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Entitled

HEAT TRANSFER ANALYSIS OF MICROCHANNELS HEAT SINK WITH SIDEWALL FINS

by

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Abstract

This study aims to carry out model-based research to investigate microchannel heat sinks with side wall fins. The main objective of the project is to design and study the thermal performance of straight microchannel heat sinks with square and triangle-shaped fins on sidewalls. A mathematical model is developed and used to carry out the computational fluid dynamics (CFD) simulation-based study to examine the performance of the microchannel heat sink. The mathematical modeling is achieved by building a CAD model of the heat sink then the thermal analysis is done using the ANSYS Fluent software. From the CFD simulation study, numerical results are obtained for different operational and geometrical conditions. The study employed the Figure of Merit (FOM) approach to balance the advantages of thermal enhancement with the drawbacks of increased pressure drop. The results of this study demonstrate that reducing the size of fins leads to improved FOM values for both square and triangle designs. In square-shaped fin microchannels, FOM performance is enhanced by decreasing the spacing between fins, while in triangle-shaped fin microchannels, performance is improved by increasing the spacing between fins. Moreover, increasing channel size enhances FOM performance in both square and triangle-shaped fin microchannels. Additionally, reducing the spacing between channels enhances FOM performance in both designs. Importantly, square-shaped fin microchannels consistently outperformed triangle fin microchannels in all cases. These results highlight the importance of achieving a balance between thermal performance and pumping power in heat sink design.

Keywords: heat sink; straight microchannel; pin fins; pressure drop; thermal resistance.