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CRITICAL HEAT FLUX ENHANCEMENT OF POOL BOILING USING HONEYCOMB POROUS PLATE WITH TWO-LAYER STRUCTURE

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Abstract

The critical heat flux (CHF) during saturated pool boiling of water was investigated experimentally using a honeycomb porous plate attached to a heated surface. In a previous study, the CHF was shown experimentally to be enhanced to more than twice that for a plain surface. According to the proposed capillary limit model, the CHF can be increased by decreasing the thickness of the honeycomb porous plate. However, the CHF could not be greatly enhanced when the thickness of the honeycomb porous plate was comparable to the thickness of the thin liquid film (the macro-layer thickness) formed beneath coalescent vapor bubbles. The results of the previous study showed that honeycomb porous plates for CHF enhancement in saturated pool boiling should be constructed by the superposition of two kinds of porous materials and that each of the honeycomb porous plates must fulfill two conditions. First, a honeycomb porous plate simply attached to a heated surface should have very fine pores to supply water to the heated surface due to strong capillary action, and the honeycomb porous plates should be as thin as possible to decrease the pressure drop caused by internal water flow. Second, the other honeycomb porous plate, stacked on top of the thin honeycomb porous plate, needs to be structured to hold a sufficient amount of water in order to prevent the inside of the honeycomb porous plate from drying out during the bubble hovering period on the plate.