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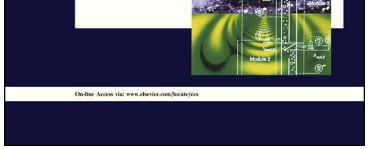

Multiphase Fluid Flow and Heat transfer Characteristics in Microchannels

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Abstract

The boiling flow or condensation is widely encountered in many industrial applications for both cooling as well as heating processes. Compact heat transfer devices, such as micro- heat exchangers and evaporators, are extensively used for both cooling as well as heating processes over conventional heat exchangers, such as microelectronic circuits, automobile and aerospace industries, due to high surface area to volume ratio and heat transfer rates, compactness and easy thermal control. For better design of micro– or mini– heat exchangers, a detailed specific knowledge of the multiphase flow and its properties such as the flow pattern during flow boiling, critical heat flux (CHF) and stable operation are very important. This paper provides a state of art review on boiling flow in microchannels since year 2000 till date. Flow patterns formed and the parameters influencing flow pattern transitions, during multiphase heat transfer in micro– or mini– channels, have been reviewed in detail. The flow regimes and flow pattern maps, and modeling approaches considered for boiling flow in micro–channels/devices with various challenges have been discussed. A lot of contradiction between the experimental data has been observed for the analysis of flow regimes and flow pattern maps. Further, the effect of hydrodynamics during flow boiling and CHF on heat transfer coefficient has been discussed in detail. Recently, with the advancement in measurement techniques, the heat transfer measurement technologies have been synchronized with the visualization techniques, which helped in understanding the boiling flow physics in micro- and mini- channels. Therefore, an in-depth understanding of flow patterns and regimes under boiling flow conditions in mini- and micro- channels can be used to predict the boiling heat transfer mechanism, which can be further used for developing better heat transfer models for boiling flow. Further, enhancement in heat

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