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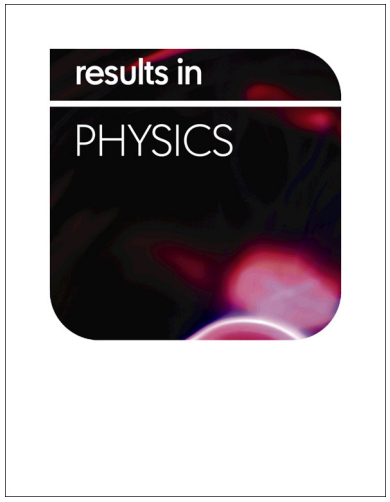

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ENTROPY GENERATION OF NANOFLUID FLOW IN A MICROCHANNEL HEAT SINK

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ABSTRACT

Present study aims to investigate the effects of the presence of nano sized TiO_2 particles in the base fluid on entropy generation rate in a microchannel heat sink. Pure water was chosen as base fluid, and TiO_2 particles were suspended into the pure water in five different particle volume fractions of 0.25%, 0.5%, 1.0%, 1.5% and 2.0%. Under laminar, steady state flow and constant heat flux boundary conditions, thermal, frictional, total entropy generation rates and entropy generation number ratios of nanofluids were experimentally analyzed in microchannel flow for different channel heights of 200µm, 300µm, 400µm and 500µm. It was observed that frictional and total entropy generation rates increased as thermal entropy generation rate were decreasing with an increase in particle volume fraction. In microchannel flows, thermal entropy generation could be neglected due to its too low rate smaller than 1.10e-07 in total entropy generation. Higher channel heights caused higher thermal entropy generation rates, and increasing channel height yielded an increase from 30% to 52% in thermal entropy generation. When channel height decreased, an increase of 66%-98% in frictional entropy generation was obtained. Adding TiO_2 nanoparticles into the base fluid caused thermal entropy generation to decrease about 1.8%-32.4%, frictional entropy generation to increase about 3.3%-21.6%.

Key Words: Microchannel, nanofluid, entropy generation, TiO_2.

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Nomenclature

A	Heat transfer surface area (m^2)
Cm	Mass fraction
Cp	Specific heat at constant pressure (J/kgK)
Dh	Hydraulic diameter (m)
f	Friction coefficient

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