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HEAT TRANSFER IN MICROCHANNEL COMPACT HEAT EXCHANGER

by

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Abstract

This study aims to investigate heat transfer in a microchannel heat exchanger. The main objective of the study is to develop and build a high-performance heat exchanger for thermal management in various processing applications. This research is carried out using experimental- and model-based investigation. This work conceptualizes compact microchannel heat exchangers (MCHX) model, and studies its effectiveness by validating the developed mathematical model experimentally. The proposed design of the MCHX is to use microtubes containing microchannels in the heat exchanger to improve heat transfer. The microchannel heat exchanger is investigated with single-phase fluid (water, air). The obtained experimental results show improvement of heat transfer coefficients in the heat exchanger with increasing Reynolds number. Compact microchannel heat exchanger is fabricated to perform experiments and obtain results. The effectiveness of the compact microchannel heat exchanger increased with increasing Reynolds number. The results demonstrate that a parallel microchannel heat exchanger achieves an experimental effectiveness of 60%, a significantly higher value than the conventional heat exchanger effectiveness of 40-50%. This finding in this study demonstrates that microchannel heat exchangers are more effective and better in performance than conventional heat exchangers, and LMTD and effectiveness method are sufficient enough to design microchannel heat exchanger. The theoretical modeling study and experimental investigation provide heat transfer results that are useful in understanding enhanced heat transfer and are valuable to the heat transfer research field. Microchannel heat exchangers have been demonstrated to have greater merits than traditional heat exchangers making them ideal for numerous thermal and energy applications.

Keywords: heat exchanger; microchannel; effectiveness.