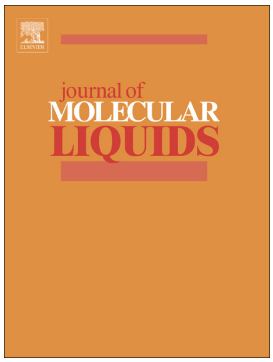

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Numerical study of nanofluids thermal and hydraulic characteristics considering Brownian motion effect in micro fin heat sink

Wenwen Guo,[a] Guoneng Li,[a] Youqu Zheng,[*,a] Cong Dong[a]

[a]Department of Energy and Environment System Engineering, Zhejiang University of Science and Technology, Hangzhou 310023, China

* Corresponding author: zyq888@zust.edu.cn

Abstract

The thermal and hydraulic performance in a micro fin heat sink (MFHS) with ZnO-water nanofluids is investigated numerically using the static and dynamic single phase model (i.e. SSPM and DSPM). For DSPM, both the Brownian motion effect on thermal conductivity and viscosity was taken into consideration. The model is established and validated by comparing with literatures. It is found that the DSPM results are higher than SSPM in heat transfer performance and pressure drop by taking the Brownian motion effect into account. With Re ranging from 85 to 595 the heat transfer coefficient of DPSM and SSPM at ZnO volume concentration (φ) of 3.0% are enhanced by 25.6-38.3% and 16.6-23.8% respectively. Particle size and volume concentration are both critical to the nanofluids heat transfer performance of MFHS. DSPM considering Brownian motion by utilize proper thermal conductivity and viscosity model, which is probably more appropriate for investigating the influence of nanofluids particle size. Nanofluids of higher volume concentration and lower particle size are in favor of higher efficiency of heat sink in certain condition. The overall heat transfer efficiency (γ) was also evaluated and the maximum of 34.9 was obtained at φ=3.0% and d_P=30nm using DSPM (γ_{water}=29.97).

Keywords: micro fin heat sink; nanofluids; Brownian motion; numerical study; particle size.