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FLOW BOILING HEAT TRANSFER COEFFICIENT OF R-134A/R-290/R-600A MIXTURE IN A SMOOTH HORIZONTAL TUBE

ABSTRACT

An investigation on in-tube flow boiling heat transfer of R-134a/R-290/R-600a (91%/4.068%/4.932% by mass) refrigerant mixture has been carried out in a varied heat flux condition using a tube-in-tube counter-flow test section. The boiling heat transfer coefficients at temperatures between -5 and 5 °C for mass flow rates varying from 3 to 5 g/s were experimentally arrived. Acetone is used as hot fluid, which flows in the outer tube of diameter 28.57 mm, while the test fluid flows in the inner tube of diameter 9.52 mm. By regulating the acetone flow rate and its entry temperature, different heat flux conditions between 2 and 8 kW/m2 were maintained. The pressure of the refrigerant was maintained at 3.5, 4, and 5 bar. Flow pattern maps constructed for the considered operating conditions indicated that the flow was predominantly stratified and stratified wavy. The heat transfer coefficient was found to vary between 500 and 2200 W/m2K. The effect of nucleate boiling prevailing even at high vapor quality in a low mass and heat flux application is highlighted. The comparison of experimental results with the familiar correlations showed that the correlations over predict the heat transfer coefficients of this mixture.

KEYWORDS

flow boiling, heat transfer coefficient, stratified flow, acetone, R-134a, HC blend, M09

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