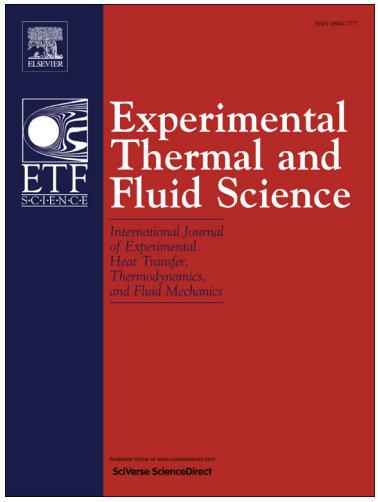

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PII: S0894-1777(15)00196-X
DOI: http://dx.doi.org/10.1016/j.expthermflusci.2015.07.019
Reference: ETF 8529

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 21 September 2014
Revised Date: 26 July 2015
Accepted Date: 26 July 2015

Please cite this article as: W. Duangthongsuk, S. Wongwises, A Comparison of the Heat Transfer Performance and Pressure Drop of Nanofluid-Cooled Heat Sinks with Different Miniature Pin Fin Configurations, *Experimental Thermal and Fluid Science* (2015), doi: http://dx.doi.org/10.1016/j.expthermflusci.2015.07.019

A Comparison of the Heat Transfer Performance and Pressure Drop of Nanofluid-Cooled Heat Sinks with Different Miniature Pin Fin Configurations

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Abstract

The paper reports an experimental investigation into the thermal performance and pressure-drop characteristics of nanofluid-cooled heat sinks and then compares the results with the data for water-cooled heat sinks. Heat sinks with miniature circular-fin (MCFHS) and square-fin (MSFHS) structures are used and made from aluminum material with dimensions of 28x33 mm. Similarly, SiO_2 nanoparticles dispersed in deionized water with particle concentrations of 0.2, 0.4, and 0.6% volume are used as working fluids. The effects of pin fin configuration, particle concentration, and flow rate on the heat transfer performance and flow behaviors are presented. Reynolds numbers based on the hydraulic diameter of each flow channel ranging between 700 and 3700, fluid temperature of 15 ^{o}C, and heat flux ranging from 2 and 5 W/cm^2 are tested. Hydraulic diameters based on each flow channel are equally designed at 1.2 mm for both heat sinks. The experimental results indicate that the heat transfer coefficient increased with increasing Reynolds numbers and particle concentrations. The MCFHS gave greater heat transfer performance than that of the MSFHS by about 6–9%. For pressure drop data, the measured data showed that the pin fin configuration and particle concentration had small effects on the pressure drop and pumping power.