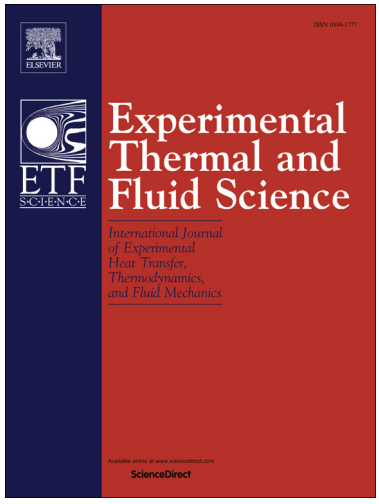

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Effect of silver nanoparticle deposition in re-entrant inclined minichannel on bubble dynamics for pool boiling enhancement

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Abstract. Silver nanoparticles were deposited on copper substrate by boiling a new industrial nanofluid (DZ nanocoolant) in two different concentrations to investigate the saturated pool boiling enhancement of distilled water under atmosphere pressure. Microstructure, surface topography, and contact angle of the surfaces were examined. The optimum concentration with hydrophobic characteristics was deposited on the re-entrant inclined minichannel. Effects of reentrancy and hydrophobicity on bubble dynamics were observed and pool boiling curves were compared. As the nanoparticle concentration increased, the cluster deposition and hydrophobicity increased, however the deposition stability was decreased. The experimental results indicated that by increasing the nanofluid concentration to reach nanocoated polished surface, the critical heat flux (CHF) and heat transfer coefficient (HTC) of pool boiling increased. Nano-fins are introduced as a new concept for heat transfer enhancement. It was observed that inclination and reentrancy enhanced pool boiling performance in comparison with polished copper. Finally, as expected, the combined modification including coating the surface with deposited silver nanoparticles in internal side of re-entrant inclined minichannel possesses the highest CHF and HTC of 196W/cm^2 and 10W/cm^{2}K, respectively which are 120% and 100% higher than those of the plain surface.

Keywords*: Pool boiling; Re-entrant Minichannel; Silver nanoparticle; Copper.*

1. Introduction

Boiling heat transfer is a highly efficient way to dissipate heat and is widely employed in many areas of science and technologies. There is a great interest in using boiling heat transfer in electronics, computers, nuclear and fossil energies in order to cool chips and reactors. Boiling heat transfer efficiency is restricted by critical heat flux (CHF). Many studies have been