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Experimental Investigation of Gas Bubble Behaviours in a Domestic Heat Pump Water Heating System

Authors : J. B. Qin, X. H. Jiang, Y. T. Ge

Abstract : The growing awareness of global warming potential has internationally aroused interest and demand in reducing greenhouse gas emissions produced by human activity. Much national energy in the UK had been consumed in the residential sector mainly for space heating and domestic hot water production. Currently, gas boilers are mostly applied in the domestic water heating which contribute significantly to excessive CO₂ emissions and consumption of primary energy resources. The issues can be solved by popularizing heat pump systems that are attributable to higher performance efficiency than those of traditional gas boilers. Even so, the heat pump system performance can be further enhanced if the dissolved gases in its hot water circuit can be efficiently discharged. To achieve this target, the bubble behaviors in the heat pump water heating system need to be extensively investigated. In this paper, by varying different experimental conditions, the effects of various heat pump hot water side parameters on gas microbubble diameters were measured and analyzed. Correspondingly, the effect of each parameter has been investigated. These include varied system pressures, water flow rates, saturation ratios and heat outputs. The results measurement showed that the water flow rate is the most significant parameter to influence on gas microbubble productions. The research outcomes can significantly contribute to the understanding of gas bubble behaviors at domestic heat pump water heating systems and thus the efficient way for the discharging of the associated dissolved gases.

Keywords : heat pump water heating system, microbubble formation, dissolved gases in water, effectiveness
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