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Experimental Investigation and Optimization of Nanoparticle Mass Concentration and Heat Input of Loop Heat Pipe

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Abstract : This study presents experimental and optimization of nanoparticle mass concentration and heat input based on the total thermal resistance (Rth) of loop heat pipe (LHP), employed for PC-CPU cooling. In this study, silica nanoparticles (SiO2) in water with particle mass concentration ranged from 0% (pure water) to 1% is considered as the working fluid within the LHP. The experimental design and optimization is accomplished by the design of the experimental tool, Response Surface Methodology (RSM). The results show that the nanoparticle mass concentration and the heat input have a significant effect on the Rth of LHP. For a given heat input, the Rth is found to decrease with the increase of the nanoparticle mass concentration up to 0.5% and increased thereafter. It is also found that the Rth is decreased when the heat input is increased from 20W to 60W. The results are optimized with the objective of minimizing the Rt, using Design-Expert software, and the optimized nanoparticle mass concentration and heat input are 0.48% and 59.97W, respectively, the minimum thermal resistance being 2.66(ºC/W).

Keywords : loop heat pipe, nanofluid, optimization, thermal resistance
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