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Research Paper

Comparative study of thermo-physical properties of SiO_2 and Al_2O_3 nanoparticles dispersed in PAG lubricant

A.A.M. Redhwan [a,c], W.H Azmi [a,b,*], M.Z. Sharif [a], R. Mamat [a,b], N.N.M. Zawawi [a]

[a] Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
[b] Automotive Engineering Centre, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
[c] Faculty of Manufacturing Engineering Technology, TATI University College, 24000 Kemaman, Terengganu, Malaysia

HIGHLIGHTS

- Measurement of thermal conductivity and dynamic viscosity for SiO_2 nanolubricant.
- Measurement are undertaken with SiO_2 nanolubricant up to 1.5% volume concentration.
- Comparison of SiO_2 nanolubricant with Al_2O_3 nanolubricant for application in compressor.
- Allowable concentration of SiO_2 and Al_2O_3 nanolubricants up to 1% and 0.3% respectively.
- It was recommended to use SiO_2 nanolubricant with concentration less than 1%.

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ABSTRACT

Currently, the possibility to enhance fuel efficiency with cutting edge advancements is thoroughly investigated by researchers. One of the best ways to increase the fuel efficiency is by improving the performance of the automobile air conditioning system. As a result, nanoparticles are dispersed in the lubricants of automobile air conditioning compressor for heat transfer and tribology enhancement. In this paper, viscosity and thermal conductivity of the SiO_2 nanoparticles dispersed in Polyalkylene glycol (PAG) lubricants for 0.2–1.5% volume concentrations and 303–353 K working temperatures was investigated and compared with Al_2O_3 nanolubricant. The viscosity and thermal conductivity of the nanolubricants increased with volume concentration but decreased with temperature. The paper proposed correlations for viscosity and thermal conductivity of SiO_2 nanolubricants at various concentrations and temperatures. The allowable volume concentration of SiO_2 and Al_2O_3 nanolubricants for application in automobile air conditioning compressors are up to 1.0% and 0.3%, respectively. The thermal conductivity of SiO_2 nanolubricants at 1.0% concentration is higher than Al_2O_3 nanolubricants at 0.3% allowable concentration. As a conclusion, it is advisable to use the SiO_2 nanolubricants with volume concentration of less than 1.0% for applications in automotive air conditioning system.