Abstract

In this study, we have critically examined the thermal characteristics of fluid flows through narrow confinements in presence of electro-magneto-hydrodynamic interactions. Firstly, we have studied the heat transfer processes using a uniform electromagnetic field. The viscous dissipation and Joule heating effects have been duely taken care of. In the next case study, we have extended the previous considerations to study the heat transfer processes using a spatially varying magnetic field, keeping the electric field uniform. The above analyses revealed many facets of fundamental transport processes that occur inside narrow confinements in presence of electro-magneto-hydrodynamic interactions that may eventually dictate the thermal characteristics in a rather profound manner. We have used several dimensionless parameters in our study. Results from the present study reveal how we can use different parameter combinations to control the heat transfer processes. The knowledge acquired can be applied in various fields that involve fluid flow through narrow confinements, including thermal management of electronic devices.

Keywords. Microchannel, Electric Double Layer, Electroosmosis, Electromagnetohydrodynamics, Heat Transfer