Numerical Study of an Evaporating Meniscus on a Moving Heated Surface

Abhijit Mukherjee
e-mail: mukherje@mtu.edu

Satish G. Kandlikar
Thermal Analysis and Microfluidics Laboratory,
Department of Mechanical Engineering,
Rochester Institute of Technology,
Rochester, NY 14623

The present study is performed to numerically analyze an evaporating meniscus bounded between the advancing and receding interfaces on a moving heated surface. The numerical scheme developed for analyzing interface motion during bubble growth in pool boiling has been applied. A column of liquid is placed between a nozzle outlet and a moving wall, and calculations are done in two dimensions with a fixed distance between the nozzle and the wall. The results show that the wall velocity creates a circulation near the meniscus base, resulting in transient heat conduction. The local wall heat transfer is found to vary significantly along the meniscus base, the highest being near the advancing contact line. The heat transfer coefficient is found to depend on the advancing contact angle and wall velocity but is independent of the wall superheat. Reasonable agreement is observed when the meniscus profile and heat transfer results obtained from the numerical simulation are compared to the experimental data.