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Characterization of the microscopic mechanics in falling film evaporation outside a horizontal tube

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ABSTRACT

In order to get a deep insight of the heat transfer mechanism of falling film evaporation outside a horizontal tube, the characterization of the microscopic mechanics was numerically investigated. A numerical model was developed to obtain the dynamic and heat transfer performance including film thickness, film velocity, film temperature and local heat transfer coefficient. The simulated results were found to be in a good agreement with the reported data. The results show that the convection plays an important role in the thin film evaporation even at low Reynolds number through the analysis on the profiles of the local film velocity and local heat transfer coefficient in the falling film. The distribution of the thermal developing region and thermal developed region along the tube circumference for a single tube and a tube bundle was predicted. The local film temperature increases and local heat transfer coefficient stabilizes at the top thermally developing region while the former stabilizes and the latter decreases at the fully thermal developed region which is at the bottom part of the tube.

Keywords: Characterization of the microscopic mechanics; Falling film evaporation outside a horizontal tube; Convection; Thermal developing region; Thermal developed region

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