

# Rejuvenator to increase use of recycled asphalt

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Sasol Chemicals



SASOL





## About us

We at Sasol Chemicals innovate for a better world and deliver long-term value to our customers, communities and society.

Our broad portfolio of high-value products plays an integral role in the creation of numerous solutions that benefit the lives of millions of people.

Thousands of companies around the world leverage our technology, world-class facilities, expertise and collaborative approach to tackle their challenges.

## Introduction

Asphalt pavements and Asphalt shingles are aging during their life, i.e. ravel, get brittle and crack over the time.

In order to save resources, reduce feedstock costs and improve sustainability of a road, the asphalt industry reuses old materials such as reclaimed asphalt pavements (RAP) and reclaimed asphalt shingles (RAS). However, due to loss of performance the amount is limited.

Small quantities of **SASOBIT RE** added to an asphalt mix at a plant or at an asphalt terminal enable the user to increase the amount of RAP/RAS in the final application, because the properties of a virgin asphalt will be restored. **SASOBIT RE** rejuvenates and does not only soften. The performance of the pavement can be enhanced or at least maintained compared to the use of an asphalt mix with less RAP/RAS and no **SASOBIT RE**.

## Product description

SASOL Chemicals North America LLC offers two grades of rejuvenator to the market:

- **SASOBIT RE 80**
- **SASOBIT RE 100**

**SASOBIT RE 80** and **SASOBIT RE 100** are high purity petrochemical-based linear primary alcohols with even-numbered chain lengths. They are off-white solids with a slight sweet odor, physically and chemically equivalent to corresponding oleochemical-based alcohols derived from such sources as coconut oil and palm kernel oil.

## Product properties

Typical physical properties are listed in table 1. Actual properties will vary slightly from lot to lot.

**Table 1:**  
Typical properties of  
**SASOBIT RE 80** and  
**SASOBIT RE 100**

Typical properties	SASOBIT RE 80	SASOBIT RE 100
Total alcohol, wt %	80 min.	97 min
Hydroxyl number, mg KOH/g	140 – 175	205 – 218
Density, g/mL @ 70 °C	0.811	0.806
Melting range, °C	50 – 54	48 – 53
Viscosity, cSt @ 70 °C	11.6	8.3



# Impact on asphalt characteristics

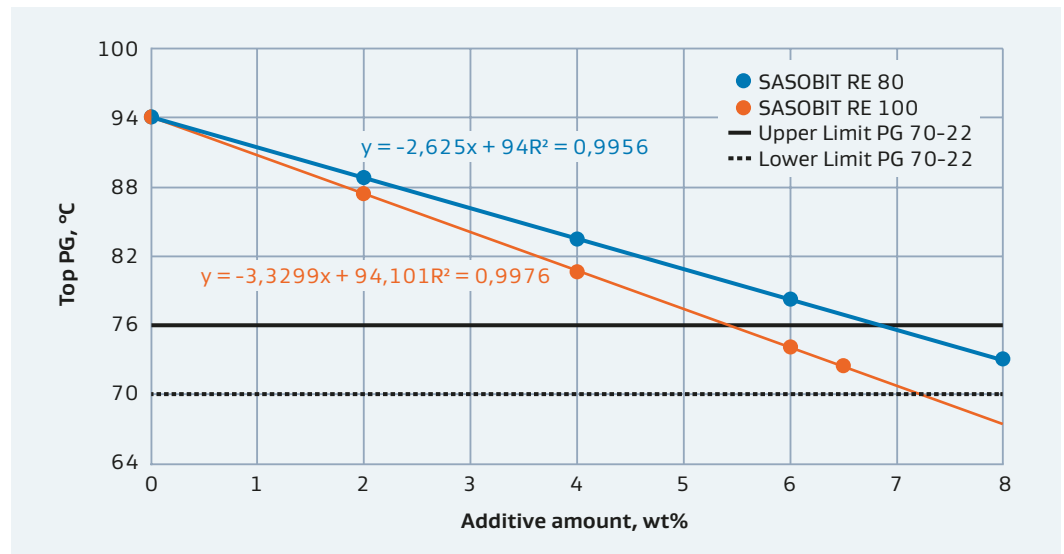
## Effectiveness

Figure 1 and 2 show the impacts of **SASOBIT RE 80** and **SASOBIT RE 100** on the asphalt characteristics TOP PG ('High end temperature') and Bottom PG ('Low end temperature'). Every 1 wt% of **SASOBIT RE 80/RE 100** lowers the Top PG by roughly 2.5 to 3 °C/3 to 3.5 °C. (see figure 1), which indicates the high effectiveness of both rejuvenators.

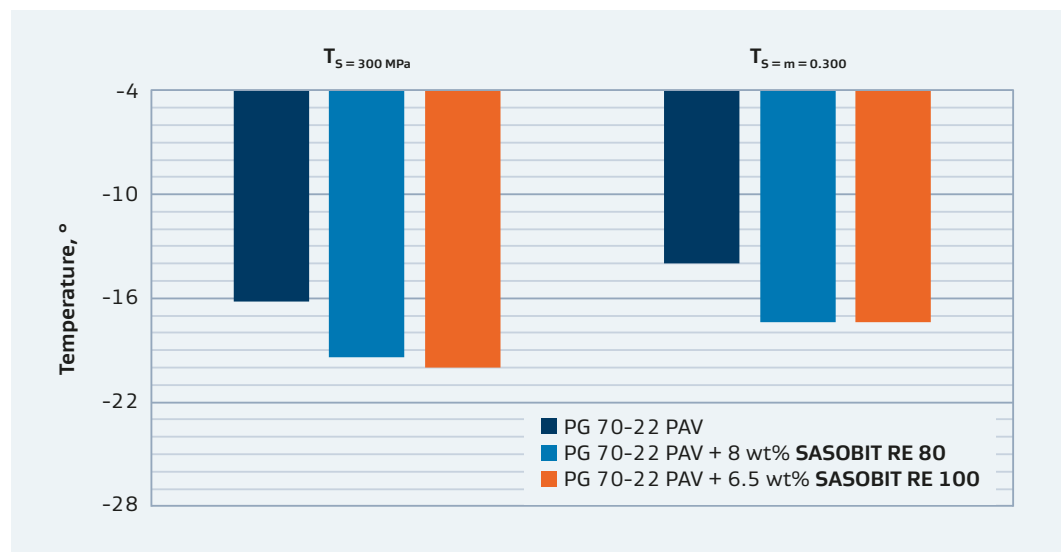
This first example displays that 6.5 wt% of **SASOBIT RE 100** and 8 wt% of **Sasobit RE 80** in a PAV aged PG 70-22 are necessary to obtain the high-end temperature properties of the original binder.

These amounts of additives in the PAV aged PG 70-22 lead to an enhancement of low-end temperature characteristics by around 3 to 4 °C, for both Stiffness and m-value-criteria (see figure 2).

**Figure 1:**  
Impact on **Top PG**  
of aged and rejuvenated PG 70-22  
by using different amounts of  
**SASOBIT RE 80** and **SASOBIT RE 100**

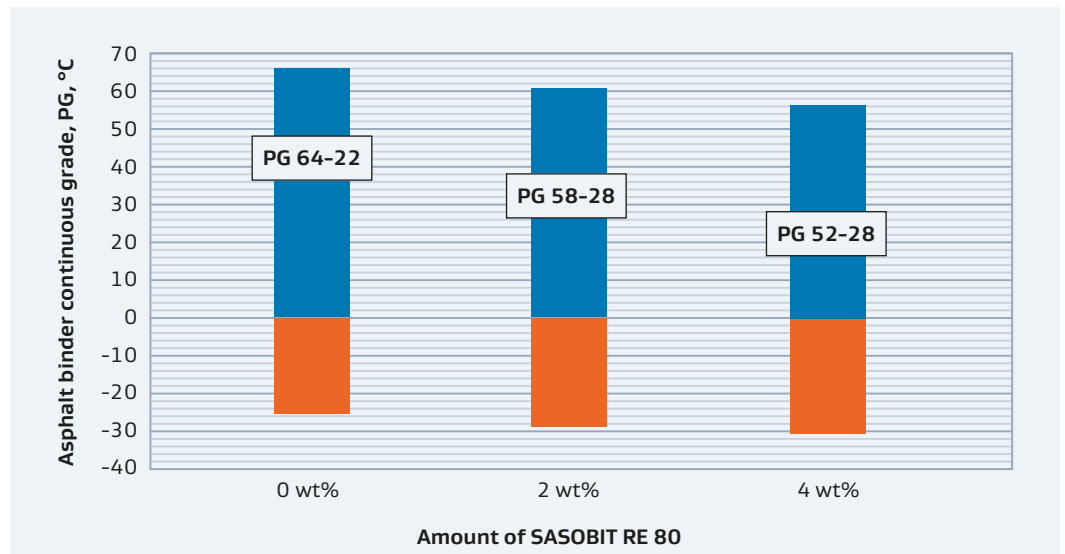


**Figure 2:**  
Impact on **Bottom PG**  
of aged and rejuvenated PG 70-22



In a second example 2 and 4 wt% of **SASOBIT RE 80** are added to a PG 64-22 base asphalt. The impact on PG classification is given in Figure 3. Only 2 wt% **SASOBIT RE 80** are necessary to move the original binder one grade softer, from PG 64-22 to PG 58-28.

**Figure 3:**  
Impact of **SASOBIT RE 80** on  
PG classification

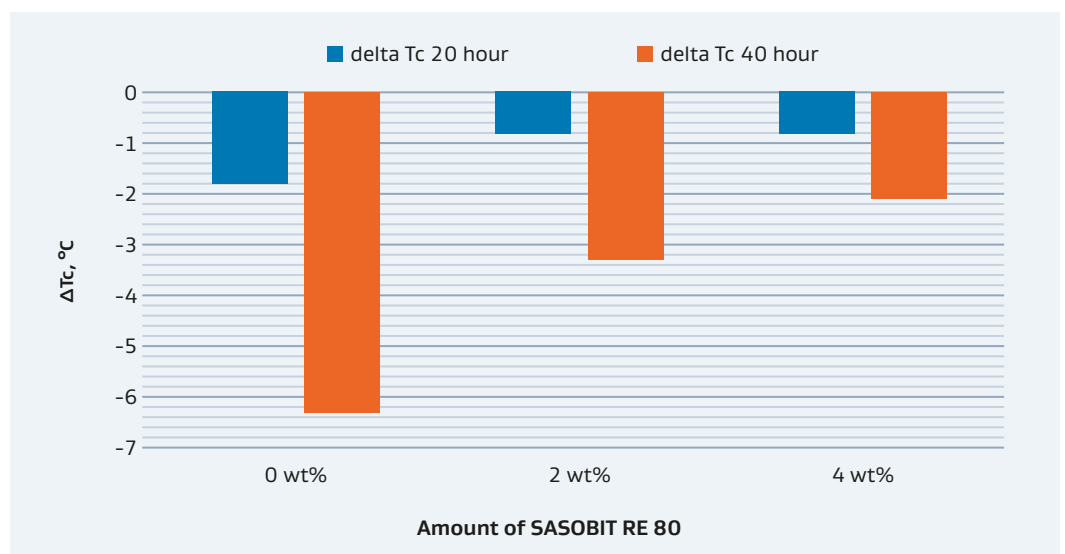


A useful method to evaluate the risk of cracking due to premature aging of asphalt is the  $\Delta T_c$  method.  $\Delta T_c$  is the difference of critical temperatures for the creep stiffness at 300 MPa and the m-value at 0.300. The more negative  $\Delta T_c$  gets, the more the asphalt prone to crack.

Figure 4 shows that 2 wt% to 4 wt% of **SASOBIT RE 80** improves  $\Delta T_c$  by 1 °C after standard 20-hour PAV and by 3 to 4.2 °C after 40-hour PAV. 20-hour PAV shall simulate the state of binder after 8 to 12 years in a top layer of an asphalt pavement, 40-hour PAV after 16 to 20 years.

The addition of Sasol’s rejuvenators reduce the risk of cracking and hence enhance the durability of an asphalt pavement.

**Figure 4:**  
Impact of **SASOBIT RE 80** on  $\Delta T_c$



### Rejuvenation versus softening

A rejuvenator added to an aged asphalt shall restore properties of the original binder. Many products only soften the aged asphalt. The difference between rejuvenation and softening is illustrated with a BLACK space diagram, in which  $G^*$  is plotted over phase angle.

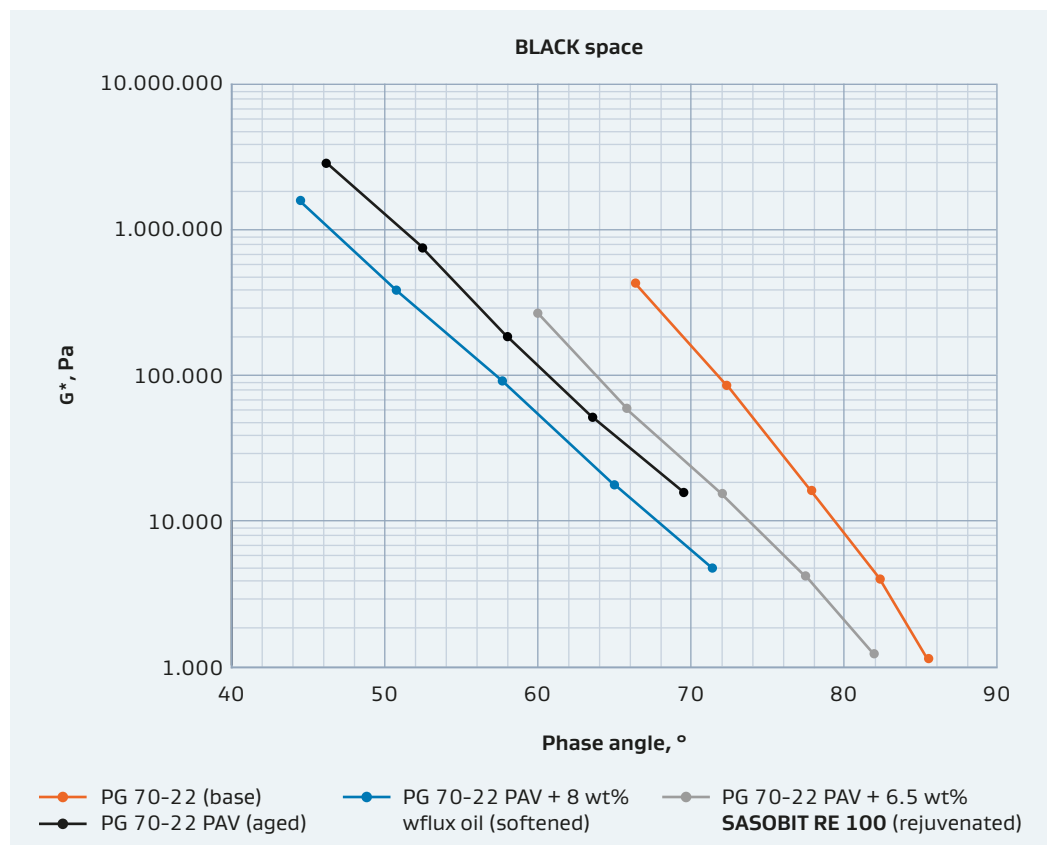
Rejuvenation takes place when the curve of the aged and rejuvenated binder moves towards the curve of the base asphalt.

Softeners reduce stiffness by either fluxing the aged asphalt or even elastifying it. In the first case the graph overlaps the one of aged binder and shifts to the bottom right. In the second case the graph is shifting to bottom left, away from the curve of the original binder.

Figure 5 shows this BLACK space diagram for an aged PG 70-22. On the one side with 6.5 wt% of **SASOBIT RE 100** rejuvenated and on the other side with 8 wt% of flux oil softened binder.

**SASOBIT RE** clearly rejuvenates aged asphalt unlike softeners that merely soften aged asphalt.

**Figure 5:**  
Rejuvenation versus Softening  
illustrated by BLACK space





## Summary

**SASOBIT RE 80** and **SASOBIT RE 100** are designed to

- reduce the risk of cracking and to enhance the durability of an asphalt pavement
- increase the amount of RAP and/or RAS in an asphalt mix without affecting the final performance
- to rejuvenate and to not only soften a binder
- be added in small quantities since they are highly efficient
- be added at asphalt terminals or asphalt mixing plants

# At your service



Sasol Chemicals

Performance Solutions  
Asphalt Additives

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