Effects of tip clearance in flow and local heat transfer in a microchannel with a pin fin were experimentally and numerically studied. A 150-µm diameter pin fin with tip clearances of 0, 30, 45 and 100 ?µm were made from SU8 in a 200 µm height microchannel. Several experiments with these tip clearances for three different Reynolds numbers in laminar region were conducted. Nusselt numbers associated with local temperatures along the centerline of the channel were presented and investigated. Micro resistance temperature detectors (RTDs) were employed on top of the heater surface downstream the pin fin to measure the local temperatures. A solid/fluid conduction and convection simulation using a conjugate CFD model was carried out to show velocity and heat counters over the heated area.

Results showed that incorporating a certain tip clearance resulted in a significant enhancement in heat transfer at the wake region. The numerical simulations of the flow and heat transfer revealed that tip clearance alters the flow structure by increasing three dimensionality and mixing of flow, shortening the wake region and increasing the velocities in the pin fin downstream. A tip clearance with half height of the channel showed the best heat transfer enhancement. For a microchannel with array of pin fins with tip clearance, an experimental study carried out with the tip clearance of 0 and 100 ?µm in a 200-µm high microchannel. Results revealed that introducing tip clearance in pin array can double Nusselt number compared to full height array of pin fins.

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The public is welcome to attend.