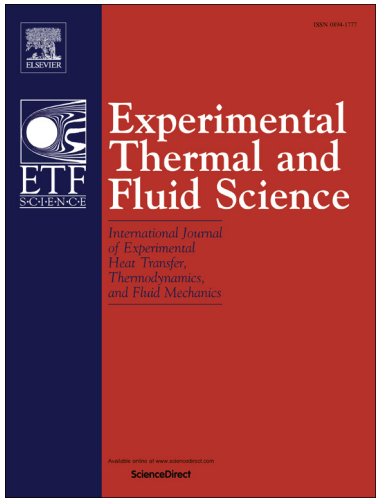

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An experimental investigation on the heat transfer and pressure drop characteristics of nanofluid flowing in microchannel heat sink with multiple zigzag flow channel structures

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Abstract

This research reports the thermal performance and flow characteristics of nanofluid flows in two different types of microchannel heat sink (MCHS) with multiple zigzag flow channel structures experimentally with regard to the continuous zigzag flow channel (CZ-HS) and the single cross-cutting zigzag flow channel (CCZ-HS). SiO_2 nanoparticles with particle loadings of 0.3, 0.6, and 0.8 vol.% and dispersed in deionized water (DI water) are used as the working medium. Both CZ-HS and CCZ-HS are made from copper material. Their dimensions are approximately 28 x 33 mm. Hydraulic diameter and number of flow channels are equally designed as seven 1-mm flow channels, respectively. The heat transfer area of CZ-HS is approximately 1,176 mm^2 and that of CCZ-HS is 1,238 mm^2. The effects of single cross-cutting of the flow channel, Reynolds number, and particle concentration on the Nusselt number and pressure drop characteristics are investigated. The experimental data indicate that the nanofluid-cooled heat sink provided larger thermal performance than the heat sink cooled by water of approximately 3–15%. Similarly, the results indicated that the thermal performances of the CCZ-HS are larger than those of the CZ-HS by an average of 2–6%. For the pressure drop, the measured data showed that particle concentration and cross-cutting of the flow channel have a small effect on the pressure-drop data.

Keywords: Nusselt number, pressure drop, microchannel heat sink, nanofluid, cross-cutting