Joule Heating and Viscous Dissipation on Electromagnetohydrodynamic Flow with Electroosmotic Effect in a Porous Microchannel

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Abstract

This work investigates the effect of Joule heating and viscous dissipation due to electric double layer (EDL) and electroosmotic effect on steady fully developed electromagnetohydrodynamic flow in a porous microchannel. Dimensionless formulations of the Poisson-Boltzmann, momentum, and energy equations are derived for the electric potential, velocity profile and temperature distribution in the microchannel. Exact solutions for the temperature distributions and velocity profile were obtained using the method of undeterminate coefficients. The Debye-Hückel linearization is used to get exact solution for the electric potential. The results showed that Brinkmann number (Br) , Joule heating parameter (J) , Debye-Hückel parameter (K) , Hartmann number (M) , electric field (E z) and suction/injection parameter (S) have a substantial impact on flow formation and heat transfer. Using MATLAB software, graphical simulations are provided in order to deliver a greater understanding of the influence of relevant parameters on the results achieved.

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