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Entrapped Grease Film Behavior under Sliding Motion

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This study presents an experimental study of the effect of grease thickeners on the behavior of the grease entrapped film formed by vertical motion in EHL point contact. It is also shown that there is a relationship between the behavior of the grease entrapped film, the film thickness under rolling conditions, and the bearing performance.

Keywords: Grease, Thickener, EHL, Film thickness

1. Introduction

Grease have been widely used as lubricants, however the behavior of grease composed of base oil and thickener is complicated and has not been completely elucidated. The purpose of this study is to make clear the mechanism of grease lubrication by direct observation of grease EHL film.

2. Methods

The film thickness was measured using optical interferometry technique. The EHL contact was composed of the glass disc (E_D = 80 GPa) of 180 mm diameter with chromium coating and the steel ball (E_B = 206 GPa) of 25.4 mm diameter. Figure 1 shows experimental procedure. The steel ball approaches the glass disc at v_{im} = 1 μm/s and comes into contact with it, and a load 50 N is applied. At this time, a thick thickener-rich film is formed [1]. After that, slide at u_D = 10 μm/s and observe the time change of the film and friction.

3. Results and Discussion

Figure 1 and 2 show time variations of Interferogram and friction coefficient for Li greases. The initial film thickness of Li-A is very thick over 3 μm, and the film thickness does not become 0 in the test range and the friction coefficient is over0.03 or more for most period. On the other hand, the coefficient of friction of Li-B and Li-C are about 0.1 for a long period and then rises to a value higher than Li-A. In the interference image, the film thickness is very thin and it can be seen the friction increases due to the direct contact between the two surfaces. This difference is due to the difference in the strength of the interaction of the thickeners, and this tendency was confirmed for the bearing torque. Depending on the operating conditions, it is necessary to select the optimum thickener, such as protecting the surface or reducing the resistance.

4. References

[1] Nishikawa, H. and Ikeda, N., Behaviour of grease EHL films at very low speed, WTC2017, Beijing, 2017.9, PS1-68.

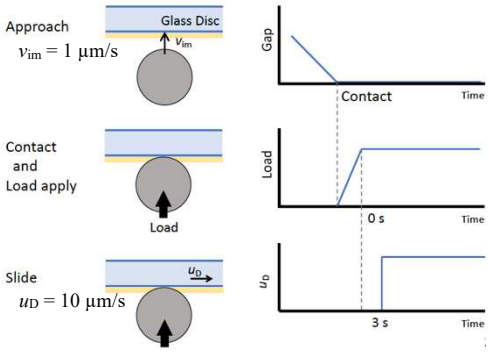

Figure 1: Experimental procedure.

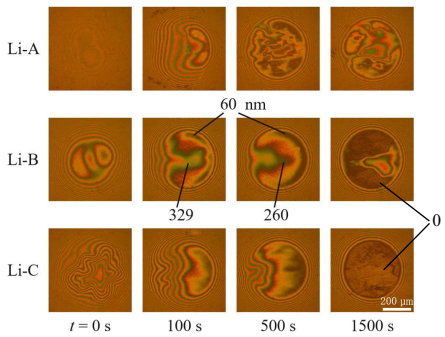

Figure 2: Time variations of Interferogram.

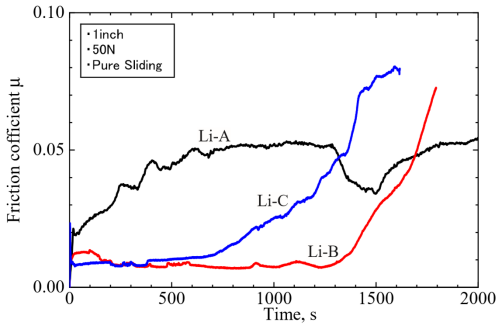

Figure 3: Time variations of Friction coefficient.