(Title)

A method for predicting void fraction of vapor-liquid two-phase flow inside a microfin tube

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(Abstract)

The void fraction is one of the important parameters in heat transfer and fluid flow characteristics for vapor-liquid two-phase flow. It is worthwhile to predict the void fraction in a microfin tube as a function of the design and operating parameters of the heat exchanger since most of air-conditioning systems adopt microfin tube widely to improve their efficiency. However, there are only few studies found in the literature and the characteristics of void fraction in a microfin tube are not clarified yet because of insufficient data.

The present paper deals with experiments and a prediction model for the void fraction of R134a vapor-liquid two-phase flow in a microfin tube under adiabatic condition. The void fraction was measured by quick closing valves method. The microfin tube tested is 8.86 mm in mean inside diameter and 1000 mm in length; the fin height is 0.18mm, the helix angle of fins is 25o and the number of fins is 70. The experimental data were obtained in the ranges of vapor quality of 0.01 to 0.96 at the pressure of 1.2 and 0.8 MPa, and at mass flow rate of 20 and 40 kg/h. It is confirmed that the void fraction in the microfin tube is lower than the prediction results using previous correlations for smooth tube. In the prediction model, the stratified flow is assumed in the case of void fraction lower than 0.95; the most of liquid flows at the bottom of tube and all grooves are filled full with additional liquid. The momentum equations in the vapor flow, the main liquid flow at the bottom and the additional liquid flow in grooves are solved numerically. In the case of void fraction higher than 0.95, all grooves are assumed to be filled with liquid uniformly, and the momentum equations in the vapor flow and liquid flow in grooves are solved. The predicted results agree with the present experimental data for microfin tube within a discrepancy of 5%.