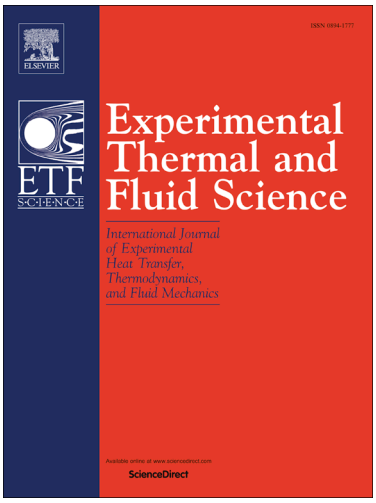

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Convective condensation in three enhanced tubes with different surface modifications

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Highlights:

- Convective condensation heat transfer coefficient and pressure drop in novel enhanced tubes were compared.
- The micro-fin tube shows the best heat transfer performance and the 1EHT tube provides heat transfer coefficient 1.4-1.65 times larger than a smooth tube.
- Mechanisms of flow condensation enhanced heat transfer for the new type surfaces were discussed.

Abstract

An experimental investigation took place in order to determine the convective condensation characteristics of R410A in: two enhanced heat transfer tubes with novel surface modifications; a micro-fin tube and a plain tube. Conditions included: mass flux values ranging from 70to330 kg m^{-2} s^{-1}; saturation temperature is fixed at 313K; with an inlet quality of 0.9 and outlet quality of 0.2. All tubes evaluated havean outer diameter of 9.52 mm; the heat transfer surface ofthe 1EHT tube consistsof dimplesand petal arrays;andthe 4EHT tube is producedusingtrapezoidal dimples in a grid-like arrangement. The experimental results were analyzed using available flow pattern maps.Results indicate that several flow regimes are involved over the range of conditions, including stratified wavy, intermittent and annular. The micro-fin tube exhibits the best enhanced performance withheat transfer coefficients1.8to2.2 times higher than those of the plain tube; while the 1EHT tube produces a heat transfer coefficient that is 1.4to1.65 times larger than those of the plain tube. Enhancement of the 1EHT tube is achieved by: disruption ofthe boundary layer; secondary fluid flow generation; fluid mixing caused by a transverse fluid transport;increased fluid turbulence; and increased heat transfer area.When considering enhanced tube frictional pressure drop, the 1EHT tube produces the largest