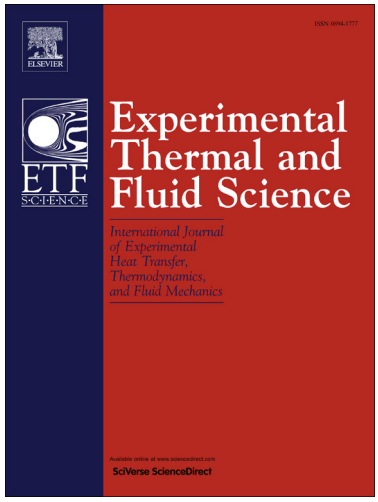

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PII: S0894-1777(14)00143-5
DOI: http://dx.doi.org/10.1016/j.expthermflusci.2014.06.002
Reference: ETF 8238

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 19 March 2014
Revised Date: 28 May 2014
Accepted Date: 1 June 2014

Please cite this article as: W-C. Liu, C-Y. Yang, Two-Phase Flow Visualization and Heat Transfer Performance of Convective Boiling in Micro Heat Exchangers, *Experimental Thermal and Fluid Science* (2014), doi: http://dx.doi.org/10.1016/j.expthermflusci.2014.06.002

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ABSTRACT

Attributed to its high heat transfer coefficient, evaporating cooling involving the use of micro heat exchangers is considered a possible thermal management solution for cooling of high heat flux electronic devices. The desire to develop high-performance micro heat exchangers operating in the evaporation regime provides a major motivation for the present work. Flow boiling heat transfer in a micro heat exchanger with straight and chevron flow passages were tested in the present study. The boiling flow pattern was also observed for further understanding of the heat transfer mechanisms. The test results show that the heat transfer coefficient increased with increasing flow rate in both chevron and straight flow passages micro heat exchangers. But the effect of heat flux on the heat transfer coefficient in the straight passages heat exchanger is in adverse to that in the chevron passages heat exchanger. The heat transfer coefficient increased with increasing heat flux in the chevron passages heat exchanger but decreased in the straight passages heat exchanger. The flow visualization through transparent cover heat exchangers shows that partial dryout happened in the straight passages heat exchanger at the lowest heating rate condition. This caused a poor heat transfer area and significantly degraded the overall heat transfer performance. The partial dryout area ratio and time fraction increased with increasing heat flux and therefore the heat transfer coefficients decreased with increasing heating rate. For flow boiling in chevron passages heat exchanger, liquid film was dragged at the intersection corner between the upper and lower plate chevron passages by the surface tension force and supplement liquid flowed back into the heating surface from other chevron passages. No partial dryout was observed and therefore, the heat transfer performance test results followed the trend of conventional correlations.