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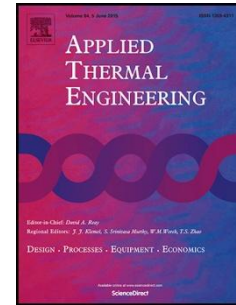
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Heat transfer analysis of a non-Newtonian fluid flowing through a Plate Heat Exchanger using CFD

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Highlights

A CFD analysis is applied to a non-Newtonian flow through plate heat exchangers. The effect of plates number, distance between plates and flow regime is analyzed. An empirical correlation for the friction factor is proposed. The relation between Nu and Pe is described by a modified Sieder-Tate equation. The relation between the heat transfer rate and the pumping power is reported.

Abstract

In this work, the moment and heat transfers of a non-Newtonian fluid flowing in steady laminar regime through a plate heat exchanger at constant wall temperature is studied using CFD. Single-pass U-type plate heat exchangers with multiple flat plates with and without baffles are used. The effect of plates number and distance between plates on the heat transfer and the pressure drop are investigated. An empirical correlation for the friction factor as a function of the generalized Reynolds number and the ratio between the friction characteristic length and the flow trajectory length is developed. It is found that the dependence of the Nusselt number on the Peclet number can be described by the modified Sieder-Tate equation. Although the flow pattern is highly complex, under an adequate definition of the characteristics parameters, it is possible to establish simple correlations between the dimensionless numbers that characterize the thermal-hydraulic behavior of plate heat exchangers.

Keywords: CFD analysis, non-Newtonian flow, plate heat exchanger, baffles, moment and heat transfers.

1. Introduction

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