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FLUID FLOW AND HEAT TRANSFER WITH PHASE CHANGE IN MINICHANNELS AND MICROCHANNELS

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Abstract

Heat pipe and microchannel heat sink are the high performance heat transmission devices with an extremely high thermal conductivity which strongly depends on two phase flow heat transfer. The regularities of capillary hydrodynamics and heat transfer during flow boiling, evaporation and condensation in the minichannels and microchannels with rectangular cross section, resulting from the experimental and theoretical studies, were discussed in this paper. The patterns of the two-phase gas-liquid flow and capillarity induced liquid flow distribution along the channel perimeter are presented for different channel orientations. The influence of forced convection, nucleate boiling and thin film evaporation on microscale flow boiling heat transfer in minichannels and microchannels is reviewed and analyzed based on the experimental data. The evaporative and condensing heat transfer model for the curved liquid microfilm in microchannels and rivulet flow on a hot surface is developed and discussed. New methods for calculating of the heat transfer with flow boiling and condensation, including the phenomena of nucleate boiling suppression and heat transfer enhancement during evaporation of extremely thin liquid film, were presented.