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Tribology Performance of Polyol-Ester Based TiO₂, SiO₂, and Their Hybrid Nanolubricants

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Abstract

The tribology properties of TiO₂/POE, SiO₂/POE and TiO₂-SiO₂/POE nanolubricants were investigated for an automotive air-conditioning system with an electrically-driven compressor (EDC). A two-step preparation method was used in dispersing TiO₂ and SiO₂ nanoparticles into Polyol-ester (POE)-based lubricant at different volume concentrations of 0.01 to 0.1%. The coefficient of friction (COF) and wear scar diameter (WSD) were investigated using a Koehler four-ball tribo tester and microscopes. For the TiO₂/POE, SiO₂/POE and TiO₂-SiO₂/POE nanolubricants, respectively, the lowest COFs with maximum reduction were attained at 37.5%, 33.5% and 31.6% each at volume concentrations of 0.05%, 0.01% and 0.03%. The highest WSD reduction for the TiO₂/POE and SiO₂/POE mono nanolubricants were attained at 12.5% and 26.4%, respectively, at the same volume concentration of 0.01%. Meanwhile, the maximum reduction of WSD for the TiO₂-SiO₂/POE hybrid nanolubricant was reached at 12.4% at 0.03% volume concentration. As a conclusion, mono and hybrid nanolubricants with volume concentrations of less than 0.05% are suggested for use in air-conditioning systems with EDC because of their outstanding tribology performances. Further performance investigation of nanolubricants in the air-conditioning system is required to extend the present work. © 2023 by the authors.

Author Keywords

coefficient of friction; four ball tribo tester; nanolubricants; polyol-ester; tribology; wear scar diameter

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