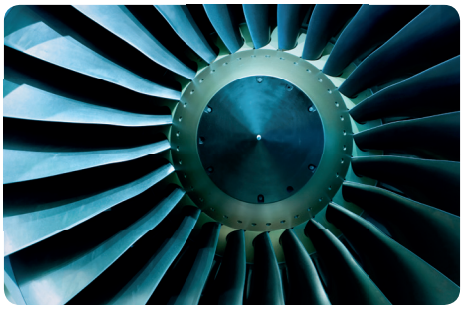
HEXION™

Information Sheet

Duresta™ 10GP Glycidyl Ester

Acid Scavenger For Ester Base Stocks – Kinetics



High Performance Lubricants

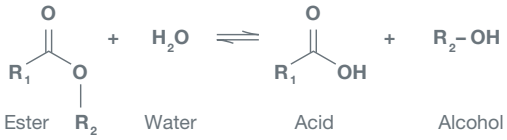
Synthetic ester base stocks

Synthetic ester base stocks are one of the key Group V* base oils used for a wide range of high-performance lubricant applications, such as refrigeration and air-conditioning, aviation turbines, automotive production and gear oils.

Hydrolysis

The issue with hydrolysis

These synthetic esters are obtained by esterification of alcohols and carboxylic acids. The esterification reaction produces the ester and water. The reverse reaction, called hydrolysis, consumes water, generating acid and alcohol (see figure below).



One of the basic requirements of an ester-based lubricant base stock is the ability to withstand hydrolysis. The rate of hydrolysis is influenced by several factors:

- The composition of the base oil
- Water concentration in the oil
- Oil temperature (higher temperatures speed up the hydrolysis reaction)
- Presence of acids (e.g. hydrolysis products), which act as catalysts
- Nature of additives, some of which support hydrolysis
- Presence of copper

Effective Hydrolysis Reduction

Duresta 10GP acid scavenger

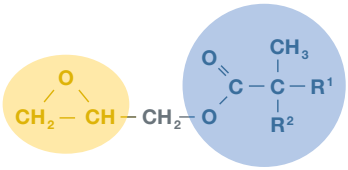
In order to enhance the life and performance of an ester-based lubricant, it is key to minimize the residual raw material acids from esterification and to avoid the formation of additional acids by hydrolysis. This prevents an autocatalytic or “snowball effect”, which would lead to losses of performance and to reduced durability. For this reason, lubricant producers specify the acid value as a measure of quality. A common method to reduce the acid value is adding a base. However, the addition of a base reduces the acid value, yet is not an effective way to prevent hydrolysis.

Duresta 10GP glycidyl ester acts as an acid scavenger and enables base stock producers to actually reduce the initial acid concentration and to scavenge acids formed by hydrolysis. Duresta 10GP acid scavengers effectively reduce the hydrolysis and the snowball effect.

Duresta 10GP Glycidyl Ester

Duresta 10GP glycidyl ester quick facts

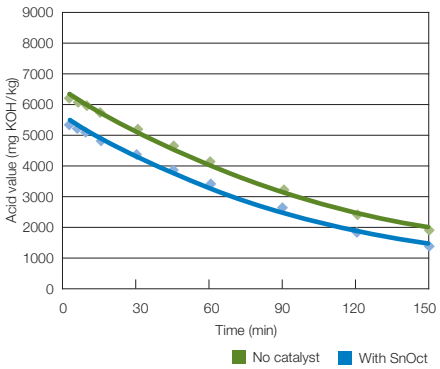
- Epoxy equivalent weight: approx. 241 g/Eq-g
- Boiling range: 251 – 278 °C (5 – 95%)
- Viscosity (23 °C): 7.1 mPas
- High flame/flash point



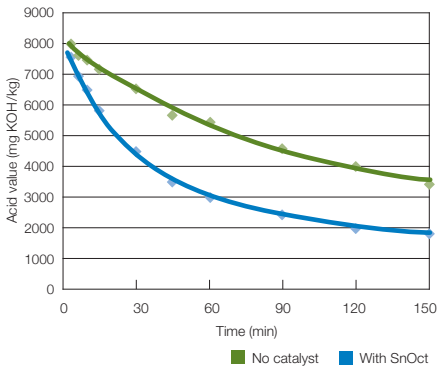
Reaction of Acids with Duresta 10GP Acid Scavenger

Kinetics with different acids, with and without catalyst

2-Ethyl Hexanoic Acid (eq. mol. 110 °C)



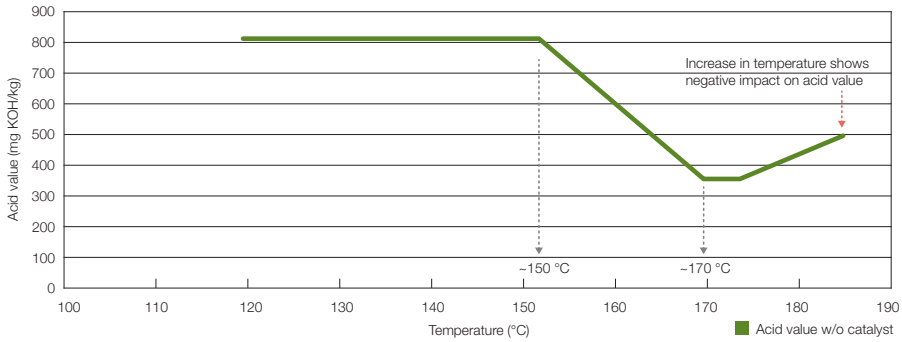
Benzoic Acid (eq. mol. 110 °C)



Different acids show diverse reaction kinetics with Duresta 10GP acid scavenger. Catalysts can have a positive effect on the reaction rate. Duresta acid scavenger enables base stock producers to reach very low acid value levels in a short period of time, which saves production time and energy. Furthermore, ester oils with a lower acid number are less prone to hydrolysis.

Example of the effect of temperature on final acid value

The Acid: Duresta 10GP glycidyl ester ratio is 1:6. All acid values were measured after 2 hours.



In order to maximize the efficiency of Duresta 10GP glycidyl ester, the reaction temperature, the reaction time and the amount of Duresta 10GP glycidyl ester used must be optimized. For example, the figure below shows the final acid value of a tri-oleate base oil with an initial acid value of 820 mg KOH/kg after treatment with a large excess of Duresta 10GP glycidyl ester (6 times the acid concentration) or 2.1% weight. The final acid value, measured two hours later was found to be minimal at 360 mg KOH/kg when the reaction was performed at 170 °C in this case. Note that in other cases the optimum temperature might be up to 220 °C.

Summary

Duresta 10GP glycidyl ester enables efficient synthetic ester base stock production

- Reduce base stock processing time and energy
- Reach very low acid values

Enabling high performance lubricants

- Reduce additives
- Minimize corrosion
- Provide high performance and high stability
- Increase lubricant life and enhance protection of lubricated parts

HEXION™

World Headquarters
180 East Broad Street
Columbus, OH 43215-3799

Reach our Global Customer Service network at:
U.S., Canada and Latin America
+1 888 443 9466/+1 614 986 2497 4information@hexion.com
Europe, Middle East, Africa and India
+800 836 43581/+39 0331 355 349 4information.eu@hexion.com
China and Other Asia Pacific Countries
+86 2 1386 04835 4information.ap@hexion.com

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* Per the American Petroleum Institute (API) categorization of types of lubricant base oil

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