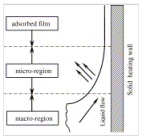
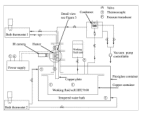
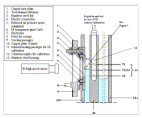
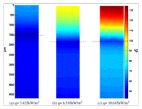
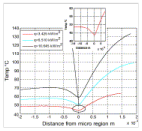
Figures and tables

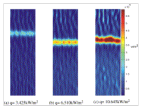












Experimental Thermal and Fluid Science

Volume 34, Issue 8, November 2010, Pages 1036–1041

Experimental investigation of evaporative heat transfer characteristics at the 3-phase contact line

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https://doi.org/10.1016/j.expthermflusci.2010.02.014

Abstract

An experimental study is conducted to investigate the local heat flow at a solid–liquid–vapor contact line. A vertical channel of 600 μm width is built using two parallel flat plates; a 10 μm thick stainless steel heating foil forms a part of one of the flat plates. A liquid–vapor meniscus is formed between the plates due to capillary forces. In this study the fluid HFE7100 is evaporated inside the channel under steady state conditions. Two-dimensional microscale temperature fields at the back side of the heating foil are observed with a infrared camera with a spatial resolution of 14.8 μm × 14.8 μm. An in situ calibration procedure is applied. The measured local wall temperature difference between the contact line area and the bulk liquid is up to 12 K. The liquid front undergoes a slow oscillatory motion which can be attributed to the instability of evaporating 3-phase contact line. The local heat fluxes from the heater to the evaporating meniscus are calculated from the measured wall temperatures using an energy balance for each pixel element. The local heat fluxes at the contact line area are found to be about 5.4–6.5 times higher than the mean input heat fluxes at the foil.

Keywords

3-Phase contact line; Meniscus; Micro-region; Heat transfer

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