

The Stability of TiO₂/POE Nanolubricant for Automotive AirConditioning System of Hybrid Electric Vehicles

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Abstract:

Nanolubricant are containing nanoparticles that are mixed with the base lubricant. Nanoparticle consists of ultra-fine size of particles from 1 to 100 nm. It was widely used as additional material to enhance properties of lubricant. The thermo-physical properties of the nanolubricant enhanced and thus able to improve the performance of vapour compression refrigeration system (VCRS) and automotive air-conditioning (AAC) system. The stability condition is one of the priority in formulation of nanolubricant for new application in AAC system of hybrid electric vehicles (HEV). The main objective of this study is to investigate the stability of TiO₂ nanoparticles dispersed in Polyol-Ester (POE) lubricant. The TiO₂/POE nanolubricant was prepared at volume concentration of 0.01 to 0.1% using the two-step method without any surfactant. The stability investigations were conducted by using visual sedimentation observation, micrograph observation, UV-Vis Spectrophotometer measurement and zeta potential measurement. The findings by visual sedimentation observation showed the best stability condition for more than 14 days at 0.01% and 0.03% volume concentration. Meanwhile the optimum sonication time is observed at 5 hours by visual and supported by UV-Vis evaluation. Further, the concentration ratio from UV-Vis evaluation was recorded above 95% for 5 hours sonication time and more than 30 days observation. Finally, the Zeta potential for the present nanolubricant was measured with 81.1 mV and obtained within the range of very good stability condition. Hence, this can confirm a good stability condition for the present TiO₂/POE nanolubricant. Further investigation is required for the properties evaluation and performance of the nanolubricant in AAC system of HEV.

Keywords: Polyol-Ester (POE); Automotive Air-Conditioning (AAC); Vapour Compression Refrigeration System (VCRS)

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