Analysis on the refrigerant (R32) flow maldistribution of microchannel heat exchanger under superheat and sub-cool

ABSTRACT

The aim of this research is to study the impact of statistical moments of probability density function such as mean, standard deviation, skew of R32 flow maldistribution profile on the thermal performance of microchannel heat exchanger under superheat, and subcooling effect. A mathematical model was developed in order to analyse the influence of the statistical moments of probability density function of R32 flow maldistribution on the thermal performance of microchannel heat exchanger under superheat and sub-cooling effect. It was found that the high standard deviation and high negative skew of R32 flow maldistribution profile gave a large impact on the D of microchannel heat exchanger and can achieve up to 10%. Moreover, it was found that the heat transfer performance of microchannel heat exchanger dropped significantly when the sub-cool increases. In short, low standard deviation, high positive skew, and superheat of a flow maldistribution profile is preferred in order to minimize the performance deterioration effect. An experiment was set up to verify the mathematical model. The results from the mathematical model agreed well within 10% of the experimental data. A performance deterioration correlation related to refrigerant maldistribution under superheat and subcool was developed to provide a faster solution to design an even flow distribution heat exchanger. The proposed correlation in this research offers a quicker and simpler way to study the R32 flow maldistribution problem.

Keyword: Refrigerant maldistribution; Microchannel heat exchangers; R32