

عنوان مقاله:

Experimental Study for Investigating the Mechanism of Heat Transfer Near the Critical Heat Flux in Nucleate Pool Boiling

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خلاصه مقاله:

The regime of nucleate pool boiling near critical heat flux (60-98% of CHF) is known as vapor mushroom regime. Understanding the mechanism of heat transfer in regime of vapor mushroom of nucleate pool boiling is not only helpful to explain high rate heat transfer, but also useful to explain boiling crisis phenomenon. In this paper, an experimental setup is designed and fabricated to study the mechanism of heat transfer from boiling surface to bulk liquid near critical heat flux (vapor mushroom regime). In addition, vapor mass frequency and thickness of macro-layer are measured at various heat fluxes in this regime of boiling. The experimental study reveals that individual bubbles coalesce due to very high bubble site density and form vapor mass entrapping a relatively thicker film of liquid known as 'macro-layer' between the growing vapor mass and the heating surface of pool boiling near the high heat flux region. The rate of evaporation of macro-layer and transient conduction through macro-layer is the prime parameter to transfer heat from the heated surface. The thickness of the macro-layer is found to be lying in the range of 153- 88 μm , respectively, for range of 60-98% critical heat flux. As the heat flux increases, the thickness of macro-layer decreases. The vapor mass frequency varies from 4 to 8.80 Hz for water in the range of 60-98 % of critical heat flux. The vapor mass frequency increases as heat flux increases due to higher evaporation rate associated with higher heat flux. The data reported in this manuscript are more consistent as comparing to data available in the literature and these data are useful in modeling heat transfer in nucleate pool boiling near critical heat flux.

کلمات کلیدی:

Pool Boiling Nucleate , Macro-layer , Mashroom , Critical Heat Flux , Vapor Mass , Frequency

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