

An experimental study on characterization and properties of nano lubricant containing Cellulose Nanocrystal (CNC)

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ABSTRACT

Nano-lubricant is a new kind of engineering lubricant composed of nanometer-sized particle dispersed in a base lubricant. Recently, nanoparticles have been explored as lubricant additives for improving the stability and lubricity properties of a technological fluid. Cellulose nanocrystals (CNC), a unique and natural material extracted from native cellulose, has gained much attention in many field application due to its remarkable physical properties, special surface chemistry, and excellent biological properties, making them attractive as a green lubricant additive. The purpose of this study is to investigate the characterization of the CNC nanoparticles and to evaluate the influence of CNC nanoparticles on the lubricating properties added to the base oil. In this study, CNC nanoparticles were prepared and suspended in five different volume concentrations in the engine oil (0.1, 0.3, 0.5, 0.7 and 0.9%). The kinematic viscosity and viscosity index of the resulting nano lubricant was determined while varying both the nanoparticle volume fraction and the temperature. The size, morphology, and structure of CNC nanoparticles were characterized using Field Emission Scanning Electron Microscope (FESEM), Energy Dispersive X-ray (EDX) and X-ray diffractions (XRD). The dispersion analysis of CNC nanoparticles in lubricating oil using UV spectrometer confirms that CNC nanoparticles possess good stability and solubility in the lubricant and improve the lubricating properties of the engine oil. The overall results of this experiment reveal that the addition of CNC nanoparticle with base Oil SAE40 lubricant shows the highest value of VI and most suitable concentration for improving properties of the base oil.

KEYWORDS:

Cellulose nanocrystals; Lubricant additives; Nanoparticles; Kinematic viscosity; Viscosity index