Copper (II) oxide nanoparticles as additve in engine oil to increase the durability of piston-liner contact

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ABSTRACT

In the current decade, the development of recyclable, renewable, and sustainable products to replace fossil products is an essential and important matter for industrial and environmental purposes. In the present study copper (II) oxide nanoparticles were dispersed in SAE10W-30 to reduce wear and friction on piston skirt. Moisture content and viscosity values were analysed to study the physical properties of the dispersed lubricant. The wear and friction performance was evaluated using a piston skirt-liner contact tester, and the material used was aluminium 6061, which is the standard material for piston skirt. The design of experiment (DOE) was constructed using the response surface methodology (RSM) technique. The influence of different operating parameters such as rotational speed (200 rpm, 250 rpm, 300 rpm), volume concentration (0.005% and 0.01% of dispersed nanomaterial), and load (2 N, 5.5 N, and 9 N) were determined and optimal lubricant concentration was obtained. FESEM was used to identify the type of wear occurring during the experimental process. The results showed that CuO nano-particles dispersed in the base oil exhibited good friction-reduction and anti-wear properties. The coefficient of friction obtained was 0.06125 and the wear rate was 0.2482 mm^3/Nm when a concentration of 0.005% was used. SEM results showed that the constituent element of the nano-particles precipitated at the contact area. A protection layer was observed during the EDAX analysis. The optimal parameters obtained were 0.008% concentration; 291 rpm speed and 75.152 N load.

Keywords: Nanoparticle, Copper (II) oxide, Engine oil, Durability