

INVESTIGATION OF ALUMINA ADDITIVE IN LUBRICANT OIL FOR
ENHANCED ENGINE PERFORMANCE

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Report submitted in partial fulfillment of the requirements for the award of Bachelor
of Mechanical Engineering Majoring in Automotive Engineering

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

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I hereby declare that the work in this report is my own except for quotations and summaries which have been acknowledged. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

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LIST OF SYMBOLS

k_{eff}	Thermal conductivity of nanofluid
k_p	Thermal conductivity of nanoparticles
k_1	Thermal conductivity of liquid
φ	Volume fraction of particles
ξ	Correlation of the thermal conductivity enhancement
ξ_{max}	Limiting value of thermal conductivity
ρ_p	Density of nanoparticle
m_p	Mass of nanoparticle

LIST OF ABBREVIATIONS

Al ₂ O ₃	Aluminum oxide
EP	Extreme pressure
ZDDP	Zinc dithiophosphates
ASTM	American Society for Testing and Materials
VI	Viscosity index
TBN	Total base number
CuO	Copper oxide
vol.	Volume
TiO ₂	Titanium oxide/Anatase
MO	Mineral oil
h-BN	Hexagonal boron nitride
S	Sulphur
P	Phosphorus
Cl	Chlorine
Cu	Copper
SEM	Scanning electron microscope
EDS	Electronic data systems
XPS	X-ray photoelectron spectroscopy
AFM	Atomic force microscopy
ZrO ₂	Zirconium oxide
SiO ₂	Silicon oxide
CaCO ₃	Calcium carbonate
PAO	Poly-Alpha-Olefin

LIST OF ABBREVIATIONS: Continued

SA	Stearic acid
XRD	X-ray diffraction
HRTEM	High-resolution transmission electron microscopy
FT-IR	Fourier transform infrared spectroscopy
TGA	Thermogravimetry
LP	Liquid paraffin
CNT	Carbon nanotube
ZnO	Zinc oxide
TiO ₂	Titanium oxide
Fe ₂ O ₃	Iron (III) oxide
Fe ₃ O ₄	Iron(II) diiron(III) oxide
Ag	Silver
Sn	Stannum