Effect of Different Shape ZnO Nanoparticles on the Thermal Conductivity of ZnO Nanofluids

Tengku Nur Azza Tengku Ahmad Faizal, Radhiyah Abd Aziz, and Suraya Sulaiman

Abstract Remarkable thermal conductivity improvement in nanofluids containing only a small proportion of nanoparticles, as well as their outstanding thermo-physical properties with no or low-pressure drop penalty, greater transport properties, and significant heat transfer enhancement, drew many researchers to nanofluids. The main goal of this research is to investigate the effect of various shapes of Zinc Oxide (ZnO) nanoparticles on the thermal conductivity of ZnO nanofluids; i.e., nanospheres and nanoplates. The synthesized ZnO undergoes several physico-chemically characterized by various techniques. The appearance of pure hexagonal wurtzite phase structures of ZnO nanoparticles is revealed by X-ray diffraction (XRD) structural analysis. The surface morphologies of ZnO nanoparticles were studied using a field emission scanning electron microscope (FESEM), which successfully revealed nanosphere and nanoplate shapes. Fourier transforms infrared spectroscopy (FTIR), analysis confirms the presence of Zn–O stretching. Brunauer Emmett Teller (BET) analyse showed that nanosphere which had the smaller size particle thus larger surface area. The stability and absorbance of ZnO nanospheres and nanoplates based on nanofluid were evaluated using UV–Vis spectrum methods in this paper. Finally, the C-therm analysis data showed thermal conductivity of nanofluid with nanosphere shape is higher than nanoplate.

Keywords Nanofluid · Nanosphere · Nanoplate · Thermal Conductivity

1 Introduction

Metal particles the size of nanometers is dissolved in manufacturing heat transfer liquids such as ethylene glycol, water, or engine oil to establish an innovative category of engineered fluids through high thermal conductivity. Many industrial sectors, such as transport, machining, chemical reaction, and electronics, rely heavily on

T. N. A. Tengku Ahmad Faizal · R. Abd Aziz · S. Sulaiman (✉)
Faculty of Manufacturing and Mechatronic Engineering Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, 26600 Pekan, Pahang, Malaysia
e-mail: surayas@umpsa.edu.my

R. Abd. Aziz et al. (eds.), *Intelligent Manufacturing and Mechatronics*, Springer Proceedings in Materials 40, https://doi.org/10.1007/978-981-99-9848-7_22