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Review

Simulation of nanofluid heat transfer in presence of magnetic field: A review

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ABSTRACT

Existence of magnetic field causes heat transfer to reduce in free convection but in several engineering uses for example: electronic application; enhancing heat transfer is a purpose. Thus, nanofluid should be selected as working fluid. Nanofluid is dispersion of very small metal particles in the base fluid. Two phase and single phase are two ways for estimating the behavior of nanofluid. At first model, nanofluid suppose as homogenous fluid without any slip mechanism. But in second method, slip velocities are included. Brownian motion and Thermophoresis impacts are taken into consideration in second approach. In this paper, previous publications about nanofluid hydrothermal treatment in existence of magnetic field are reviewed. Rely of variable and constant magnetic fields, Ferrohydrodynamic (FHD) and Magnetohydrodynamic (MHD) can take role in simulations. Numerical and analytical methods are considered by authors. Results proved that temperature gradient augments with augment of solid particle concentration and buoyancy forces, while it decreases with augment of magnetic field.

Contents

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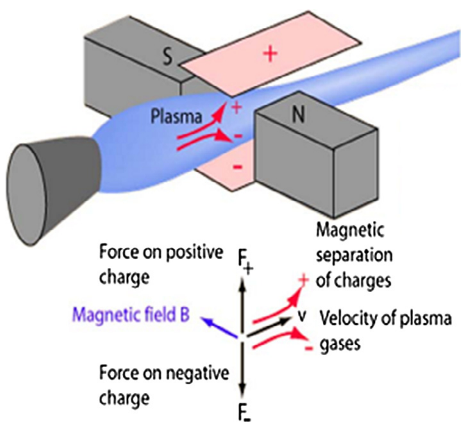

Fig. 1. Induced current in a moving conductive fluid in presence of magnetic field.

1. Magnetohydrodynamic (MHD)

1.1. Definition of Magnetohydrodynamic

The word Magnetohydrodynamic (MHD) has three section which are mean magnetic field, liquid and movement [1]. Fig. 1 depicted the basic idea of MHD. Fig. 2 illustrated the mechanism of affecting Lorentz forces on fluid motion. Right hand side law is shown in this figure which is determined the direction of Lorentz forces. In order to simulate MHD, Maxwell's equations should be solved coupled with Navier-Stokes equations.

1.2. Mathematical model

In order to reach Mathematical model, conductivity considered as a constant scalar. In Fig. 3 two important effects are shown: Lenz's law and Lorentz force law.

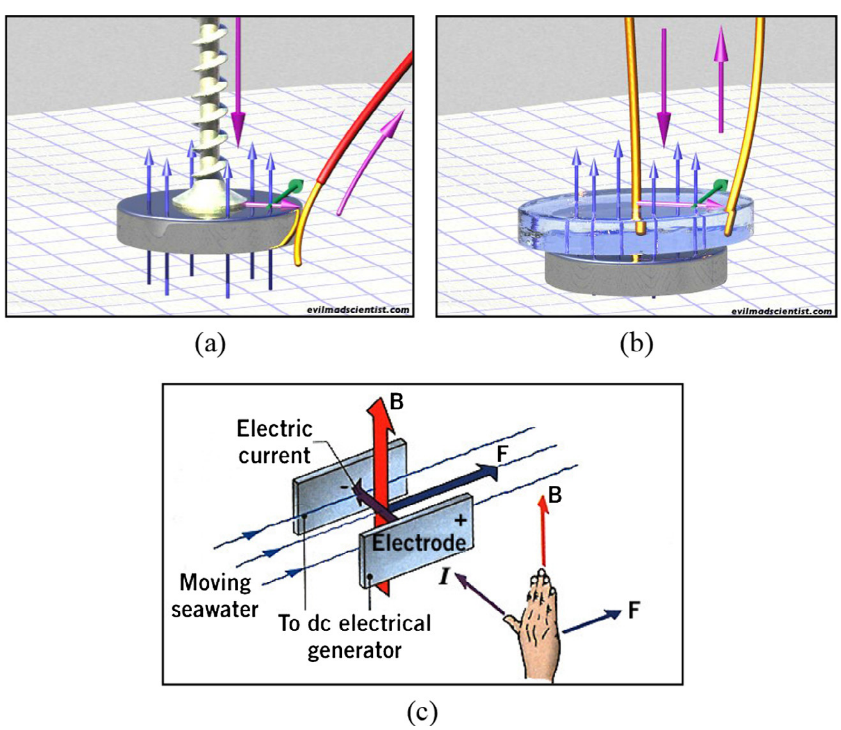

Fig. 2. (a and b) Effect of magnetic field on conductive fluid flow; (c) Right hand side law. (Blue Line: Magnetic Field; Purple Line: Current; Green Line: Motion.) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)