Lube-Tech

PUBLISHED BY LUBE: THE EUROPEAN LUBRICANTS INDUSTRY MAGAZINE

No.74 page 1

Synthetic Basestocks - Synergy with Greases

Summary

The continuing debate on how to describe or define lubricating grease has not prevented it from becoming an important component of modern automotive and industrial machinery. Between 80-90% of all rolling element bearings are now grease lubricated [1]. This is easily explained if we look at the numerous reasons for employing grease. Similarly synthetic basestocks offer numerous advantages over conventional mineral basestocks. Comparing the benefits of both grease and synthetic basestocks we can see a natural fit that encourages grease manufacturers to make tailored, high performance synthetic lubricants.

Recent developments in polymer thickener technology which extends grease life significantly [2] make the use of synthetic basestocks such as Polyalphaolefins and Alkylated Naphthalenes highly desirable for manufacturing high performance greases.

This paper will look at these specific synthetic basestocks and the benefits they offer the grease manufacturer whether that be long life, improved film thickness, energy saving, NSF registration or solvency.

Introduction

It seems strange that despite the long history of grease utilization, debates still continue about its definition. Derived from the Latin word "Crassus" meaning fat [3], simple descriptions for greases have included "a thick-ened lubricant" [4], "thinned down soaps" [5], "a plastic fluid" [6], and less commonly "an elusive butterfly"[5].

A typical description of a grease is that of a three dimensional matrix of thickener particles with the spaces in the matrix filled with a lubricating oil. As the matrix is compressed under load, the oil is released to provide its lubricating function. Based on this, it is easy to see how the common analogy of a sponge full of oil became standard teaching (Figure 1).

Figure 1. the 'Grease sponge'

However, as we now know, things are not as simple as that and greases are really "a complex, physical, multi-phase system" [7]. The films that separate moving surfaces are a combination of the thickener and lubricant. Logically, this should not be a surprise - it is the properties given by the combination of thickener and oil which makes grease so useful.

In general, greases stay where they are put. Imagine trying to lubricate a vertical slide way with oil or the bouncing wheel bearing on a car. The thickener acts as a seal, keeping oil in and contamination out. This of course also has the negative effect of keeping internal wear debris within the grease. However, the fact that the grease remains in place is vital in helping reduce the effects of corrosion, especially on standby equipment where oil films drain away. Noise reduction and the ability to deal with shock loading are also features of grease lubrication.

The lack of fluidity does reduce the ability of grease to provide a cooling function but in the majority of applications temperatures are relatively low and cooling can be implemented through suitable design features i.e. electric motor fans. We can of course make semi fluid greases which act like thick oil. These will flow under gravity (slump) and get splashed about by mechanical motion which helps with heat transfer but still have the ability to provide a sealing function.
In comparison to oils, greases require less maintenance and, even when replen-ishment is required, this can be achieved automatically either individually per bearing or via a central pumped multiple discharge system.

In general, the benefits of grease lubrication far outweigh the disadvantages and it is therefore no surprise that between 80-90% of all rolling element bearings are now grease lubricated [1].

Thickeners

The thickener is used to create a 3 dimensional matrix with which to hold the lubricant. The final properties of the grease can be adjusted by using different types of thickeners of which there are many different options offering certain advantages and/or disadvantages. They are generally classified as soap based (e.g. lithium, sodium or calcium) or non soap based (clay or polymer). The thickener needs a good affinity with the lubricant and the ability to create a stable matrix with a uniformly dispersed lubricant.

The thickener, so often thought of as just a "sponge", has, in fact, an extremely difficult balancing act:

- It needs to be mechanically and thermally stable.
- It needs to be able to flow at low temperatures,
- It needs to hold the lubricant in its structure but allow some oil bleed at all temperatures,
- It needs to have an affinity for the surface in order to remain where it is put even under arduous conditions such as high pressure water spray,
- It needs to protect that surface from the environment whilst not interfering with the surface active additives,
- It needs to provide part of the lubricant film thickness under ElastoHydroDynamic (EHD) lubrication conditions [10].

Due to their properties, lithium complex thickeners are very popular offering the ability to create high performance multi-purpose greases. For electric motor bearings requiring long life at relatively high operating temperatures and low loads, polyurea thickeners have become