Systematic Measurements of Heat Transfer Characteristics in Saturated Pool Boiling of Water-Based Nanofluids

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ABSTRACT

Experiments were carried out to investigate the heat transfer characteristics in saturated pool boiling of water-based nanofluids. An upward-facing copper surface of 20 mm in diameter was used as the heated surface. Main experimental parameters in this work were nanoparticles' material (TiO_2, Al_2O_3 and SiO_2), mass concentration (0.04, 0.4 and 1 kg/m^3) and dispersion condition (fine and coarse dispersions). Effects of these parameters on the time-variation of wall superheat under constant heat flux, the heat transfer coefficient (boiling curve) and the critical heat flux (CHF) were explored. It was found that the particle dispersion condition has no noticeable influence on the heat transfer characteristics within the range tested in this work. Whilst, the material and concentration of nanoparticles greatly affected the time-variation of wall superheat and the boiling curve. In particular, it was found that the wall superheat likely to increase significantly when the nanoparticle layer formed on the heated surface is partially detached. The CHF in nanofluid was 2.5–3 times higher than that for pure water in all the experimental conditions.

KEYWORDS: Nanofluid; Saturated pool boiling; Particle material; Particle concentration; Particle dispersion condition; Heat transfer coefficient; Critical heat flux

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