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A new insight into the interfacial mechanisms of the tribofilm formed by Zinc Dialkyl Dithiophosphate

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Understanding the true interfacial mechanisms of the growth of the tribofilms generated by Zinc Dialkyl Dithiophosphate (ZDDP) is important because it is the most widely used anti-wear additive and there is legislative pressure to find efficient environmentally friendly replacements. The main focus of this study is to investigate the durability of the ZDDP tribofilm and correlate it to the chemical properties of the glassy polyphosphates. The effect of parameters such as temperature and load on tribofilm formation and its durability has been studied experimentally by using a Mini Traction Machine (MTM) with the Spacer Layer Interferometry Method (SLIM) attachment. The role of additive depletion on the pre-formed tribofilm thickness under mechanical stress has also been studied. Results show that physical parameters such as temperature and pressure significantly influence the tribofilm. XPS analyses were carried out before suspending the test and after changing the oil to assess the difference in chemical structure of the tribofilm before and after stopping the test. The chemical analyses suggest that there are different chemical properties across the thickness of the tribofilm and these determine the durability characteristics. Tribofilm durability so far has not been studied extensively. The experimental results in this paper show for the first time that running conditions do not affect only the formation of the tribofilm but also its durability and as such it should be considered in the tribochemical studies of such additives.

Biography

Pourya Parsaeian holds a bachelor degree in chemical engineering. In 2009, he finished his MSc in advanced chemical Engineering. After being exposed to academic environment he decided to pursue PhD in Mechanical Engineering (Tribology). Therefore, he started his PhD in tribology of bearings in a dynamic research group led by Professor Anne Neville. He finished his PhD in 2016 and currently, he is a joint researcher at the University of Leeds and SKF Engineering Centre in Netherlands investigating bearing design and performance to alleviate the effects of tribocorrosion in industrial sectors. His research area employs a combination of experimental, analytical and theoretical techniques to understand the effect of different parameters such as water, load and temperature on wear, friction and tribofilm formation and durability under rolling/sliding conditions. To assess the effects of water and its tribochemistry on tribological performance, he designed a novel humidity control system, which was integrated for the first time with MTM/SLIM to study the effect of both relative humidity and water contamination interactions with lubricant additives.

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