MOS_2 NANO SHEETS FORMATION KINETICS FROM LOW VISCOSITY LUBRICANTS

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ABSTRACT
The future of engine oils is moving towards lower viscosity oils, enabling a reduction of energy losses in systems such as pumps but also increasing the boundary lubrication occurrence in engine components in the cylinder block. Friction and wear in boundary lubrication are highly determined by chemical properties of the lubricant, where important features are solvency, dispersancy, detergency, antiwear, anticorrosion, frictional properties, and antioxidant capacity. Some of these properties are already part of the base oil mixture, and others are introduced separately as additives in the oil [1].

This study focuses on the friction and wear performance of fully formulated oils containing MoDTC friction modifier at different concentration. This additive is known to produce MoS_2 molecular sheets in the tribocontact providing a low coefficient of friction under boundary lubrication conditions. However, there is a gap of knowledge considering oil friction behaviour and formed tribofilm quality. The study conducted in [2] has set the combined Raman Spectroscopy and AFM methodologies as efficient techniques to quantify tribofilm distribution and thickness. In the current study, this methodology has been used to study the kinetics of MoS_2 formation from MoDTC in a low viscosity engine oil, during the induction time and their effect on friction and wear.

Tribological tests using low viscosity fully formulated oils are run. Rheological properties of the oils are modified by varying the base oil and the polymeric viscosity modifier, keeping the rest of the oil composition constant. Oils are blended with 0.2, 0.5, 0.7 and 1 wt% MoDTC friction modifier and tested in boundary lubrication regime using a pin-on-disk tribometer.

Raman Spectroscopy, AFM and FIB/TEM systems are used to analyze the formed tribofilm chemical and structural quality on the wear track surface.

A correlation between MoDTC concentration in the oil and the duration of the induction time prior to the friction reduction has been observed. This performance has been linked to the physical and chemical properties of MoS_2 tribofilm formed on the wear scar.

REFERENCES

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