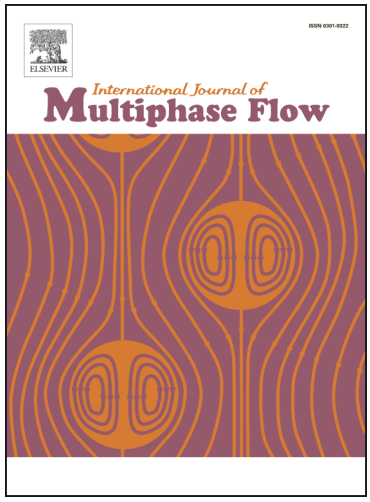

A comparative study of flow boiling performance in reentrant copper microchannels and reentrant porous microchannels with multi-scale rough surface

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A comparative study of flow boiling performance in reentrant copper microchannels and reentrant porous microchannels with multi-scale rough surface

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Abstract:

Flow boiling in porous-based microchannel heat sinks offers a potential and attractive solution for efficient cooling of high-heat-flux devices. In this study, a type of Ω-shaped reentrant porous microchannels with multi-scale rough surface (RPM-RS) was fabricated via a solid-state sintering method and constructed for heat sink cooling. Two-phase boiling experiments were conducted to explore their enhancement in flow boiling performance compared to the solid copper microchannels with the same reentrant configurations. Two coolants tests, i.e., deionized water and ethanol, with inlet subcooling of 10 ℃ and 40 ℃, were conducted at mass fluxes of 125-300 kg/m^2·s. Experimental results show that the RPM-RS promoted the bubble nucleation and reduced the wall superheat for the onset of nucleate boiling (ONB) significantly. They presented a significant enhancement in two-phase heat transfer at low to moderate heat fluxes, as well as a considerable mitigation of the two-phase flow instabilities. Furthermore, They produced more uniform heat sink base temperatures compared to reentrant copper microchannels (RCM). The above encouraging results of reentrant porous microchannels highlight their promising potential to be an alternative of conventional solid microchannels for thermal management applications.

Key words: Microchannel heat sinks; Flow boiling; Porous microchannels; Multi-scale rough surface

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