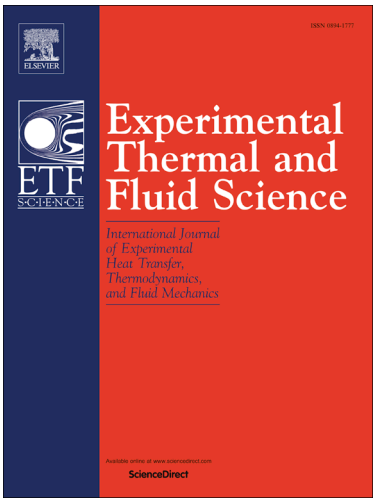

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Experimental Investigation of Non-Boiling Gas-Liquid Two Phase Flow in Downward Inclined Pipes

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Abstract

This experimental work provides data on flow patterns, void fraction, pressure drop and heat transfer coefficient for non-boiling gas-liquid two phase flow in the entire range of downward pipe inclinations. The experiments are conducted in 12.5 mm I.D. pipe using air-water fluid combination over the entire range of downward pipe inclinations (horizontal to vertical downward). The thermofluidic measurements are performed over a wide range of gas and liquid phase flow rates that correspond to all the key flow patterns experienced during downward inclined gas-liquid two phase flow. The experimental results show a significant effect of the pipe inclination on two phase flow structure and the two phase flow variables at low values of gas and liquid flow rates. Especially, the void fraction and two phase heat transfer coefficient exhibit non-linear relationship as a function of downward pipe inclination. A significant effect of pipe inclination is also observed on the transition between stratified and non-stratified (slug, intermittent) flow patterns. At steeper pipe inclinations this transition is observed to be accompanied by the peculiar transient behavior of two phase flow. It is found that the two phase flow variable such as void fraction, pressure drop and heat transfer coefficient are significantly affected by the negative slippage at the gas-liquid interface governed by the buoyancy driven nature of the two phase flow. Whereas, the two phase flow phenomenon is apparently insensitive to the change in downward pipe inclination in the inertia driven region of the two phase flow.

Keywords: Downward inclined two phase flow, stratified flow, transient behavior void fraction, pressure drop, non-boiling heat transfer.

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