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Experimental study on dynamic viscosity of Mg(OH)2-ethylene glycol nanofluid

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Abstract

In this paper, we aim to investigate the dynamic viscosity of the $Mg(OH)_2$-ethylene glycol(EG) nanofluid. The study is conducted in different solid volume fractions (0.1%, 0.2%, 0.4%, 0.8%, 1%, 1.5%, and 2%) at the temperatures of 23 and 55^0C. It should also be mentioned that the average diameter of the nano-particle is 10nanometer. Moreover, the Newtonian behavior of the nanofluid is evidenced by examining the shear rate of the nanofluid. The results proof that while the solid volume fraction is increased, the dynamic viscosity is increased too. This increase is more noticeable at lower temperatures in comparison with higher temperatures.

Keywords: Dynamic viscosity, Temperature, Solid concentration, $Mg(OH)_2$.

Introduction

A suspension of particles, in the scale of nano, in based fluid is called ‘nanofluid’. It is accepted that nanofluids are capable to provide a noticeable heat transfer improvement compared with conventional fluids; water and ethylene glycol. In recent years, due to the usage of the nanofluid in various industrial applications such as thermal engineering systems (nuclear reactors, solar energy etc.), researchers pay careful attention to this field. Namburu et al. [1] measured the viscosity of CuO-ethylene glycol and water, experimentally. Their results indicate that the nanofluid shows the Newtonian behaviour in such mixture of EG-water in different solid volume fractions (up to 0.0612). Prasher et al. [2], in an experimental investigation, studied the effects of shear rate, temperature, size of the nanoparticles, and solid concentration on the viscosity of Al_2O_3 based nanofluids. They declared that the viscosity is independent from shear rate which proofed the nanofluids are naturally Newtonian. In another empirical paper, Kulkarni et al. [3] measured the dynamic viscosity of CuO-water nanofluid in different solid volume fractions (between 0.05 and 0.15). Their results state that the nanofluid shows the non-Newtonian behaviour in different temperatures (from 5 to 50^0C). Phuoc et al.[4], in an empirical study, investigated the effects of the solid concentration and the shear rate on the viscosity of Fe_2O_3-diluted water nanofluid. Phuoc et al. [5] studied the effects of the solid concentration and shear rate on the viscosity of Fe_2O_3-wtaer nanofluid. Their results show that at higher solid concentration, the nanofluid shows the non-Newtonian behaviour. In another experimental study, Pak and Cho [6], measured the dynamic