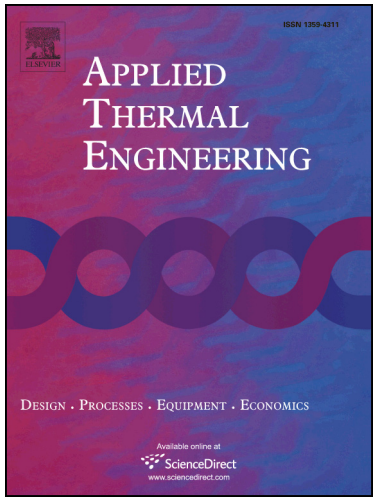

Research Paper

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PII: S1359-4311(16)33068-X
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.11.034
Reference: ATE 9444

To appear in: *Applied Thermal Engineering*

Received Date: 28 July 2016
Revised Date: 12 October 2016
Accepted Date: 5 November 2016

Please cite this article as: S. Zhang, F. Hao, H. Chen, W. Yuan, Y. Tang, X. Chen, Molecular dynamics simulation on explosive boiling of liquid argon film on copper nanochannels, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.11.034

Molecular dynamics simulation on explosive boiling of liquid argon film on copper nanochannels

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Abstract

Phase change from liquid to vapor of the working fluid has been widely used in thermal control for microelectronic devices. In this study, the effects of nanochannels on the explosive phase transition of ultrathin liquid argon film on the copper substrate in confined space are investigated through molecular dynamics simulation. The results show that nanochannels significantly facilitate the thermal energy transfer from solid copper surface to the liquid argon which leads to a much more violent explosive boiling than the plain surface. Liquid argon atoms adjacent to the solid surface are instantly overheated and consequently a cluster of liquid argon detaches from the surface once the explosive boiling occurs. The temperature of the liquid argon when it separates from the solid surface increases with respect to the increasing nanochannel heights, while the time for the system to reach equilibrium decreases distinctly. Furthermore, though continuous heat transfers to the liquid argon, a non-vaporized layer always exists near the bottom surface of the solid copper base with a stable number density of about 0.025 $1/Å^3$.

Key words: explosive boiling; nanochannels; molecular dynamics simulation; phase transition; liquid argon.