# Numerical Investigation on Heat Transfer Enhancement in Microchannels Through Micro-orifice Induced Cavitation

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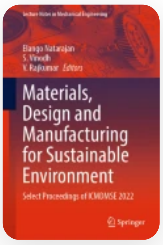


**Materials, Design and Manufacturing for Sustainable Environment**

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## Abstract

Miniaturization of electronic components has laid more emphasis on thermal management of such components for their effective working. Microchannel based liquid cooling techniques have shown good promise in achieving the above objective and micro-orifice induced cavitation phenomenon has aided in improving its efficiency. The present study focusses on numerically proving the enhancement of heat transfer in micro-orifice ($R = 0.325$) entrenched microchannel in comparison with straight microchannel and also investigates the heat transfer coefficient variation with orifice size. A microchannel with hydraulic diameter of 500 μm was used for the analyses and it was found that cavitation occurs only after Reynolds number (Re) = 2500. The inlet flow velocity was varied from 4.25 to 4.76 m/s. The convective heat transfer coefficient ($h$) was compared with that of straight channel and the percentage increase of the same was found to be 5.28% at 4.25 m/s and 15.69% at 4.76 m/s. In addition, the heat transfer coefficient for different orifice radii 0.325, 0.330 and 0.335 mm were compared. It was found that the heat transfer coefficient increased with the decrease in orifice area because of the reduction in the base temperature of the channel as we reduce the orifice size. It is found that the minimum pressure drop required to initiate the cavitation in the microchannel, with the orifice of radius 0.325 mm is around 230 kPa. With increase in inlet velocity, heat transfer is enhanced along with increase in pressure drop, which ultimately increases the pumping power.