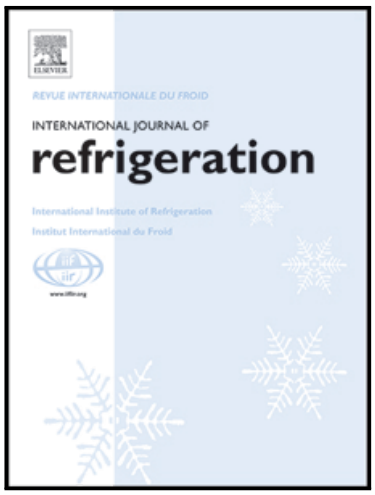

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Measurement of the Void Fraction and Maximum Dry Angle Using Electrical Capacitance Tomography Applied to a 7 mm Tube with R-134a

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Highlights

- Electrical capacitance tomography can be used to determine the maximum dry angle
- Electrical capacitance tomography can be used to quantify the dynamic void fraction
- Two phase fluid instabilities can be studied with electrical capacitance tomography

Abstract

The void fraction and maximum dry angle are important because they can be associated with heat transfer occurring in the passages of refrigeration systems. In addition, the void fraction can be used for estimating the pressure drop. Experiments involving electrical capacitance tomography were performed to measure the void fraction and maximum dry angle for refrigerant R-134a flowing in a 7 mm ID horizontal tube. The measurements were conducted at saturation temperatures in the range 18^{o}C to 22^{o}C, qualities in the range 0.1 to 0.9, and mass velocities in the range 100 to 150 kg m^{-2}s^{-1}. The ability of an electrical capacitance tomography system to measure the void fraction was studied in static and dynamic experiments. The time-averaged void fractions compared well with values obtained from correlations found in the literature. Further, a new technique using tomographic images to determine the maximum dry angle was developed. It was found that this technique can be used over a range of flow patterns, from stratified flows to annular flows with partial dryout.