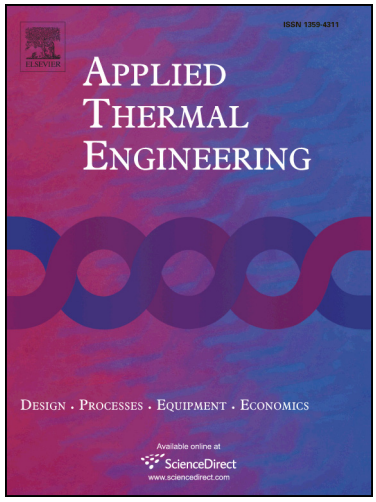

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Numerical Study of Laminar Non-Newtonian NanofluidFlow in a T-Junction: Investigation of Viscous Dissipation and Temperature Dependent Properties

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Abstract

In this paper, mixing of laminar non-Newtonian nanofluid flow in a two dimensional microchannels numerically investigated. The governing equations are discretized using the finite volume approach. The selected non-Newtonian nanofluid is an aqueous solution of 0.5 $wt\%$ carboxymethyl cellulose (CMC) with10 nm diameter TiO_2 nanoparticles. The nanofluid as well as the base fluid exhibit pseudoplastic behavior. In the current study, new correlations for the power-law index, the consistency index and the thermal conductivity of the nanofluid as a function of temperature and volume fraction are presented. Furthermore, the significance of the viscous dissipation term on the nanofluid behavior is studied. The results showed that adding nanoparticles to the non-Newtonian fluid intensifies its non-Newtonian treatment. For the mixing process and diffusing the wall temperature into the fluid, a low Reynolds number and high volume fraction is promising, the same condition is also favorable from the "Thermal Performance Factor" study.

Keywords: Non-Newtonian; Carboxymethyl cellulose; Pseudoplastic; Temperature dependent properties; Viscous dissipation.

1. Introduction

Nanofluids are suspensions of nanoparticles with at least one of their critical dimensions smaller than 100 nm [1]. During the past decade, much attention has been paid to the nanofluid related issues because of their substantial thermal properties. These enhanced properties cause an enormous potential of nanofluids in device miniaturization and process intensification which could have an

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