

Experimental Investigation of Tribological Properties Using Nanoparticles as Modifiers in Lubricating Oil

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Abstract-Nanoparticles can be used as an additive in the engine oil to improve its tribological properties to reduce wear and friction of the engine. In this research molybdenum disulphide (MoS_2) and copper oxide (CuO) nanoparticles are added to engine oil SAE20W50 and tribological properties are investigated. Samples were prepared of varying percentage of CuO and MoS_2 nanoparticles in engine oil (0.25, 0.5 and 1 wt. %). The friction and wear tests were performed on DUCOM's four ball tribo-tester and the tests were performed with varying concentration of nanoparticles in engine oil. Also viscosity tests were performed on Redwood viscometer for different samples at three different temperatures. The experimental observations show that MoS_2 , CuO nanoparticles added in engine oil exhibits good friction reduction and anti-wear properties and also decreased the coefficient of friction by as compared with standard engine oil without MoS_2 , CuO nanoparticles. This tribological behavior is closely related to the deposition of nanoparticles on the rubbing surfaces.

Keywords – MoS_2 , CuO nanoparticles, tribological properties, engine oil, friction coefficient, wear

1. INTRODUCTION

Nowadays nanoscience is one of the most expansively developing spheres of world's science and its achievements can be applied in different areas of science and technology. For example nanomaterials, existing in the form of so called nanostructures (nanotubes, nanowires, nanopowders and others) that are wider and wider used in many fields of human activity - from cancer treatment through to engineered textiles or energy storage to rocket propellant and explosives. And it is beyond a doubt that numerous new fields of nanostructures application will arise in the nearest time. One of them seems to be the unexplored area of nanostructures use as additives

modifying properties (especially tribological) of lubricating or cutting oils.

Nanotechnology is regarded as the most revolutionary technology of the 21st century. It can be used in many fields and material science into a new era. In recent years numerous investigations have been carried out on the tribological properties of lubricants with different nanoparticles added in it. A large number of papers have reported that the addition of nanoparticles to lubricant is effective in reducing wear and friction. Among those that were added into oils, MoS_2 nanoparticles have received much attention and exhibited excellent applications for their good friction reduction and wear resistance properties. The reduction of wear depends on interfacial conditions such as normal load, geometry, relative surface motion, sliding speed, surface roughness, lubrication, and vibration. In addition, anti-wear properties, load-carrying capacity and friction reduction are mainly controlled by the chemical additives in lubricating fluid under boundary lubrication conditions. Since stabilization of nanoparticles has been resolved by the addition of a dispersing agent to the use of a surface modification preparation technique, inorganic nanoparticles have received considerable attention in the lubrication field. Nanoparticles have received considerable attention because of their special physical and chemical properties. The preparation of organic-inorganic complex nanoparticles was causing more interest in science and industry. Now, a number of these nanoparticles have been synthesized and many of them have been studied as lubrication oil additives. However, few of them were used and studied as water-based lubrication additives. In recent years, with the development of nanomaterial, many scientific researchers have added nanoparticles into lubricating oils to improve extreme pressure, anti-wear and friction reducing properties, and efficiency and service life of machinery were improved and prolonged. The application of advanced nanomaterials



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