World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:8, No:07, 2014

The Impact of Surface Roughness and PTFE/TiF3/FeF3 Additives in Plain ZDDP Oil on the Friction and Wear Behavior Using Thermal and Tribological Analysis under Extreme Pressure Condition

Authors : Gabi N. Nehme, Saeed Ghalambor

Abstract : The use of titanium fluoride and iron fluoride (TiF3/FeF3) catalysts in combination with polutetrafluoroethylene (PTFE) in plain zinc dialkyldithiophosphate (ZDDP) oil is important for the study of engine tribocomponents and is increasingly a strategy to improve the formation of tribofilm and to provide low friction and excellent wear protection in reduced phosphorus plain ZDDP oil. The influence of surface roughness and the concentration of TiF3/FeF3/PTFE were investigated using bearing steel samples dipped in lubricant solution @100°C for two different heating time durations. This paper addresses the effects of water drop contact angle using different surface finishes after treating them with different lubricant combination. The calculated water drop contact angles were analyzed using Design of Experiment software (DOE) and it was determined that a 0.05 µm Ra surface roughness would provide an excellent TiF3/FeF3/PTFE coating for antiwear resistance as reflected in the scanning electron microscopy (SEM) images and the tribological testing under extreme pressure conditions. Both friction and wear performance depend greatly on the PTFE/and catalysts in plain ZDDP oil with 0.05% phosphorous and on the surface finish of bearing steel. The friction and wear reducing effects, which was observed in the tribological tests, indicated a better micro lubrication effect of the 0.05 µm Ra surface roughness treated at 100°C for 24 hours when compared to the 0.1 µm Ra surface roughness with the same treatment.

Keywords : scanning electron microscopy, ZDDP, catalysts, PTFE, friction, wear
Conference Title : ICEMA 2014 : International Conference on Engineering Materials and Applications
Conference Location : London, United Kingdom
Conference Dates : July 27-28, 2014