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Determination of Forced Convection Heat Transfer Performance in Lattice Geometric Heat Sinks

Authors : Bayram Sahin, Baris Gezdirici, Murat Ceylan, Ibrahim Ates

Abstract : In this experimental study, the effects of heat transfer and flow characteristics on lattice geometric heat sinks, where high rates of heat removal are required, were investigated. The design parameters were Reynolds number, the height of heat sink (H), horizontal (Sy) and vertical (Sx) distances between heat sinks. In the experiments, the Reynolds number ranged from 4000 to 20000; heat sink heights were (H) 20 mm and 40 mm; the distances (Sy) between the heat sinks in the flow direction were45 mm, 32 mm, 23.3 mm; the distances (Sx) between the heat sinks perpendicular to the flow direction were selected to be 23.3 mm, 12.5 mm and 6 mm. A total of 90 experiments were conducted and the maximum Nusselt number and minimum friction coefficient were targeted. Experimental results have shown that heat sinks in lattice geometry have a significant effect on heat transfer enhancement. Under the different experimental conditions, the highest increase in Nusselt number was 283% while the lowest increase was calculated as 66% as compared with the straight channel results. The lowest increase in the friction factor was also obtained as 173% according to the straight channel results. It is seen that the increase in heat sink height and flow velocity increased the level of turbulence in the channel, leading to higher Nusselt number and friction factor values.

Keywords : forced convection, heat transfer enhancement, lattice geometric heat sinks, pressure drop
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