Impact of Grease Churning type on Grease Leakage, Oil Bleeding and Rheology

Sathwik Chatra K R[1, 2)*] and Piet M Lugt[1, 2)]

[1)]SKF Research and Technology Development, The Netherlands.
[2)]University of Twente, The Netherlands.
*Corresponding author: sathwik.chatra@skf.com

Grease performance is strongly determined by the properties and quantity of the grease after the churning phase where grease reservoirs are formed. During this phase macroscopic flow takes place, leading to drag forces imposing energy onto the grease causing mechanical degradation. A good/peak-churning type grease shows a short churning period with less energy and therefore less grease degradation, a poor/plateau-churning type grease shows a long churning period with large grease degradation. This paper describes the impact of grease type on the grease properties such as bleed and leakage.

Keywords (from 3 to 5 max): Grease Lubrication, Rolling Element Bearings, Lubricating Grease

1. Introduction

Early rotation of a grease lubricated bearing results in macroscopic grease flow, leading to drag forces, grease degradation and thus rise in temperature. The temperature will stay high until most of the grease is pushed to the unswept area. At this point this flow will stop and the contacts will be lubricated mainly by the oil that is slowly bleeding from the more-or-less stationary grease. This leads to a reduction in temperature, which remains more-or-less constant after this. This phase is called "bleeding phase". We have earlier characterized greases into good/peak type and poor/plateau type based on these temperature profiles[1]. Basically, a good/peak-type grease has a short churning period and a poor/plateau-type grease has a long churning period. More specifically, this is measured by the imposed energy E', a concept that was earlier explored by Kuhn [2]. In this study the impact of churning type on grease properties like grease leakage, rheology and oil bleeding capabilities are evaluated.

2. Methods

Bearing experiments

2.3. Experiments have been performed with 6204 DGBB bearings in R0F+ with 15000 rpm speed and 150N radial load. Collected grease samples from bearing tests were measured for its rheological properties and grease leakage and correlated with the imposed energy E'

2.4. Roll Stability Test (RST)
A modified RST method was used to age two greases at the churning temperatures (110℃ and 125℃).

2.5. Oil bleeding measurement
The oil bleed capabilities were measured using the SKF MaPro method for grease samples aged in the RST

2.6. Results
Grease leakage increased with increased E'. The change in the oil bleeding capability can be described by the level of grease degradation where this initially increases and subsequently decreases. For the good/peak-type grease, tackiness increased and stayed constant during the churning period whereas for a poor/plateau-type grease it decreased.

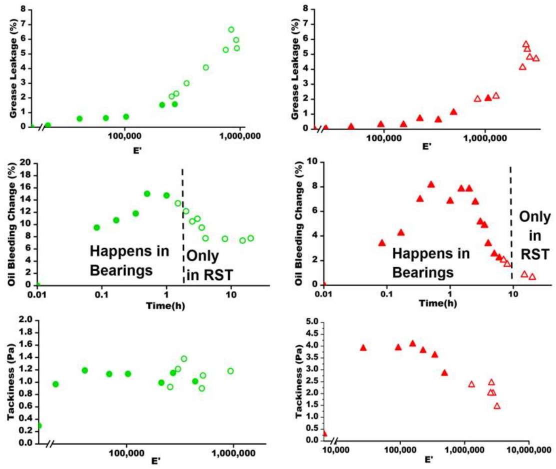

Figure 1: Grease properties. Good/peak-type (green markers) and Poor/plateau-type (red markers)

3. Discussion

Changes in grease properties such as grease leakage and tackiness in a bearing are correlated with the Energy input (E'). In the early period of degradation, the oil bleeding increased due to grease microstructural changes. Later degradation of the fibers itself resulted in a decrease in the oil bleed probably due to the increased surface area. The same happens in a bearing but the degradation will be less severe as in the RST. Mechanical degradation clearly also leads to a reduction in tackiness.

4. References

[1] Chatra, K. R. S. and Lugt, P.M., "Channeling Behavior of Lubricating Greases in Rolling Bearings: Identification and Characterization," Tribology International, 143, 2020, 106061

[2] Kuhn, E., "Investigations into the Degradation of the Structure of Lubricating Greases," Tribology Transactions,41, 2, 1998, 247-250.