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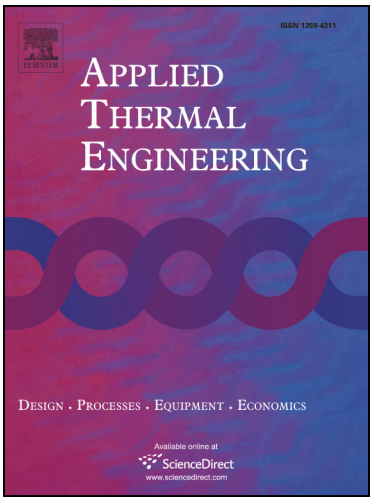


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# Comparative Study of Pool Boiling Heat Transfer from Various Microchannel Geometries

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## ABSTRACT

This paper presents the experimental investigation of pool boiling heat transfer enhancement using open microchannels. Rectangular, parabolic and stepped microchannels are fabricated on the 10 mm diameter circular copper test piece and their boiling characteristics are compared with that of the plain surface at saturated condition of distilled water. The effect of channel shape and geometrical parameter on the boiling heat transfer is studied. The channel top width and channel base width are varied from 250 µm to 500 µm and 500 µm to 800 µm, respectively. The fin tip thickness is varied from 200 µm to 500 µm. The channel height is fixed at 500 µm. The morphology of bubble is observed by using high-speed camera. Compound study of bubble departure diameter and bubble frequency has proved the significant performance of parabolic and stepped microchannel. All the microchannel geometries enhanced the heat transfer rate. The modification of rectangular channel into parabolic and stepped microchannel resulted in the maximum of 88% and 169% enhancement, respectively at 11.7°C wall superheat. At heat flux of 100 kW/m$^2$, the heat transfer coefficient increased by 21.49-35.37 % for different microchannels. The incipient temperature reduced by 13.72-23.18 %. A semi-analytical model is developed to estimate the bubble departure diameter of the microchannel which predicts the present experimental data with mean absolute error of 5.58 %.

**Keywords:** Open microchannel, Heat transfer enhancement, Bubble departure diameter, Bubble frequency, Incipient Temperature

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