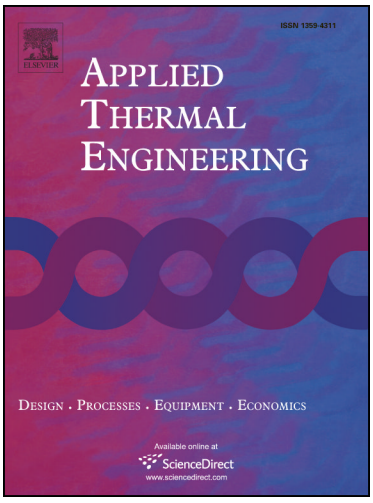

Pool boiling performance and bubble dynamics on microgrooved surfaces with reentrant cavities

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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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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/m^2 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