Comparative study of thermo-physical properties of SiO$_2$ and Al$_2$O$_3$ nanoparticles dispersed in PAG lubricant

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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$_2$O$_3$ 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$_2$O$_3$ 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$_2$O$_3$ 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.