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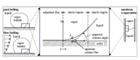
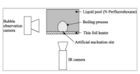
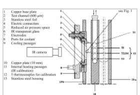
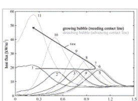
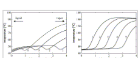
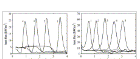
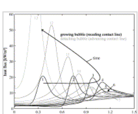
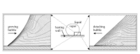
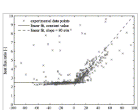
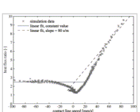
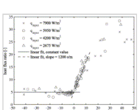

International Journal of Heat and Mass Transfer

Volume 55, Issues 7–8, March 2012, Pages 1896–1904

The effect of three-phase contact line speed on local evaporative heat transfer: Experimental and numerical investigations

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https://doi.org/10.1016/j.ijheatmasstransfer.2011.11.044

Abstract

In pool boiling or flow boiling devices or e.g. during meniscus evaporation within capillary structures the local heat flux and evaporation rate at the position where the liquid–vapor interface meets the solid wall can be extremely high. This three-phase contact line region is characterized by a thin liquid film with a very low heat resistance. Depending on the application the contact line can move with velocities of several meters per second, either in receding (dewetting) or in advancing (wetting) direction. In this paper, experimental and numerical results on the influence of three-phase contact line speed on the local heat transfer in the contact line region during pool boiling and during meniscus evaporation are presented and analyzed. It is shown that the local heat flux can be one or more orders of magnitude higher than the mean heat flux supplied to the system. This local heat transfer peak is almost independent of the contact line speed in the case of a receding contact line while it significantly increases with contact line speed for an advancing contact line. This behavior could be observed in different evaporation configurations and with different fluids. Experimental and numerical results agree well and allow a characterization of the transient heat transfer phenomena in the contact line region during evaporation.

Keywords

Evaporation; Boiling; Contact line

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