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A Review based on the effect and mechanism of thermal conductivity of normal nanofluids and hybrid nanofluids

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Abstract

In last three decades, nanofluids have been the focus of attention by several researchers. Nanofluids are attracting by many scientist due to their anomalous thermal conductivity enhancement in nanofluids with a small percentage of nanoparticles, for their remarkable thermo-physical properties with no or low penalty in pressure drop, superior transport properties and significant enhancement in heat transfer characteristics. Preparation of a long term stable nanofluid is one of the basic requirements for its better utilization in heat transfer applications and also a key aspect of their sustainability and efficiency. The main aim of this article is to give a comprehensive review, which summarizes recent research progress on thermal conductivity of nanofluids and an overview of experimental and numerical studies about different nanofluids. This article also discusses several factors affecting thermal conductivity; including types of nanoparticles, solid volume fraction, different base fluids, temperature, particle size, pH, sonication, surfactants and various mechanisms of thermal conductivity enhancement in nanofluid development are discussed. Furthermore synthesis, preparation methods, thermal conductivity, and challenges of hybrid nanofluids are also discussed. There are many contradictory results found in the literature on the influence of effective parameters on thermophysical properties. It has been observed that thermal conductivity of nanofluids are affected by the mentioned parameters. So this article will be benefited for researchers to have a precise screening of a broad range of studies in this field. Hybrid nanofluid exhibits improved thermal conductivity characteristic than normal nanofluids. However results indicate that the selection of proper hybrid nanoparticles is a major challenge for preparing stable nanofluids. So a depth knowledge and understanding on these areas are required in order to develop hybrid nanofluid for better thermal conductivity.

Keywords: Synthesis; Nanofluids; Effective parameters of thermal conductivity; Mechanism of heat transfer; Hybrid nanofluids.

1. Introduction

Fluid heating and cooling is one of the most significant and challenging aspects for various heat transfer applications and many industries such as; including power generation, manufacturing, production, chemical processes, transportation, microelectronics and many more. If there is an enhancement in the rate of heat transfer in industrial applications then there will be reduction in processing time, increase in the life of equipments, and saving in energy. For example: (i) an automotive systems, where improved

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