
# Synthetic Greases Poised for Growth

*by John Lorimor*

Innovations in equipment design have resulted in components operating at higher speeds, producing increased power output and, as a direct result, operating at higher continuous temperatures as well. Under these severe conditions, protecting equipment is stretching the limits of conventional grease technology. As new equipment is placed into service, end users are surprised to find their standard grease products don't work as well as they once did. Add to this growing pressure to reduce maintenance costs, and this situation is creating new opportunities for grease formulators to test their skills in developing products to meet these new challenges.

## Extended Service Intervals

Commercial truck fleets have long recognized the value of extended service intervals. It was once common to grease equipment at mileage intervals of 5,000 to 15,000 miles. As oil change intervals have increased to 30,000 miles and more, the need for reduced greasing maintenance has driven the adoption of extended service life greases, keeping the trucks productive and on the road.

Industrial manufacturers have concentrated a great deal of attention on grease life as well. In years past, acceptable grease life for a high-speed spindle has been about two or three years. But recent improvements to the internal sealing system have extended spindle life to six and seven years by minimizing contamination, and a three-year grease life isn't good enough anymore.

Bearing manufacturers consider lubricants to be vital design elements that require continuous improvement, as operating conditions under which bearings perform become tougher and tougher. A rolling element bearing can only be as good as the grease it contains. Just a few years ago 60,000 operating hours was considered a good operational lifetime for bearings in a fan motor; today 110,000 operating hours is expected.

## Polyurea Greases Are Different

Polyurea greases have long been known for their long life performance. However, emerging lubricant technology is advancing the performance further, and allowing the formulator new flexibility in building tailored greases for these new and more demanding applications.

Metals can have a catalytic effect on oxidation, speeding up grease degradation reactions. The most common grease thickeners are based upon the metal salt of fatty acids. Selection of a thickener system which is not formed from metallic components significantly reduces this limiting factor in grease life.

Polyurea grease thickeners are unique in that they are metal-free. They are produced from the reaction of polyfunctional isocyanates and amines to form small oligomers of linked urea groups. The simplest polyurea can be formed from the bifunctional isocyanate and two equivalents of a monofunctional amine to yield a compound containing two urea structures. This type of polyurea is referred to as diurea, and is the primary high-temperature thickener produced in Japan. Use of a combination of bifunctional isocyanates and amines, with monofunctional amine in the correct proportions, yields a tetraurea, which is a common type found in the United States. The many raw materials options that can be used to produce polyurea greases allow the grease maker great flexibility in imparting different properties to the finished grease.

## Synthetic Polyurea Greases

One of the most common grease degradation mechanisms is oxidation. It occurs when oxygen reacts with the lubricant's base oil, which is typically a hydrocarbon. When the oil becomes oxidized, some hydrocarbon molecules are transformed into acid and lacquer. Some molecules are better equipped to resist oxidation than others, and by selecting base oils synthesized from these structures allow the production of greases with high oxidative stability.

Coupling metal-free polyurea thickener systems with stable synthetic oils increase the greases' functional life at higher temperatures. These specialized products can easily achieve grease lifetimes which are

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20 times longer than standard greases, depending on the temperature. This means the user may be able to increase the safety margin for lubricant-related bearing damage and simultaneously increase relubrication intervals.

Polyalphaolefins (PAOs) are hydrocarbon polymers manufactured by the catalytic oligomerization of linear alpha olefins like alpha-decene. They are considered high-performance lubricants and provide a high viscosity index and hydrolytic stability. PAOs are the most commonly used, and are generally less expensive than other synthetic lubricants. The wax-free nature of PAO, together with its low coefficient of traction compared with mineral oils, provide excellent low temperature pumpability and very low starting and running torque, and can reduce operating temperatures of rolling element bearings.

Recent improvements to the production of PAO by the use of innovative catalyst technology have further enhanced many desirable properties for high-temperature lubrication. PAOs are non-polar, and as a result typically require the incorporation of additional blending components to achieve good additive solubility. Early synthetic greases used esters to improve additive solubility, but new PAG-based options have become available which further enhance high temperature performance without hydrolytic stability concerns.

Polyalkylene glycols (PAGs) are long known for offering a very high viscosity index (VI), good low temperature properties, low deposits and hydrolytic stability. However, their incompatibility with conventional hydrocarbons has limited their use in grease. Recently commercialized versions increase the carbon to oxygen ratio to improve oil compatibility. The fluid's polarity helps to stabilize and disperse polar oxidative by-products, virtually eliminating varnish and deposits. Greases prepared with these new fluids have shown significantly longer high-temperature bearing performance versus their conventional hydrocarbon counterparts, and the low aniline point allows production of synthetic greases with reduced soap content and higher additive solubility.

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Incorporation of specialized chemical additives can also improve grease life. Antioxidants' chemistries function sacrificially to protect the base oil from oxidation. Improved solubility allows higher additive loading levels, extending the protection. Friction modifiers reduce friction between moving parts by creation of an easily sheared surface layer. Bearing manufacturers have reported that reduced friction levels can reduce operating temperatures by up to 30 percent, which can easily double the grease life.

### The Market for Synthetic Grease

Although the published estimates for growth in overall lubricating grease consumption have been modest in volume terms, value gains will be more substantial as high-performance versions are substituted. The industrial sector has been the most successful to date for synthetic grease adoption, with broad product acceptance and support for the reduced maintenance aspects.

As more manufacturers become aware of the higher level of protection afforded by the newest synthetic greases, which can extend the lifetime of a part beyond its original specifications, lengthen service intervals and reduce warranty claims, interest in synthetic greases will continue to grow.

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