



Beyond Synthetics vs. Mineral Basestock or What Happened to the Application?

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As lubricant manufacturers search to improve their profitability, a trend has been emerging from the major oil lubricant manufacturers and independent commodity oil blenders. This trend is to emphasize synthetic lubricants, an issue that appears to be coming up frequently in sales presentations to lubricant end users. While the trend is for improved lubrication from the users standpoint, they can be led down the wrong path that a synthetic based lubricant will always provide superior performance. To help the end user choose the right path they must be provided with some basic knowledge of how the different types of lubricants are formulated with respect to performance in the application.

Lubricant Types

There are four principal types of finished lubricants being produced today. The first and oldest is mineral oils with no additives. These oils are typically seen in the limited applications where no enhancement to the base oil is needed. Applications of this type are API SA engine oil, barrier oils, seal oils, technical oils, etc.

The second type is mineral base oils with additives. These lubricants make up the majority of the commercially available lubricants in the marketplace today. Applications of this type of lubricant are engine oil, hydraulic oil, turbine oil, gear oil, air compressor oil, etc. These types of lubricants are applicable with the exception of high or low temperature or where a hostile environment is affecting the lubricant.

The third type is synthetic base oils with additives. These oils make up a small part of the overall lubricant marketplace but are increasing due to their popularity with many lubricant end users. For the past decade the end user has been told, in passenger car motor oil advertising campaigns from the majors, that these lubricants perform better than mineral based oils.

Due to the strategic advertising directed at the general public for passenger car motor oil, most

lubricant end users believe that synthetic equals superior performance over any other type of lubricant regardless of the application.

Synthetic base oils can be many different types of compounds with many being limited to one specific application. The majors push synthetic base oil lubricants because the primary synthetic is PAO (poly-alpha-olefin). PAO is a primary product produced by two of the major oil companies in the United States. They heavily market these synthetic lubricants because the PAO base oil provides them with improved profitability over mineral base oil lubricants. One only needs to compare pricing of a mineral oil based passenger car motor oil to that of a synthetic base to see that the pricing would improve the marketer's profitability. Independent commodity oil blenders have also jumped on the synthetic bandwagon because it helps them improve profitability.

A limited number of high performance lubricant manufacturers go beyond the synthetic vs. mineral oil argument to truly formulating a superior enhanced lubricant. These lubricants are formulated for superior performance in a specific range of applications without limitations to the base oil type or performance additives used. If the high performance lubricant manufacturer believes that synthetic base oil with additives is needed for the application then this is how the lubricant is formulated. In most cases however, these manufacturers know that mineral base oil with properly selected and balanced conventional and proprietary additives can be formulated with a robust treat level to provide superior application performance. Thus, the lubricant end user is given a lubricant that provides superior performance at the most economical cost for the application. This is why the lubricant end-users are looking at a synthetic in the first place, because of their desire for a superior performance lubricant.

Enhanced Lubricants

To describe the concept of formulating an enhanced lubricant that is application specific we must first look

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at the strengths and weaknesses of both the mineral and synthetic base oils. Strengths of the synthetic base lubricants are applications where high or low temperatures are expected or a hostile environment would be detrimental to mineral oil based lubricant. A source that explains this more in detail is the Shell lubricants website at shell-lubricants.com/syntheticlubricants/synthetic_descriptions.pdf. Strengths of the mineral oil are improved additive solubility, natural oxidation resistance characteristics, better seal compatibility and lower base oil cost.

Weaknesses of the synthetic based lubricants are: limited additive solubility, reversal of ester based synthetic base oil to an acid, seal incompatibility with some seal materials, and a significantly higher per gallon cost compared to most mineral based oil. Mineral base oils have limitations in high and low temperature applications and certain atmospheres.

Mission of the Enhanced Lubricant Formulator

The high performance lubricant manufacturer must educate lubricant end users that lubricants are formulated beyond the base oil, whether it is mineral or synthetic base oil. Enhanced lubricants that are formulated and manufactured by a high performance lubricant manufacturer are designed to provide the highest level of performance in a specific application. This performance is proven in both laboratory tests and actual field applications. What the lubricant end user seeks is improved performance in their particular application. By seeking a synthetic lubricant, they perceive they are asking for a lubricant that will give them superior performance when compared to the commercial grade lubricant they have been using with limited success.

Enhanced lubricants are designed significantly beyond the minimal formulating done for commercial grade mineral or synthetic base oil lubricants. When formulating these enhanced lubricants, research staff looks for synergistic combinations between the base oil (synthetic or mineral), conventional additives and proprietary additives. This synergy is what allows the product to provide the maximum performance for the application.

Formulation of Enhanced Lubricants

As we have discussed earlier, the first step in formulating is to decide if the application needs mineral or synthetic base oil. Determine which one will provide the superior application performance. Should the research person use a synthetic base oil which limits additive choice and concentration or a mineral base oil which allows a wider range of additive chemistries at a higher, more robust treatment concentration?

The second step is to determine what conventional additives and what quality levels are available to build the

core of the lubricant around. While commercial grade lubricants are formulated only to a minimal performance level, an enhanced lubricant is formulated well beyond this point. This is accomplished by looking for synergy with high quality component additives, which “enhance” the performance of the lubricant. Additional additive components are then added at optimum treat levels to assure the enhanced lubricant will deliver maximum performance for the specific application. If the formulation requires synthetic base oil, the main issue is still the additive concentration needed for superior performance. Many times synthetic base oil will not hold enough additive in solution to deliver the needed performance for the application.

The third and final step of formulating an enhanced lubricant is choosing which proprietary additives should be used? Through basic research and proven field performance, high performance lubricant manufacturers will have a number of proprietary additives that work in specific applications and have proven will enhance the performance of the lubricant. One or more of these additives will be used to fine-tune the enhanced lubricant.

The Educated End User

Once a lubricant end user understands what is involved in formulating an enhanced lubricant it becomes easy to see where a synthetic lubricant might not be the superior product for the particular application. Also, the price of the enhanced lubricant is now more justified because the customer understands that there is a technology and performance level beyond that of the lubricant that has been used in the specific application.

Sure, the synthetic lubricant manufacturer recommends a synthetic. He recommends a synthetic because it brings him better profitability than the commodity mineral base oil lubricant that he is also selling. An article discussing synthetics in the June 2003 edition of [Lubricants World](#) covers how the public has embraced the synthetic concept and how they do not understand what they are really receiving for the extra money they spend. The article indicates that consumers were “becoming more acquainted with the word “synthetic” and the **impression** was favorable in terms of better performance than was **perceived** as available from conventional motor oil.” The article goes on to state that “the public is **enraptured** by the concept and so the market is growing, despite a higher price.”

In the continuing debate about synthetic versus mineral oils, the end user is really only interested in protecting the investment they have in their equipment. High performance lubricant manufacturers have lubricants to provide this protection beyond that offered by major oil lubricant manufacturers and commodity oil blenders.