HEAT TRANSFER CHARACTERISTICS FOR FLOW BOILING OF R134A IN HORIZONTAL CIRCULAR MICROTUBES

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ABSTRACT

An experimental study of heat transfer characteristics and the critical heat flux (CHF) condition for flow boiling of R134a in horizontal circular microtubes was conducted. Experiments were carried out over a wide range of mass flux, heat flux, saturation pressure, and inlet subcooling in horizontal circular microtubes with internal diameters of 0.50, 0.96, and 1.60 mm. Heated length was approximately 125 mm.

CHF was found to increase with increasing mass flux, increasing diameters, and increasing degrees of inlet subcooling. CHF decreased with increasing saturation pressure and increasing vapor quality. CHF occurred under saturated conditions. The experimental results were compared to the existing correlations of Bowring, Katto-Ohno, and Thome. All three correlations predicted the correct trend but predicted the experimental data with a MAE of approximately 30%.

Heat transfer coefficients were found to increase with increasing heat flux and saturation pressure and remained independent of variations in mass flux and vapor quality. Nucleate boiling was the dominant heat transfer mechanism. The experimental data was compared to three small channel correlations-Lazarek-Black, Kandlikar, and Tran. The correlations predicted the data with MAE above 35%.