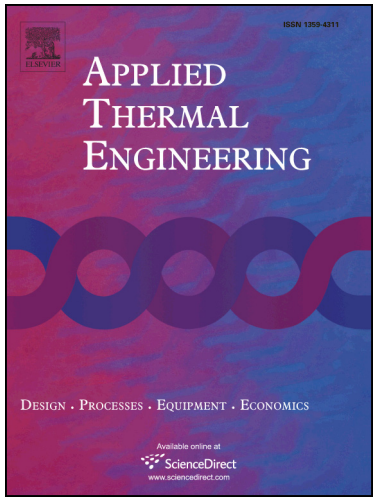

Comparative experimental study on pool boiling performance of porous coating and solid structures with reentrant channels

Daxiang Deng, Wei Wan, Junyuan Feng, Qingsong Huang, Yu Qin, Yanlin Xie

PII: S1359-4311(16)31086-9
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.06.172
Reference: ATE 8583

To appear in: *Applied Thermal Engineering*

Received Date: 3 February 2016
Revised Date: 24 May 2016
Accepted Date: 26 June 2016

Please cite this article as: D. Deng, W. Wan, J. Feng, Q. Huang, Y. Qin, Y. Xie, Comparative experimental study on pool boiling performance of porous coating and solid structures with reentrant channels, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.06.172

Comparative experimental study on pool boiling performance of porous coating and solid structures with reentrant channels

Daxiang Deng[1,2*],Wei Wan[1], Junyuan Feng[3], Qingsong Huang[1], Yu Qin[1], Yanlin Xie[1]

[1]*Department of Mechanical & Electrical Engineering, Xiamen University, Xiamen, 361005, China*

[2]*State Key Laboratory of Fluid Power and Mechatronic Systems (Zhejiang University), Hangzhou 310027, China*

[3]*Key Laboratory of Surface Functional Structure Manufacturing of Guangdong High Education Institutes, School of Mechanical and Automotive Engineering, South China University of Technology, Guangzhou 510640, China*

Abstract:

Pool boiling heat transfer in a porous coating with reentrant channels was experimentally studied together with the comparison of a solid sample with the same reentrant configurations. The porous coating was totally constructed by sintered copper powder, and featured 12 parallel Ω-shaped reentrant channels. Pool boiling tests were conducted using two coolants (deionized water and ethanol) in different liquid subcoolings at atmospheric pressure. The boiling heat transfer performance was systematically examined and compared together with the high-speed visualization observations. Experimental results revealed that the porous coating introduced a great decrease in wall superheat at the onset of nucleate boiling (ONB), and a significant enhancement in boiling heat transfer at low to moderate heat fluxes compared to its solid counterpart. The porous coating promoted the boiling nucleation significantly by increasing the nucleation sites and hindering early condensation of vapor embryos. Liquid replenishment through the horizontal reentrant channels and efficient surface rewetting were maintained even at high heat fluxes. Moreover, the effects of liquid subcooling on the boiling heat transfer performance of both porous and solid sample were also assessed.

Key words: pool boiling; porous coating; reentrant channels; bubble nucleation

* Corresponding author. Tel./fax: +86 592 2186383.
E-mail address: dxdeng@xmu.edu.cn (D.X. Deng).