Accepted Manuscript

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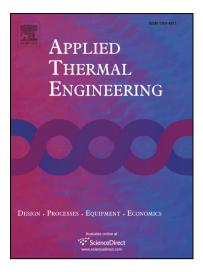
PII: S1359-4311(17)31809-4

DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.07.044

Reference: ATE 10711

To appear in: Applied Thermal Engineering

Received Date: 17 March 2017 Revised Date: 21 June 2017 Accepted Date: 4 July 2017



Please cite this article as: Y. Sun, G. Chen, S. Zhang, Y. Tang, J. Zeng, W. Yuan, Pool boiling performance and bubble dynamics on microgrooved surfaces with reentrant cavities, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.07.044

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CCEPTED MANUSCRIPT

Pool boiling performance and bubble dynamics on microgrooved

surfaces with reentrant cavities

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Abstract

Microgrooved surfaces with reentrant cavities (MSRCs) were fabricated on pure copper substrates by employing the orthogonal Ploughing/Extrusion (P/E) method.

The pool boiling heat transfer characteristics of this enhanced structure at different

liquid subcooling degrees were investigated with deionized water as the working fluid

at atmospheric pressure. The results indicated that the MSRCs had a higher heat

transfer coefficient (HTC) than the smooth copper sheet (SCS) at any liquid

subcooling. In addition, the wall superheat at the onset of nucleate boiling (ONB) for

the MSRC was lower. Studies on the visualization of bubble growth process were also

conducted with a high-speed digital camera, which showed that there were two kinds

of bubbles on the MSRC surface depending on the different locations of nucleation

sites. i.e., in the reentrant cavities and in micro-grooves. The departure diameter of

bubbles that nucleated in the grooves increased with increasing heat flux for q_a <

465.58 kW/m² and then started decreasing sharply. However, heat flux had little

influence on the departure diameter of bubbles growing in the reentrant cavities.

Increasing the liquid subcooling temperature reduced the bubble departure diameter

while increased the HTC.

Key words: pool boiling; heat transfer; bubble growth; micro groove; reentrant cavity

1

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