

The Effect of Fuel and Soot on Tribofilm Formation from ZDDP-Containing Lubricant Oils with Different Friction Modifiers

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Keywords: Lubricant oil, Tribochemistry, Contamination, Friction Modifier

ABSTRACT

The negative impact of contamination on the tribological performance is ubiquitous of lubricants. How contaminants affect the formation of tribofilm is less well understood [1-3]. In this study, 5 wt.% gasoline or 0.5 wt.% was added to the lubricants and the effect of them on the tribochemistry was studied by using the MTL-SLIM tribometer system. The results show that the formed patched-like ZDDP tribofilms were quite different: large size for the oil with inorganic friction modifier (MoDTC) but smaller size for the oil with the organic friction modifier (Amide). When gasoline was added to the lubricating oil, the friction coefficient of the lubricant with inorganic friction modifier increased significantly (from 0.06 to 0.08) but that of the lubricant with organic friction modifier kept almost unchanged (~0.095). The lubrication mechanism of the oil with/without contamination are discussed in terms of the viscosity, wear mechanism and tribofilm thickness and chemical composition.

REFERENCES

1. P.R. Ryason, I.Y. Chan, J.T. Gilmore, Polishing wear by soot, **Wear** 137 (1) (1990) 15-24.
2. H. Cen, Effect of water on the performance of lubricants and related tribochemistry in boundary lubricated steel/steel contacts, **University of Leeds**, Thesis (2012).
3. F. M.Salehi, A.Morina, A.Neville, The effect of soot and diesel contamination on wear and friction of engine oil pump, **Tribology International** 115 (2017) 285-296.

Biography

Dr. Shusheng Xu is a Research Fellow in the Institute of Functional Surfaces (iFS), School of Mechanical Engineering, University of Leeds (UK) since February 2018. He got his PhD in the major of materials science in Lanzhou Institute of Chemical Physics (LICP), Chinese Academy of Sciences (CAS), and joined the State Key Laboratory of Solid Lubrication (SK-LSL), LICP, CAS from July 2014. He joined in the Center for Nano-Wear, Department of Mechanical Engineering, Yonsei University (South of Korea) since August 2016. His research interests are solid lubricant film, tribochemistry and synthesis of lubricant materials. As the first author, he has published 12 papers in peer-reviewed international journals including *Carbon*, *Tribology Letters*, *Applied Surface Sciences and Materials & Design* etc.