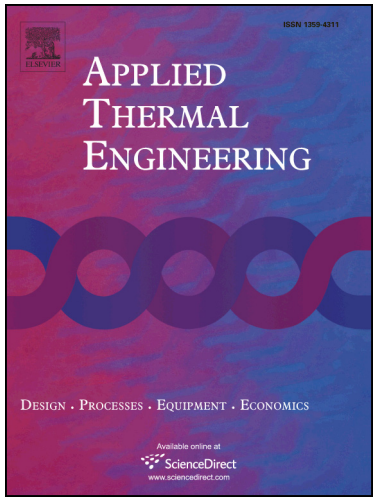

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Numerical investigation on laminar flow and heat transfer in rectangular microchannel heat sink with wire coil inserts

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ABSTRACT

A numerical investigation is carried out to study the laminar liquid flow and coupled heat transfer performance in rectangular microchannel heat sink (MCHS) equipped with wire coil inserts. Distilled water with temperature-dependent thermophysical properties is employed to perform this simulation. The effect of the length and arrangement of wire coil inserts on flow and heat transfer characteristics, and the mechanism of heat transfer enhancement in wire coil inserted MCHSs were analyzed using the first and second law of thermodynamic. This study is also to propose the frication factor and heat transfer correlations for MCHSs with wire coils are developed. The results show that the heat transfer performance in the MCHS is enhanced effectively due to the longitudinal vortexes caused by the wire coils, but the flow resistance is increased simultaneously. The MCHS with long wire coil placed at the center line of microchannel shows the best heat transfer performance with enhancement factor of 1.4-1.8 at a heat flux 400 kW/m^2. Its overall performance is the best among five configurations using the principle of entropy generation minimization, but using the performance evaluation criteria (PEC), the best performance is only limited to the low Reynolds number. The best overall performance using PEC at the high Reynolds is the MCHS with three segments of short wire coils placed at the center line of microchannel.

Key words: microchannel; wire coil inserts; heat transfer enhancement; entropy generation; performance evaluation

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