

## Accepted Manuscript

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PII: S0997-7546(18)30056-6

DOI: <https://doi.org/10.1016/j.euromechflu.2018.04.005>

Reference: EJMFLU 3286

To appear in: *European Journal of Mechanics / B Fluids*

Received date: 23 January 2018

Revised date: 6 April 2018

Accepted date: 6 April 2018

Please cite this article as: M. Kamran, B. Wiwatanapataphee, Chemical reaction and Newtonian heating effects on steady convection flow of a micropolar fluid with second order slip at the boundary, *European Journal of Mechanics / B Fluids* (2018), <https://doi.org/10.1016/j.euromechflu.2018.04.005>

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# Chemical reaction and Newtonian heating effects on steady convection flow of a micropolar fluid with second order slip at the boundary

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## Abstract

In this paper, asymptotic analysis of the chemical reaction and the Newtonian heating parameters is carried out. A mathematical model of a convective micropolar fluid flow over a permeable stretching/shrinking sheet is taken into account in the presence of the slip flow regime. A nonlinear system of transformed equations is solved by a semi-analytical technique called Homotopy Analysis Method (HAM). The current investigation is in a good agreement with the already published analytical and the numerical results with the help of tabular and graphical representations. In comparison with the stretching sheet, it is observed that the shrinking sheet produces a wider concentration boundary layer thickness by a small change in the chemical reaction parameter. In contrast to the stretching sheet, the Newtonian heating parameter raises the thermal boundary layer thickness by 39.93% for the shrinking sheet. The chemical reaction with the Newtonian heating effect is an important consideration in the solidification process of the liquid crystals and the polymeric suspensions.

*Keywords:* micropolar fluid; stretching/shrinking sheet; slip flow condition; Newtonian heating; chemical reaction

## Nomenclature

$A$ constant coefficient for mean free path, $m$	$f_w$ dimensionless suction/injection parameter
$B$ square of constant coefficient for mean free path, $m^2$	$g$ gravitational acceleration, $ms^{-2}$
$c_p$ specific heat at constant pressure, $JK^{-1}Kg^{-1}$	$Gr_x$ dimensionless local Grashof number
$C_f$ local skin friction coefficient	$h_s$ surface heat transfer coefficient, $Wm^{-2}K^{-1}$
$C$ concentration of the species	$h$ dimensionless micro rotational velocity
$C_m$ dimensionless Chemical reaction parameter	$j$ microinertia per unit mass,
$D_m$ mass diffusivity	$K$ dimensionless material parameter
$d$ mean free path, $m$	$\xi$ first order homogeneous constant reaction rate
$f$ dimensionless velocity	$k$ thermal conductivity, $Wm^{-1}K^{-1}$
	$k_n$ Knudsen number

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