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Topic of Research: **ANALYSIS OF HEAT TRANSFER PROCESS IN MICROCHANNEL HEAT SINK**

FINDINGS

Micro-sized channels in heat sinks are becoming more common as a result of efforts to improve thermal management in electronic devices. Over the last thirty years, such micro-dimensional conduits have attracted a lot of attention. Numerous previous research emphasised the inapplicability of conventional theories in these tiny dimensions, while more recent investigations came to the conclusion that differences among theoretical and experimental findings weren't caused by a change in the behaviour of the fluid, but instead it is due to the several effects that have been insignificant in regular-sized channels which are now turned out to be important in extremely small dimensions. Many researchers conducted numerical analysis and compared their findings with those of experiments, and discovered a strong correlation among them. This opened the door to investigate different types of fluid blending techniques that improve heat transmission in microchannel heat sinks. Exploring such mixing methods through experimental research is quite expensive. So, in this work numerical analysis is done. To improve heat transmission, numerous investigators have shifted their focus to examine the intricate design of the heat sink by adding different extended structures in the microchannel.

In order to carry out the analysis, research objectives were developed that are achieved by conducting three different studies which examine the impact of the varying height of pinfins, the effect of circular perforated pinfin and the influence of the number of perforations and their locations on the performance of microchannel heatsink respectively. The simulations have been performed by applying a constant uniform heat flux of 100 W/cm^2 at the heated base wall of the microchannel and incorporating deionized ultra-filtered water as a working fluid for the range of Reynold number 150 to 350.

In first study, a numerical analysis of a microchannel with the different configuration of varying height of pinfins entrenched at the bottom of the channel base wall has been carried out. Five different configurations of pinfins arrangement which are considered in this study are, Case 1(Full length fins in complete microchannel), Case 2(Full length fins at the upstream), Case 3(Full length fins at the downstream), Case 4(Full length fin at the center of micro-channel), Case 5(Full length fins at the inlet and exit of microchannel) and the results of these five cases are compared with the plain rectangular microchannel. Results reveals that the highest Nusselt number is achieved by case 2 at a lesser value of Reynold's number while by case 5 at higher Reynold's number and the lowest pressure drop is occurring in case 4. The overall thermal performance of case 2 dominate the corresponding cases.

In second study, a numerical analysis has been performed to observe the heat transfer and fluid flow characteristics of the perforated pinfin microchannel heat sink. Six equidistant cylindrical pinfins with circular perforation at the centre are entrenched at the base wall of the channel. This perforated pinfin can act as an extended surface and enhanced the heat transfer whereas the circular perforation may reduce the pressure drop and also influence the flow characteristics. The nondimensional diameter (α) of circular perforations considered in this study are 0.33, 0.5, 0.67 and 0.83. It is observed that the Nusselt number improves with the smallest perforation that is α=0.33 and decreases as the diameter of perforation increases however the maximum value of overall thermal performance is associated with the perforation size of 0.5.

In third study, a simulation has been performed to investigate the effect of circular perforated pinfins on the performance of microchannel heat sink by varying the number of holes and their locations on the pinfins. A total of ten configurations are considered in this work including a plain microchannel and a solid pinfin case. The results obtained indicate that the location, as well as the number of perforations, affects the heat transfer capacity and pressure drop that occurs in the microchannel. According to the present analysis Case 1 has the maximum Nusselt number followed by case 2 and 3 whereas the minimum pressure drop is achieved by case 8 among pinfin configurations. The highest performance factor is achieved by case 1 at a low Reynolds number while case 6 performs best at a higher Reynolds number.