

Recent Developments in Magneto-hydrodynamic Fe_3O_4 Nanofluids for Different Thermal Applications: A Review Study

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ABSTRACT

In this review study, it is tried to collect all the recent studies in the magneto-hydrodynamic (MHD) nanofluids flow application using Fe_3O_4 nanoparticles. The studies are categorized by focusing more on seven different sections: Magnetic field effect, Friction and thermal (Heat transfer) effects, Viscosity and Physical properties, Thermal applications, Thermo-physical studies, Works on synthesis and other applications. Also, the energy application of this type of nanofluid such as in microchannels, CO_2 storages, U-tubes, L shaped geometries in solar application channels, etc. are reviewed and their results were discussed. Although the studies had valuable separate outcomes, but approximately all of them confirmed that by increasing the Reynolds number and volume fraction, Nusselt number increased and friction factor decreased. Furthermore, the friction-factor is increased with increase of volume concentration in most applications.

Keywords: Fe_3O_4 , Nanofluid, Thermal Application, Synthesis, Friction Factor.

1. INTRODUCTION

One of the main objectives of engineering and industry, especially in dealing with the issue of heat transfer in the heat exchangers are nanofluids as a new generation of fluids with many applications. Nano-fluid, the term was introduced for the first time by the Choi [1], a colloidal solution formed from a base fluid and solid nanoparticles. Nanofluids previously were used to increase the thermal conductivity of fluids by micrometer-sized particles added to base fluid. The particles in suspension did not have the necessary stability and quickly settle while nano-sized particles form a stable suspension. Distribution of nanoparticles in a typical fluids can improve heat transfer properties or in other words to increase the thermal conductivity of fluid. Harandi et al. [2] prepared a nanofluid consists of Fe_3O_4 nanoparticles for the first time and functionalized multi-walled carbon nanotubes (f-MWCNTs) which dispersed in ethylene glycol. Tyurikova and Demidov [3] synthesized the magnetic nanofluids with Fe_3O_4 nanoparticles in a solvent, water-based using Oleic Acid and Mannitol successfully preparation and verification of sustainability, while the industry can have a great future.