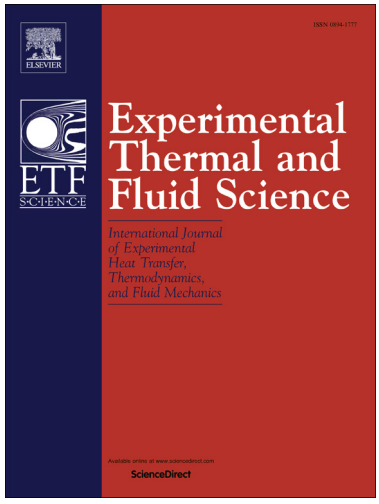

Experimental study on gas-liquid flow heat transfer in a horizontal tube with wire-coil inserts

Li Fangyong, Zhang Xingjuan, Wang Chao, Yang Chunxin

PII: S0894-1777(17)30088-2
DOI: http://dx.doi.org/10.1016/j.expthermflusci.2017.03.025
Reference: ETF 9055

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 12 October 2016
Revised Date: 12 February 2017
Accepted Date: 25 March 2017

Please cite this article as: L. Fangyong, Z. Xingjuan, W. Chao, Y. Chunxin, Experimental study on gas-liquid flow heat transfer in a horizontal tube with wire-coil inserts, *Experimental Thermal and Fluid Science* (2017), doi: http://dx.doi.org/10.1016/j.expthermflusci.2017.03.025

Experimental study on gas-liquid flow heat transfer in a horizontal tube with wire-coil inserts

Li Fangyong, Zhang Xingjuan*, Wang Chao, Yang Chunxin

School of Aeronautic Science and Engineering, Beihang University, Beijing 100191, PR China

Abstract

The forced evaporative heat transfer of the non-boiling CO_2-water flow in a horizontal tube with low water mass-flow rate enhanced by wire-coil inserts was examined through experiments. Simultaneously, a method for providing CO_2-water flow is proposed. The results show that inserting wire coil can improve the performance of the gas-liquid heat transfer since the liquid can continuously wet the entire perimeter of the tube under the swirl force produced by the helical coils; hence, the circumferential wall temperature is more uniform than in smooth tubes when the gas/liquid mass-flow rate is relatively low. Increasing either the gas or liquid mass-flow rate can enhance the heat transfer, but the enhancement efficiency decreases with the rise of the mass-flow rate. An optimum liquid flow rate exists, which depends on the heat flux and the gas flow rate. When the liquid flow rate is larger than the optimum, the heat transfer barely improved. The mean heat-transfer coefficients increase approximately 2.5~3.5 times over those of the single-phase flow in a smooth tube, but they are influenced by the gas/water flow rate and wall heat flux. The traditional method of summarizing the heat-transfer coefficients [$h=q/(t_w-t_f)$] seems unsuitable in this situation.

Keywords: CO_2-water flow; Horizontal tube; Wire coil; Heat transfer; Experiment

* Corresponding author. Tel.: +86 10 82339617; fax: +86 10 82339528.
E-mail address: zhangxingjuan@buaa.edu.cn
Postal address: Main building C-1023, Beihang University, 37 Xueyuan Road, Haidian District. Beijing, China, 100191