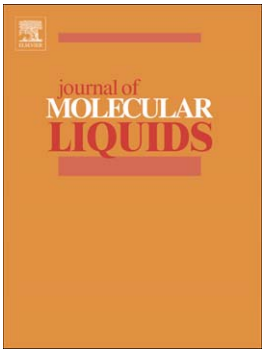

Convection heat transfer in micropolar nanofluids with oxide nanoparticles in water, kerosene and engine oil

Abid Hussanan, Mohd Zuki Salleh, Ilyas Khan, Sharidan Shafie

PII: S0167-7322(16)33098-7
DOI: doi:10.1016/j.molliq.2016.12.040
Reference: MOLLIQ 6723

To appear in: *Journal of Molecular Liquids*

Received date: 9 October 2016
Revised date: 24 November 2016
Accepted date: 5 December 2016

Please cite this article as: Abid Hussanan, Mohd Zuki Salleh, Ilyas Khan, Sharidan Shafie, Convection heat transfer in micropolar nanofluids with oxide nanoparticles in water, kerosene and engine oil, *Journal of Molecular Liquids* (2016), doi:10.1016/j.molliq.2016.12.040

CONVECTION HEAT TRANSFER IN MICROPOLAR NANOFLUIDS WITH OXIDE NANOPARTICLES IN WATER, KEROSENE AND ENGINE OIL

[1]Abid Hussanan, [1]Mohd Zuki Salleh, [2*]Ilyas Khan, [3]Sharidan Shafie

[1]*Applied & Industrial Mathematics Research Group, Faculty of Industrial Science & Technology, Universiti Malaysia Pahang, Pahang, Malaysia*

[2]*Basic Engineering Sciences Department, College of Engineering, Majmaah University, Majmaah, Saudi Arabia*

[3]*Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia (UTM), 81310 Skudai, Malaysia.*

ABSTRACT: The basic idea of nanofluid was to enhance the thermal conductivity of base fluid. However, the classical nanofluid models have some drastic limitations, i.e. they cannot describe a class of fluids that have certain microscopic characters arising from the microrotation and local structure of the fluid elements. Therefore, the present work is one of the infrequent contributions that describes the microrotation and microinertia characteristics of nanofluids. More exactly, in this work, the unsteady free convection flow of micropolar nanofuids is investigated over a vertical plate. Five types of oxide nanoparticles namely copper oxide, titanium oxide, alumina oxide, iron oxide and graphene oxide are suspended in three different types of fluids such as water, kerosene and engine oil. Exact solutions of the governing problem are obtained by the Laplace transform method. Solutions for conventional or regular nanofluid is also recovered as a special case. Temperature of graphene oxide suspended micropolar nanofluid is higher than other oxide nanoparticles based nanofluids.