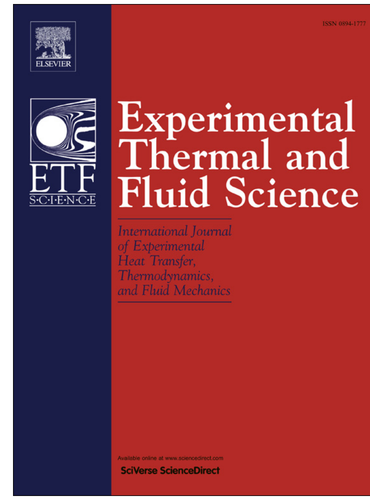

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Wall effect on heat transfer crisis

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Abstract

Various evaporation regimes were studied experimentally in a wide range of droplet sizes and wall temperatures at a change in thermal-physical and geometrical characteristics of the wall. With the increasing diameter of the wetting spot of a water sample from 1 to 30 mm, the width of the transition region of boiling crisis increases. Dynamics of large droplets boiling is determined not only by wall overheating, but also by the droplet shape. Evaporation of droplets on the surfaces, whose longitudinal dimensions are much larger than the droplet diameter, should take into account free convection of gas and thickness of diffusion boundary layer, which depends on the droplet diameter. Wall surface polishing causes a multiple increase in evaporation time within the transitional boiling region, in contrast to the rough wall. For $We \approx 0$ and polished surface of the wall, the time of evaporation and Leidenfrost temperature in the transitional boiling region increase many times, in contrast to the rough wall (for high *We* number the result is opposite). To assess the effect of wall thickness on the rate of evaporation, it is important to consider the ratio of the droplet diameter to the wall thickness, depth of solid wall cooling, ratio of wall thermal conductivity to conductivity of liquid, and values of dimensionless Bio (*Bi*) and Fourier (*Fo*) numbers.

Key words: droplets evaporation, heat flux, heat transfer crisis, Leidenfrost temperature, transitional boiling

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