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The Effect of Adding CuO Nanoparticles on Boiling Heat Transfer Enhancement in Horizontal Flattened Tubes

Authors : M. A. Akhavan-Behabadi, M. Najafi, A. Abbasi

Abstract : An empirical investigation was performed in order to study the heat transfer characteristics of R600a flow boiling inside horizontal flattened tubes and the simultaneous effect of nanoparticles on boiling heat transfer in flattened channel. Round copper tubes of 8.7 mm I.D. were deformed into flattened shapes with different inside heights of 6.9, 5.5, and 3.4 mm as test areas. The effect of different parameters such as mass flux, vapor quality and inside height on heat transfer coefficient was studied. Flattening the tube caused a significant enhancement in heat transfer performance, so that the maximum augmentation ratio of 163% was obtained in flattened channel with lowest internal height. A new correlation was developed based on the present experimental data to predict the heat transfer coefficient in flattened tubes. This correlation estimated 90% of the entire database within ±20%. The best flat channel with the point of view of heat transfer performance was selected to study the effect of nanoparticle on heat transfer enhancement. Four homogenized mixtures containing 1% weight fraction of R600a/oil with different CuO nanoparticles concentration including 0.5%, 1% and 1.5% mass fraction of R600a/oil/CuO were studied. Observations show that heat transfer was improved by adding nanoparticles, which lead to maximum enhancement of 79% compare to the pure refrigerant at the same test condition.

Keywords : nano fluids, heat transfer, flattend tube, transport phenomena
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