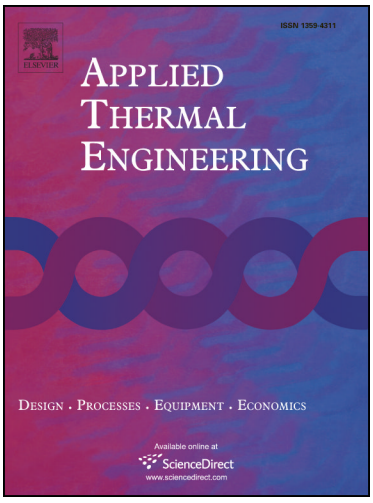

An experimental study of an anti-gravity vapor chamber with a tree-shaped evaporator

Feng Yao, ShuangShuang Miao, Mengchen Zhang, Yongping Chen

PII: S1359-4311(18)30141-8
DOI: https://doi.org/10.1016/j.applthermaleng.2018.06.053
Reference: ATE 12324

To appear in: *Applied Thermal Engineering*

Received Date: 8 January 2018
Revised Date: 28 April 2018
Accepted Date: 18 June 2018

Please cite this article as: F. Yao, S. Miao, M. Zhang, Y. Chen, An experimental study of an anti-gravity vapor chamber with a tree-shaped evaporator, *Applied Thermal Engineering* (2018), doi: https://doi.org/10.1016/j.applthermaleng.2018.06.053

An experimental study of an anti-gravity vapor chamber with a tree-shaped evaporator

Feng Yao[a], ShuangShuang Miao[b], Mengchen Zhang[b], Yongping Chen[a,b,*]

[a] Jiangsu Key Laboratory of Micro and Nano Heat Fluid Flow Technology and Energy Application, School of Environmental Science and Engineering, Suzhou University of Science and Technology, Suzhou, Jiangsu 215009, PR China

[b] Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, Nanjing, Jiangsu 210096, PR China

Abstract: A new anti-gravity vapor chamber is proposed in this study in which a tree-shaped groove is configured on the evaporator's surface, and the formed cavity is embedded with hybrid mesh wick. The thermal performances of the anti-gravity vapor chamber with a tree-shaped evaporator surface are experimentally studied and compared with those elicited from a corresponding chamber with a smooth evaporator surface. The effects of the filling rate, cavity height, and wick structure on the heat transfer performance of the anti-gravity vapor chamber are examined and analyzed. The results indicate that the thermal performance of the anti-gravity vapor chamber is greatly improved by the combination of tree-shaped grooves and hybrid mesh wick. The introduction of mesh wick eliminates the wall temperature fluctuation of the evaporator in the vapor chamber. The tree-shaped groove induces vapor distributed flow and enhances the thermal performance of the anti-gravity vapor chamber. The thermal resistance of the vapor chamber decreases first and then increases with increases of the liquid filling rate. The optimum liquid filling rate is 60%. The thermal resistance of the anti-gravity vapor chamber decreases as the cavity height decreases. The vapor chamber with an 80/200 mesh hybrid wick facilitates the reversed motion of condensate backflow and vapor flow, thereby leading to better heat transfer performance as compared to the 80 and 200 mesh wicks.

Key words: vapor chamber; groove; anti-gravity; tree-shaped

* Corresponding author at: Jiangsu Key Laboratory of Micro and Nano Heat Fluid Flow Technology and Energy Application, School of Environmental Science and Engineering, Suzhou University of Science and Technology, Suzhou, Jiangsu 215009, PR China.

E-mail address: ypchen@mail.usts.edu.cn (Y. Chen).