

Energy saving in automotive air conditioning system performance using SiO₂/PAG nanolubricants

M. Z. Sharif^a; W. H. Azmi^a; A. A. M. Redhwan^{ab}; R. Mamat^a; G. Najafi^c

^a Faculty of Mechanical Engineering Universiti Malaysia Pahang, Pekan, Malaysia

^b Faculty of Manufacturing Engineering Technology TATI University College, Kemaman, Malaysia

^c Tarbiat Modares University Tehran Iran

ABSTRACT

The use of automotive air conditioning (AAC) nowadays is essential because of the hot climate and global warming. The AAC increases the overall fuel consumption in order to cool down the car cabin, hence releases more CO₂ into the atmosphere. Nanotechnology can be implemented into the lubricant of the AAC compressor which can aid in reducing the power consumption. Therefore, this paper investigates the effect of SiO₂/PAG nanolubricants on the AAC performance and energy saving. The SiO₂/PAG nanolubricants were prepared using the two-step method. The sedimentation observation and UV–Vis spectrophotometer evaluation confirmed the stability of the nanolubricants. The tribology analysis revealed the coefficient of friction of SiO₂/PAG nanolubricants better than the original PAG lubricants. The performance parameters and power consumption (energy saving) of AAC system using SiO₂/PAG nanolubricants were compared with PAG lubricants. The condenser pressure and the pressure ratio of the AAC system decreased by an average of 10.8% and 5.6%, respectively. The volumetric heat absorb increased up to 3% and the coefficient of performance increased by an average of 21%. The compressor work and power consumption of the AAC system reduced by 16.5% and 4%, respectively. As a conclusion, it was recommended to use 0.05% volume concentration of SiO₂/PAG nanolubricants in AAC compressor for optimum system performance and energy saving.

KEYWORDS:

Nanolubricants; Energy saving; Air conditioning; Heat absorb; Compressor work; Coefficient of performance