

EFFECT OF TEMPERATURE ON TRIBOLOGICAL PERFORMANCE OF MODTC

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KEYWORDS

MoDTC; friction modifier; temperature effect; tribofilm; MoS₂

ABSTRACT

Molybdenum dithiocarbamate (MoDTC) is well-known as a friction modifier to obtain low friction coefficient under boundary lubrication conditions [1]. It has been reported that the tribological performance of MoDTC is affected by many factors such as concentration of MoDTC, combination of co-additives such as an anti-wear additive, base oils, contact conditions and temperature [2]. In this report, we focused on the effect of temperature on lubrication property of MoDTC. Lubrication tests were carried out in 400 ml of lubricant oil containing ca.2000ppm of MoDTC and ca.2500ppm of calcium sulfonate (CaSU) at temperatures of 25, 40, 60 and 80°C.

Typical curves of friction coefficient obtained at different temperatures were shown in Figure 1. The friction coefficient decreased readily after an induction period and became to be constant at higher temperature than 40°C. It was found that a shorter induction period, a steeper slope and a lower friction coefficient at a steady state were observed at higher temperature. These results can be explained by the formation rate of MoS₂ from MoDTC becomes to be higher at higher temperature. It was observed that friction coefficient was sensitive to the temperature of lubricant oil. Friction coefficient was changed reversibly by oil temperature.

Tribo-films on ball surface were analyzed with HR-TEM and XPS after lubrication tests. XPS analyses revealed that the intensity ratio of Mo(IV)/Mo(VI) was increased at higher temperature. This result suggests that low friction coefficient can be obtained by high MoS₂ content in the tribo-film formed at higher temperature. Moreover, highly oriented structure of MoS₂ in the tribo-film formed at 80°C was observed by TEM observation. It can be concluded that low friction coefficient at 80°C is originated from the highly oriented MoS₂ structure in the tribo-film.

A steady state model of tribo-film formation will be discussed.

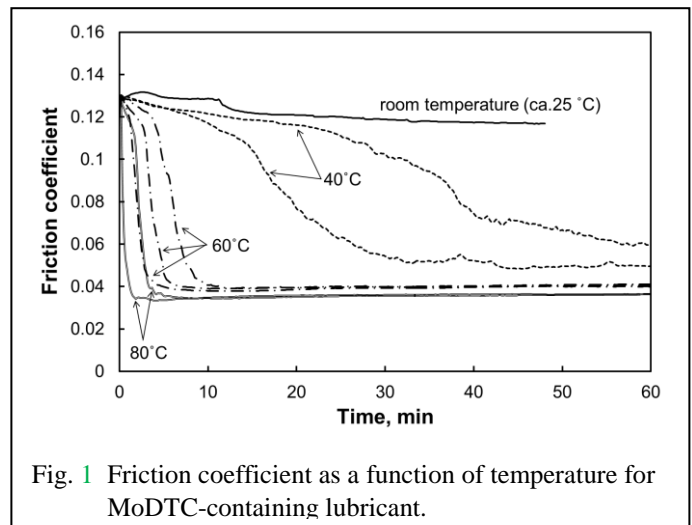


Fig. 1 Friction coefficient as a function of temperature for MoDTC-containing lubricant.

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