Numerical Study of Microscale Heat Sinks Using Different Shapes and Fluids

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Abstract

NUMERICAL STUDY OF MICROSCALE HEAT SINKS USING DIFFERENT SHAPES & FLUIDS
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For more than a decade, investigations have been conducted to better understand the fluid flow and heat transfer characteristics in different microchannel heat sinks having microscale Heat Transfer & designed for applications in electronic cooling. These microchannel heat sinks combine the attributes of high material compatibility, high surface area per unit volume ratios and large potential heat transfer performance with highly sophisticated and economic fabrication Process using micro scale Heat Transfer. Their high heat transfer to volume ratio is another significant feature which makes them favourable over other solutions in same heat transfer removal range. The present study deals with different shapes of the microchannels (rectangular, trapezoidal etc) & different properties of the Liquid Coolants using certain custom liquids. Liquid cooling promises to be a more compact arrangement and its use has been reported recently for cooling the central processing unit of a large computing system. In the present experiment, different fluids like water, ethylene glycol & certain customised fluids having CNTs (carbon nano tubes) are used to increase the performance of the system in terms of high thermal conductivity & lower pumping power & their effect on different shapes considered has been noted down. Different parameters like heat flow rate, nusselt number, heat transfer coefficient, outlet temperature are studied with different flow rates and an optimal best range of flow rate for all the fluids separately by considering maximum heat flow rate, minimum base temperature and less pumping power has been considered. It was found out that there is a direct relationship between thermal resistance & pumping power using all the fluids & different shapes of the microchannel. It is also inferred that the heat sink having the smallest hydraulic diameter has better performance in terms of pressure drop and thermal Resistance. Trade off between thermal

resistance & pumping power was analyzed with the design variables and flow constraints.

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