburgh, JOSUA MEYER, University of Pretoria, UNIVERSITY OF PRETORIA TEAM, UNIVERSITY OF EDINBURGH COLLABORATION — Flow boiling of FC72 in a semi-rectangular horizontal microchannel with one-sided heating, was investigated experimentally. Microchannel rotational orientations from bottom-heating (0) to top-heating (180), in 30increments were considered. Mass fluxes of 10, 20 and 40 kg/m^{2}s, paired with various heat fluxes which spanned from the onset of nucleate boiling to near dry out conditions, were tested in a borosilicate glass channel of 5x0.5mm internal cross-section. Ohmic resistive heating was obtained via a layer of tantalum oxide that was applied to only one of the outer surfaces of the microchannel. This optically transparent layer allowed for both transient surface temperature mapping and flow visualization. During quasi steady state average and local heat transfer coefficients as well as pressure drop were analyzed. Our results show that bottom-heating produced average heat transfer coefficients at least 17% higher than top-heating. Flow boiling instabilities are promoted at greater wall super-heats, especially in rotations between top-heating and side-heating. The effect of inclination on flow boiling in such microchannels will also be presented.

[1]ThermaSMART Project

Marius Vermaak
University of Pretoria

Date submitted: 30 Jul 2019 Electronic form version 1.4