We have hatched something new for you!
Sasobit REDUX

Sasobit, the versatile additive for asphalt mixes, has been used successfully worldwide since 1997. Today Sasol is pleased to present another member of the Sasobit family: Sasobit REDUX

Sasobit REDUX consists of synthetic Fischer-Tropsch (FT) wax and other petroleum-based waxes and has a congealing point between 72 and 83 °C and a penetration of 16 – 30 dmm at 25 °C, making it softer than Sasobit.

Comparison of Sasobit and Sasobit REDUX specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sasobit REDUX</th>
<th>Sasobit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congealing point [°C]</td>
<td>72 – 80</td>
<td>100 – 110</td>
</tr>
<tr>
<td>Penetration (25 °C) [dmm]</td>
<td>16 – 30</td>
<td>0 – 2</td>
</tr>
</tbody>
</table>

The average dosage of Sasobit REDUX is 1 – 1.5 wt% related to the bitumen content. Ideally, the product is added to the bitumen but can also be added into the pugmill. Sasobit REDUX is available in pastilles and can be added in the same way as Sasobit.

Advantages at a glance

- Reduced viscosity
- Reduced temperatures
- Reduced compaction resistance
- Reduced ageing
- Almost no impact on binder characteristics
Working principle: the effect of Sasobit REDUX on bitumen viscosity

Temperatures can be reduced by as much as 30 K when using Sasobit REDUX, because at temperatures above 85°C Sasobit REDUX is completely soluble in bitumen and significantly reduces viscosity.

Reduced viscosity at standard temperatures improves the workability of the asphalt mix. Sasobit REDUX increases process reliability and significantly reduces the risk of improper paving operations.

During the cooling phase, Sasobit REDUX begins to crystallise at 60°C, which makes it possible to widen the compaction window. The above-mentioned congealing point of 72–80°C relates to the pure wax.

Sasobit REDUX has a negligible impact on the stiffness of the binder at service temperatures. The actual increase is determined by the base binder.
Reduced viscosity

When adding only 1.5 wt% of Sasobit REDUX to a binder, the viscosity at standard temperatures can be reduced by 15 – 20 % as shown in the following graph.

The viscosity-reducing effect of Sasobit REDUX offers two key advantages.

1. Reduced mixing and paving temperatures

   The production of Warm Mix Asphalt has been a topic of discussion for many years. However, this production process has not become the standard for types of rolled asphalt mixes despite its many advantages:
   - Lower CO₂ emissions
   - Lower energy consumption, fewer fumes and aerosols
   - Less bitumen ageing
   - Less wear on machines and resources

   The results of a test carried out with a segment roller compactor by the ISBS of the Technical University of Brunswick show slightly better workability/compactability for an AC 11 D S with Sasobit REDUX at a temperature of 120 °C compared to an unmodified variant at a temperature of 145 °C.
The same trend was confirmed in a test using a gyrator compactor in the laboratory of HWT Dresden.

This means that Sasobit REDUX can be used as an effective Warm Mix additive!

2. Reduced compaction resistance

Modification with Sasobit REDUX leads to a reduction in the compaction resistance of the asphalt mix, which enhances the workability and increases the ease of compaction. Consequently, the required compaction can be achieved with fewer roller passes.

Different asphalt types (base course AC 32 T S and wearing course AC 11 D S) were examined at different independent laboratories (ISBS Technical University of Brunswick, asphalt-labor Wahstedt).
Reduced ageing

As asphalt ages, the stiffness of the binder increases. This leads to a higher risk of thermal and fatigue cracking.

The addition of Sasobit REDUX helps to minimise the risk of cracking as it reduces ageing. This can be traced back to the pure, high quality raw materials which are used for the production of Sasobit REDUX.

In order to describe the ageing behaviour of a binder, $G^*$ (complex shear modulus, characteristic value for stiffness) first has to be determined for different ageing stages. The ageing indices can then be calculated, i.e. $G^*$ after ageing is divided by $G^*$ before ageing. The smaller the ageing index, the higher the anti-ageing effect.

This approach was used by asphalt labor Wahlstedt. Binders from a AC 16 B S binder course with 20% RAP were extracted and PAV-aged (simulation of long-term ageing in lab). $G^*$ was measured after extraction and after PAV ageing of the extracted binders, and the ageing indices were calculated. This was done for two variants – with and without modification with Sasobit REDUX. The following figure shows the results of the ageing indices at different test temperatures. The ageing indices for the variant with Sasobit REDUX are much lower than those for the variant without the additive.

This demonstrates the anti-ageing effect of Sasobit REDUX!
Almost no impact on softening point and penetration

Due to their inherent properties, FT waxes will always produce a stiffening effect in the modified binder. Sasobit REDUX consists of several components and therefore has a negligible stiffening effect.

There is almost no impact on softening point and penetration in most of the commonly used binder grades.

The following table gives an overview – based on the current data set – of the impacts on softening point and penetration for different bitumen types.

Examples (average values; based on current data set)

<table>
<thead>
<tr>
<th>Type of binder</th>
<th>Softening point R&amp;B [°C]</th>
<th>Δ in softening point R&amp;B [°C]</th>
<th>Penetration (25 °C) [0.1 mm]</th>
<th>Δ in penetration (25 °C) [0.1 mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/70</td>
<td>50.4</td>
<td>–</td>
<td>57</td>
<td>–</td>
</tr>
<tr>
<td>50/70 + 1.5 wt% Sasobit REDUX</td>
<td>50.6 +0.2</td>
<td>57</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>50/70 + 1.5 wt% Sasobit</td>
<td>55.2 +5.2</td>
<td>40</td>
<td>-17</td>
<td></td>
</tr>
<tr>
<td>70/100</td>
<td>47</td>
<td>–</td>
<td>78</td>
<td>–</td>
</tr>
<tr>
<td>70/100 + 1.5 wt% Sasobit REDUX</td>
<td>50.6 +3.6</td>
<td>63</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>70/100 + 1.5 wt% Sasobit</td>
<td>55.4 +8.4</td>
<td>47</td>
<td>-31</td>
<td></td>
</tr>
<tr>
<td>25/55-55 A</td>
<td>61.8</td>
<td>–</td>
<td>40</td>
<td>–</td>
</tr>
<tr>
<td>25/55-55 A + 1.5 wt% Sasobit REDUX</td>
<td>62.8 +1</td>
<td>34</td>
<td>-6</td>
<td></td>
</tr>
<tr>
<td>25/55-55 A + 1.5 wt% Sasobit</td>
<td>70.6 +8.8</td>
<td>28</td>
<td>-12</td>
<td></td>
</tr>
</tbody>
</table>

The results show that Sasobit REDUX has a much smaller impact on the softening point as well as on the penetration compared to Sasobit.

Since Sasobit REDUX has no hardening but an anti-ageing effect, the amount of RAP can be increased.

It is thus much easier to meet the requirements when Sasobit REDUX is part of the asphalt design – for example regarding values after binder extraction, especially when using RAP. The following example shall demonstrate this context.

Example – Investigations on extracted binders

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AC 32 T S without Sasobit REDUX</th>
<th>AC 32 T S with 1.05 wt% Sasobit REDUX</th>
<th>Requirement in Germany for resulting 50/70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softening point Ring &amp; Ball* [°C]</td>
<td>55</td>
<td>57</td>
<td>&lt; 62</td>
</tr>
<tr>
<td>Penetration(25 °C)* [0.1 mm]</td>
<td>43</td>
<td>42</td>
<td>–</td>
</tr>
</tbody>
</table>
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