

THE EFFECT OF LUBRICANT CONTAMINATION WITH WATER ON FRICTION MODIFIERS TRIBOFILM PROPERTIES

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ABSTRACT

Friction and wear are unavoidable in mechanical systems with moving parts; however, their impact can be mitigated with the appropriate use of chemical additives in lubricants. Under severe conditions, these additives undergo tribochemical reactions, creating a thin tribofilm that reduces friction and wear. However, the tribofilm's growth and effectiveness can be adversely affected by the presence of water in the lubricant. The current study aims to: (i) analyse the chemical composition of the low friction tribofilm both with and without water in real-time and (ii) study the effect of film growth on the dynamics of friction and wear (Fig.2). Several formulated oils containing organic (OFM) and inorganic (MoDTC) friction modifiers have been tested using a bespoke pin-on-disc tribometer [1] integrated with Raman spectroscopy for real-time tribofilm analysis (Fig.1). SEM-EDS and FIB-TEM were also employed to obtain the tribofilm chemical composition and thickness. The paper will discuss in detail the effect of water contamination on low-friction tribofilm chemical composition and its tribological performance relevant to the lubrication of

hybrid engines.

Fig.1 Schematic of In-situ tribometer used for friction tests

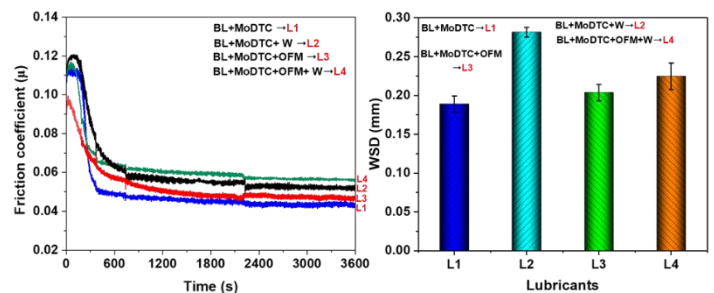


Fig.2 (i) Variation in friction with time and (ii) wear scar diameter for different lubricants containing friction modifiers and water

REFERENCES

- [1] Dorgham A, Neville A, Ignatyev K, Mosselmans F, Morina A. An in situ synchrotron XAS methodology for surface analysis under high temperature, pressure, and shear. *Rev Sci Instrum* 2017;88:015101. <https://doi.org/10.1063/1.4973354>.

