Rheological Characteristic and Optimization of Novel TiO_2-POE nanolubricant using response surface method (RSM) for compressor's air conditioning system application

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Abstract. This study aims to determine the viscosity characteristics of TiO_2-Polyolester (POE) nanolubricant and optimize it for heat transfer applications in compressor air conditioning systems. A magnetic stirrer was used to mix TiO_2 and POE lubricant for 30 min. The nanolubricant was then ultrasonicated with a probe for 120 min to stabilize the TiO_2-POE nanolubricant. There were seven different types of samples examined in this study, with concentrations of 0, 0.05, 0.15, 0.25, 0.35, 0.45, and 0.85 vol%. Rotational Rheolab QC was used to quantify viscosity from 30-90 °C. The viscosity of nanolubricant augmented as the proportion of nanolubricant increased. In contrast, when the test temperature rises, the viscosity drops. The greatest viscosity rise was 56.657 % at 0.85 vol % at 80 C, while the lowest viscosity increase was 0.029 % at 0.05 % at 30 C. Based on the Response Surface Approach, optimization using the Multivariable Functions Optimization (MBFO) method with the Central Composite Design (CCD) type. The uncertainty analysis was also performed in this study. The most optimum dynamic viscosity is 34.8098 mPa.s. At a temperature of 60 °C, this condition was achieved in samples with a concentration of 0.45 vol %.

Keywords: Central composite design (CCD), Response surface methodology (RSM), Newtonian, Viscosity, TiO_2-Polyolester (POE) nanolubricant

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