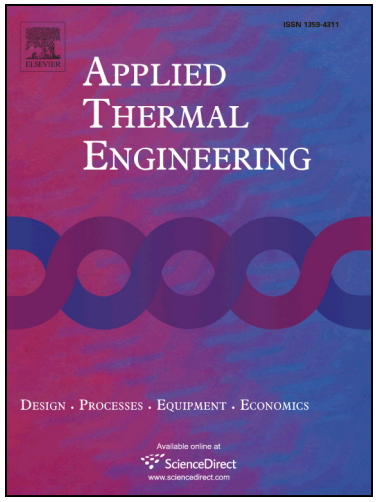

Research Paper

Thermal performance analysis of pool boiling on an enhanced surface modified by the combination of microstructures and wetting properties

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Thermal performance analysis of pool boiling on an enhanced surface modified by the combination of microstructures and wetting properties

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Highlights

Transient simulation of the saturated pool boiling on the surfaces with microstructures was carried out. Effect of wetting properties on superheat temperature and HTC of saturated pool boiling was connected with microstructures' size. The heat transfer performance of saturated pool boiling was enhanced on the surface modified by the combination of microstructures and wetting properties.

Abstract

Characterized by low temperature difference and high heat flux, pool boiling heat transfer has been widely applied in various engineering technical fields. The aim of this study was to explore the thermal performance of pool boiling heat transfer on an enhanced surface modified by the combination of microstructures and wetting properties. The two-dimensional transient volume of fluid model and numerical simulation were selected to investigate each case which was established. Variation of the vapor bubble behavior, the velocity field of computational domain, the temperature at the liquid/solid interface and heat transfer coefficient (HTC) of each case were analyzed. The heat transfer performances of mixed hydrophilic and hydrophobic microstructures were all superior to those of hydrophilic microstructures only, except the flat. With respect to hydrophilic microstructures, the average growth rates of HTC for mixed hydrophilic and hydrophobic microstructures were 17.59%, 21.59%, 2.74% and 3.81% when the heights of microstructures were 3 μm, 5 μm, 7 μm and 9 μm, respectively. Moreover, the average growth