Lubricant formulators are increasingly challenged to do more with less. Limits on ash and phosphorus in engine oils for emission protection, and lower viscosities in engine oils, gear oils and industrial lubricants for energy efficiency, mean basestock selection plays an increasingly significant role in formulating high-performance lubricants.

ExxonMobil Chemical understands this challenge and supplies a full range of synthetic basestocks that can deliver the performance advantages formulators are looking for. Polyalphaolefins (PAO) from the SpectraSyn™, SpectraSyn Plus™ and SpectraSyn Ultra™ product lines provide superior lubrication for passenger car engine oils, drive line lubricants, industrial machinery and heavy-duty truck engines. Synesstic™ Alkylated Naphthalene (AN) blendstocks can enhance the stability and performance of many industrial and automotive lubricants under severe operating conditions.

Depending on the application, synthetic lubricants formulated with ExxonMobil Chemical synthetic basestocks may provide:

- Extended drain intervals
- Improved fuel economy
- Enhanced wear protection
- Wide ranges of temperature operation

Fluid Solutions

While the global push for greater fuel economy is driving the trend toward lower-viscosity lubricants, it’s only part of the equation that formulators have to solve. Wear protection and film thickness also become lubrication challenges with these lower-viscosity lubricants, as do oxidation stability, thermal stability and deposit protection.

ExxonMobil Chemical has Group IV and Group V synthetic basestocks to help get these jobs done:

- SpectraSyn Plus is a premium low-viscosity PAO for thermal and oxidative stability.
- SpectraSyn is a high-viscosity PAO for thermal and oxidative stability.
- SpectraSyn Ultra is a high-viscosity index PAO with unique viscoelastic properties.
- Group V, Synesstic Alkylated Naphthalene (AN) is a leading blendstock for stability and additive solubility.

Together, these Group IV and Group V products enable ExxonMobil Chemical to offer customers worldwide the broadest range of high-quality synthetic basestocks.

Fuel Economy

Lower-viscosity lubricants can enhance fuel economy, but balancing the volatility and low-temperature requirements is a stretch for many oils. This is especially true for Group III basestocks, which engine oil formulators want to use to blend 0W-30 oils for cost-effectiveness.

That’s where SpectraSyn Plus PAO comes in. With its exceptional volatility and low-temperature characteristics, it enables for-
mulators to more readily blend an ideal base oil for 0W-30 engine oils. By blending SpectraSyn Plus PAO and conventional Group III base oils, formulators can meet challenging cold-cranking simulator (CCS) and volatility targets while maintaining the lower viscosities that maximize fuel economy (Figure 1).

Fuel economy retention is also important and can be facilitated by improved oxidation stability and enhanced resistance to oil thickening. In an oxidation bench test used to simulate the conditions of an API “Sequence III” engine test, testing with three SAE 5W-30 0W-40 engine oils – a pure Group III, a Group III with 10% ester and a Group III with 10% Synesstic AN – showed a significant extension of oxidation stability with the Synesstic AN blend. Even low levels of Synesstic AN can significantly improve the oxidation performance of lubricants.

**Enhanced Wear Protection**

As mentioned above, the trend toward lower-viscosity oils for fuel economy and lower phosphorus levels for emissions protection puts pressure on wear protection performance. This creates another opportunity for Synesstic AN.

In a direct comparison between a PAO/ester blend and a PAO/Synesstic AN blend, one distinguishing characteristic is that ester molecules are polar and thus more attracted to metal surfaces. The problem is that additive molecules are polar, too, creating a competition for space on the metal surface. When this occurs, additive performance capabilities may not be fully realized.

Synesstic AN is less polar, giving the additive a better chance of getting to the metal surface and delivering its intended benefit. This effect was demonstrated by a Sequence IIIG Wear Performance test, in which synthetic engine oils blended with PAO and Synesstic AN showed less cam and lifter wear than PAO/ester formulations (Figure 2).

**Industrial Applications**

The Rotary Pressure Vessel Oxidation Test (RPVOT), used to measure the oxidation resistance of oils for industrial applications...
and hydrolytic stability over a PAO/ester blend fluid. This may result in a longer-duration oil and lower maintenance costs overall as the service life of the fluid is extended (Figure 4).

While esters are frequently used to increase additive solubility in PAO and Group III basestocks, Synesstic – especially Synesstic 5 – is similar to esters in aniline point and can enhance solubility.

Any discussion of industrial applications and wear protection wouldn’t be complete without talking about SpectraSyn Ultra and its capabilities in enhancing film thickness. Its unique structure imparts viscoelastic properties that aid in film thickness.

In comparing two synthetic lubricants – one with 2 percent SpectraSyn Ultra 150 – the high-speed results of a point contact (ball-on-disk) test are virtually equal. But at lower speeds, when film thickness is critical, the SpectraSyn Ultra blend offers increased thickness and a greater level of protection against wear (Figure 5).

**Summary**

ExxonMobil Chemical is the world’s only manufacturer of both low- and high-viscosity PAO, which provides customers with a single source to cover their needs worldwide. With commercial viscosity grades ranging from 2 cSt to 100 cSt and High Viscosity Index (VI) products up to 1000 cSt, ExxonMobil provides the flexibility to formulate to the most extreme requirements.

Visit www.exxonmobil synthetics.com to get the whole story, as well as to download a Synthetic Lubricants Basestocks brochure.