STUDY OF THE EFFECTS OF GASOLINE CONTAMINATION IN ENGINE OIL ON FRICTION AND WEAR

M. Nejadhamzeeigilani [a*], Q. Zhou [b], L. Pratt [a], A. Barnes [a], J. Kanja [a], A. Morina [a], S. Kosarieh [a], A. Neville [a]
*mn11mn@leeds.ac.uk
[a] Institution of Functional Surfaces (iFS), School of Mechanical Engineering, University of Leeds, UK
[b] Changan UK R&D Centre Ltd., Parkside, Birmingham Business Park, Birmingham B37 7YG

1. Introduction

The effects of oxidation and contaminants such as soot, water, fuel and dust particles on engine lubrication have attracted significant interest and research within the area is growing as engine lubrication is critical factor of automotive performance and longevity [1-2]. Another reason industries and research are focusing on engine lubrications is due to their environmental impacts as the performance of engine lubrication effects such environmental factors such as exhaust emissions and engine efficiency [3].

Around 25% of automotive engine friction occurs in the valve train, with an estimated 80-85% of the friction losses taking place at the cam follower and the rest due to stem and valve guide, bearings, tappet and tappet bore [3-4].

This paper assesses how gasoline as an engine lubrication contaminant affects the tribology of the lubricant within valve train system. The study will focus mostly on the interface between the cam and follower to explore how gasoline affects the characteristics of the lubrication in these interfaces.

2. Methodology

The tribological experiments in this investigation were conducted using a high frequency reciprocating rig Cameron-Plint TE77. Fully formulated oil with various concentrations of gasoline from 0% to 12% were used at 25°C, 40°C and 80°C.

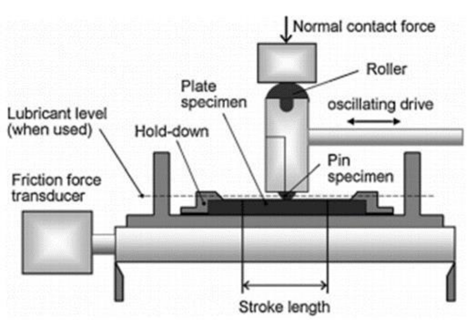

Figure 1: Schematic diagram of HFRR Cameron-Plint TE77 tribometer [1]

3. Results

The trends seen in friction at all three temperatures showed that there was an increase in friction coefficient mainly around 4% to 8% compared to the other concentrations.

For wear of the pins an inverse trend is seen to that for friction.

The viscosity of the solution also decreases as the gasoline concentration level in the fully formulated oil increases; this trend does not correspond with the friction and wear trends.

Investigations have also shown that due to the operating temperatures, lighter compounds of the gasoline evaporate at a higher rate than the heavier components, causing a build-up of heavier components of the gasoline which can be affecting the performance of the lubricant despite the decrease in viscosity.

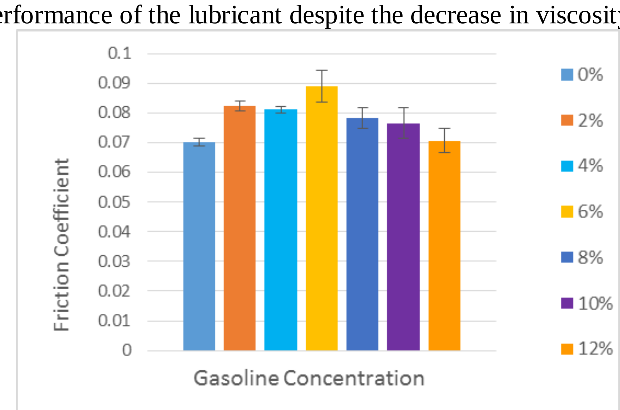

Figure 2: Friction coefficient results at 25°C tests

4. Conclusion

Results from this study have shown that the friction and wear experience in the presence of gasoline are not solely influenced by the viscosity change caused by the gasoline, and this paper assesses how gasoline affects the tribochemistry of the interface.

5. References

[1] Soleimani, M. et al. 2013. Engine oil acidity detection using solid state ion selective electrodes. Tribology International. 65(0), pp.48-56

[2] Kaleli, H. and Yavasliol, I. 1997. Oil ageing - drain period in a petrol engine. Industrial Lubrication and Tribology. 49(3), pp.120-126

[3] Ofune, M. et al. 2015. Development of valve train rig for assessment of cam/follower tribochemistry. Tribology International. (0)

[4] Kano, M. 2006. Super low friction of DLC applied to engine cam follower lubricated with ester-containing oil. Tribology International. 39(12), pp.1682-1685