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An experimental study on the effect of ultrasonication on thermal conductivity of ferrofluid loaded with carbon nanotubes

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Abstract

Nanofluids containing Fe_3O_4 and carbon nanotubes nanoparticles emulsified and dispersed using Gum Arabic (GA) and tetramethylammonium hydroxide (TMAH) were made and characterized for potential use as heat transfer fluids. Due to the interaction between the TMAH and GA molecules, the magnetic nanoparticles and CNTs were physically adsorbed. This paper reports an experimental work on the effect of ultrasonication on thermal conductivity of this aqueous suspension. The characterization and surface morphology of the dried samples were studied by using XRD and TEM measurements. Experiments were conducted in the magnetic nanoparticles mass concentration range 0.494% to 2.428%, CNT mass concentration range 0.0% to 1.535% and the temperature range 25°C to 55°C. Results show that thermal conductivity of the studied nanofluids is affected by ultrasonication time, increased first and then decreased after an optimum sonication time. Additionally, results show that addition of GA coated CNT nanofluid increases the thermal conductivity of the aqueous nanofluid containing TMAH coated Fe_3O_4 nanoparticles.

Keywords

ferrofluid, carbon nanotubes, thermal conductivity, ultrasonication, hybrid nanofluid

1. Introduction

Conventional heat transfer fluids, such as water, oils and ethylene glycol have inherently low thermal conductivities that greatly limit the performance of many engineering equipment. Many research activities have been carried out attempting to improve the thermal conductivity of the