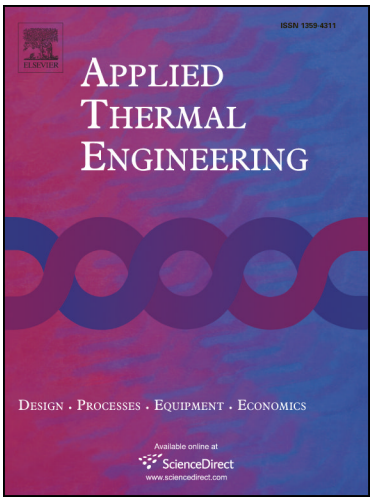

Flow boiling heat transfer and pressure drop of pure ethanol (99.8%) in a horizontal stainless steel tube at low reduced pressures

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Flow boiling heat transfer and pressure drop of pure ethanol (99.8%) in a horizontal stainless steel tube at low reduced pressures

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Abstract

Anhydrous ethanol is a potential working fluid for some applications, such as heat pipes and ORC systems. The current work presents two-phase experiments on flow boiling heat transfer and frictional pressure drop of pure ethanol in a horizontal stainless steel tube (type SS316) having an internal diameter of 6.0 mm. The influence of operating conditions in terms of mass flux, saturation temperature and imposed heat flux have been investigated. Particularly, the mass flux was fixed from 85 to 127 kg/m^2 s, the saturation temperature was set from 64.5 up to 85.8 °C (corresponding to reduced pressures of 0.009 and 0.021) and the heat flux was varied from 10.0 to 40.3 kW/m^2. According to the Taitel and Dukler flow pattern transition method [1], all the experimental points fall within the annular flow regime. Consistently, the average heat transfer coefficients show a typical convective behavior, being affected only by the mass flux and showing a significant increase with vapor quality and up to the dry-out occurrence. The frictional pressure gradients were instead seen to be increased with higher mass fluxes and lower saturation temperatures.

Among the correlations chosen for comparison, the pure convective heat transfer model of Cioncolini and Thome [2] developed for annular flow and the pressure drop correlation of Friedel [3] return the best predicting accuracy (*MAE* equal to 25.3% and 22.3%, respectively).