Lube-Tech
PUBLISHED BY LUBE: THE EUROPEAN LUBRICANTS INDUSTRY MAGAZINE
No.95 page 1

Combination of novel antioxidant system and thermally stable esters for high temperature greases

Siegfried Lucazeau
Product Manager, Automotive & Industry, NYCO, France

Introduction

High temperature lubricating greases can be described as long service life products suitable for use at elevated temperatures. These products may be found in a variety of equipment running at high temperatures: plain and roller bearings, slideways, transmission axles, gears, chains… Such greases are normally expected to show the following general features:

- High dropping point
- High resistance to oxidation
- Low evaporation rate at high temperatures
- Controlled oil separation at high temperatures
- Good mechanical stability (even though this is desirable for any type of grease)

In order to obtain the above properties, base fluids (as main constituents of greases) are generally chosen from high quality group IV or V synthetic products: PAO, esters, silicones, or fluorinated compounds, for instance. These fluids will indeed show good to outstanding resistance to oxidation, and low to extremely low volatility properties. The quality of resulting greases will largely depend on the performance of base fluids, especially under extreme conditions.

The thickening agent is usually selected between products like (amongst other things):

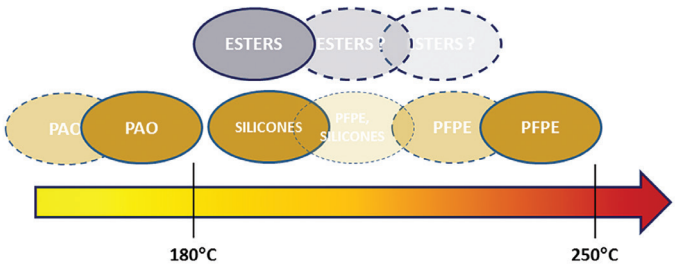
- Polyurea, for its inherently good resistance to oxidation
- Organically modified clays or silica, as they do not melt
- Polytetrafluoroethylene (PTFE), for its remarkable oxidative inertia.

However, even though these compounds all show favourable features as far as high temperature resistance is concerned, their performance in terms of thickening quality needs to be evaluated.

NYCO, as a manufacturer of synthetic esters and speciality lubricants, has been investigating the possibility of producing greases capable of withstanding elevated temperatures, on the basis of thermally stable synthetic esters treated with high performance antioxidant systems.

Of course, the term "elevated temperature" deserves a more explicit description. When looking at commercially available greases, it appears like the majority of them claim to be usable at temperatures up to 150°C, sometimes 170°C, but only a few would claim to sustain higher temperatures. Therefore, for this study, we would like to consider operating temperatures covering the range of 180°C to 250°C. Such a rather extreme range is envisaged because at such temperatures, thermo-oxidative stability is the main concern. Also, it is a temperature area where ester based greases would not usually venture.

Whilst PAO based greases generally show maximum service temperatures of about 170 to 180°C, at the other end of the scope we will find Perfluoropolyether (PFPE) based greases, sustaining temperatures of up to 250°C – sometimes even more. Silicone and fluorosilicone based greases may be found in the intermediate area of this temperature range.



Esters, and neopolyol esters in particular, are well known for their high thermo-oxidative stability. We would like to investigate the relevance of using ester based greases in temperature areas above 180°C, where PAO based greases start being insufficiently resistant, and silicone or fluorinated products may not yet be necessary. Ultimately, our goal for this study is to better understand where exactly ester based greases fit on the temperature chart, if we can push them further left on the chart, and broadly speaking, how we can make the most of synthetic esters as base fluids for high temperature greases.

In order to explore that area, we designed greases by carefully selecting a base ester fluid, treating it with a high performance antioxidant system, thickening it with an inorganic compound, and eventually evaluating high temperature performance of resulting products. An area of particular interest in this study is our ability to efficiently thicken a highly thermally stable ester, as the question is actually not so much if such a base fluid can be thickened, but if mechanical stability will be of a satisfactory level.