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Thermal Resistance and Pressure Drop Minimization for a Micro-gap Heat Sink with Internal Micro-fins by Parametric Optimization of Operating Conditions

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Abstract

In recent years, researchers are investigating several potential applications of two-phase flow in micro-gap heat sinks; electronic cooling is one of them. Further, internal micro-fins are used to enhance the heat transfer rate. However, the pressure drop penalty due to small gap height and fin surfaces is a major concern. Hence, minimization of thermal resistance and pressure drop is required. In this paper, effects of operating conditions , e.g., wall heat flux, pumping power, and inlet void fraction, on total thermal resistance and pressure drop in a micro-gap heat sink with internal micro-fins of rectangular and triangular profiles have been investigated by numerical analysis for the R-134a coolant. Furthermore, optimization of these parameters has been carried out by response surface methodology. Simulation results show that rectangular micro-fins show superior performance compared to triangular fins in reducing thermal resistance . Finally, for an optimum condition (7.1202×10^{-5} W pumping power, 1.2×107 Wm^{-2} heat flux, and 0.03 inlet void fraction), thermal resistance and pressure drop are reduced by 56.3% and 87.2%, respectively.

Author keywords

Pumping power; Thermal resistance ; Void fraction; Wall heat flux

SciVal Topics

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