

### GREASE FORMS THICK ELASTOHYDRODYNAMIC LUBRICATION FILM AT LOW SPEEDS

Many rolling contacts in practical applications are lubricated with grease, where the ease of application has been considered to be its main reason. However, it has been found that grease forms thicker elastohydrodynamic(EHL) film than lubricating oil at low speeds, which must have contributed to lower friction torques at low speeds and to prevention of surface damage like fretting.

Film thickness of grease was determined in rolling contact between a glass disk and a steel ball of 19.05mm in diameter in pure rolling contact under a load of 20N at room temperature by ultrathin-film optical interferometry "SLIM" developed in Imperial College, Fig.1.

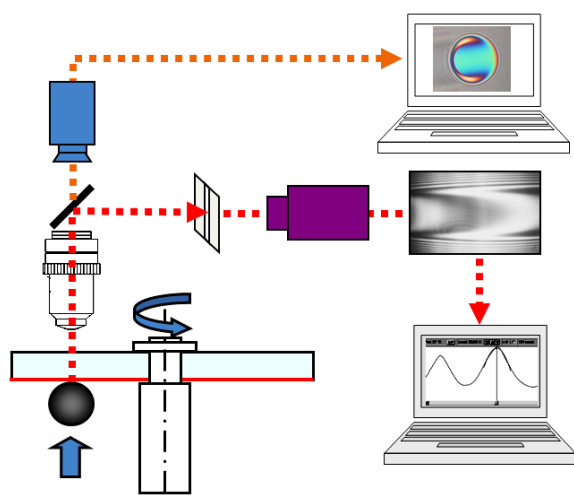


Fig.1 Interferometry setup

Three sample greases A, B, C were prepared with synthetic hydrocarbon of different viscosity, A:25mm<sup>2</sup>/s, B:81mm<sup>2</sup>/s, C:741mm<sup>2</sup>/s, as the base oils and lithium stearate as the thickener; the concentration of the thickener was adjusted to have a consistency number 3.

The measured central film thickness with grease A: ▲, B: ■, C: ● is plotted against entrainment speed in Fig.2, where the three lines show the central film thickness with their base oils alone. At higher speeds, the greases formed films thicker than their base oils alone but followed the EHL theory. On decreasing speeds, however, the film thickness of grease deviates from the EHL theory. After taking a minimum it increases again with the further decrease in the speed to form much thicker film than their base oil.

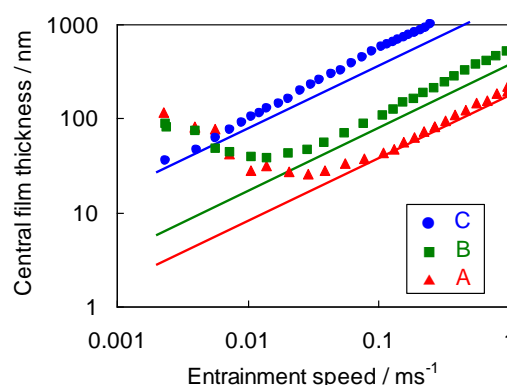


Fig.2 Change in central film thickness with speed

Different grease causes different extent of increase in the film thickness at low speed. Figure 2 shows its difference caused by different base oil viscosity, but it is also caused by the different type of the thickener.

The nature of the thick films at low speeds has been under discussion and it could differ depending on the conditions as well as greases. In the present case, interferometry revealed that, although thin, the "horseshoe" peculiar to EHL film was clearly observed at very low speed as is shown in Fig.3.

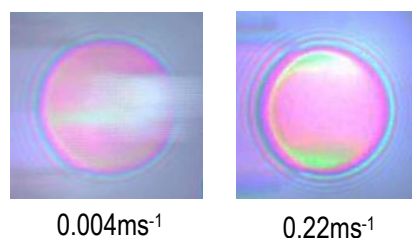


Fig.3 "Horseshoe" with grease A

Y. Kimura, T. Endo and D. Dong, "EHL with grease at low speeds", Jianbin Luo, Yonggang Meng, Tianmin Shao and Qian Zhao (eds.), *Advanced Tribology - Proceedings of CIST2008 & ITS-IFTtoMM2008 Beijing, China (2009)* pp.15-19.