With the dramatic increase in the usage of compact, yet more powerful, electronic devices, advanced cooling technologies are required to maintain delicate electronic components below their maximum allowable temperatures and prevent them from failure. One solution is to use innovative pin-finned heat sinks. This research is centered on the evaluation of hydrodynamic cavitation properties downstream pin fins and extended toward single-phase heat transfer enhancement of array of pin fins in microchannel.

In this work, transparent micro-devices capable of local wall temperature measurements were micro fabricated and studied. Various experimental methods, numerical modeling and advanced data processing techniques are presented. Careful study over cavitation phenomena and heat transfer measurement downstream pin fins were performed. Hydrodynamic cavitation downstream a range of micro pillar geometries entrenched in a microchannel were studied. Three modes of cavitation inception were observed and key parameters of cavitation processes, such as cavity length and angle of attachment, were compared among various micro pillar geometries. Cavity angle of attachments were predominantly related to the shape of the micro pillar. Fast Fourier transformation (FFT) analysis of the cavity image intensity revealed transverse cavity shedding frequencies in various geometries and provided an estimation for vortex shedding frequencies.

Experimental and numerical heat transfer studies over array of pin fins were carried out to reveal the influence of lateral interactions of fluid flow on the enhancement of heat transfer. Local temperature measurements combined with conjugate fluid flow and heat transfer modeling revealed the underlying heat transfer mechanisms over pin fin arrays.

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The public is welcome to attend.