Optigel/Laponite Formulations – Products and Applications

<table>
<thead>
<tr>
<th>LAPONITE</th>
<th>OPTIGEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>RDS</td>
</tr>
</tbody>
</table>

**Paints and Building Coatings**
- Polyvinyl acetate systems
- Pure acrylate systems
- Styrene acrylate systems
- Silicate paints
- Silicone exterior paints
- Building paints
- Paints for artists
- Finger paints
- Floor coatings
- Sealants
- Bituminous emulsions
- Construction adhesives
- Printing inks
- Paints for road markings

**Coatings**
- Acrylate resin systems
- Alkyd resin systems
- Alkyd resin systems, amine-neutralized
- Epoxy resins
- Cathodic dip paints
- PU systems
- Underbody protectants

**Miscellaneous Applications**
- Adhesives
- Agrochemicals
- Pesticides
- Fertilizers
- Foundry washes
- Release agents
- Ceramic frits
- Glazes
- Enamel
- Textile auxiliaries
- Paint removers
- Abrasives and polishing agents
- Welding electrodes

<table>
<thead>
<tr>
<th>especially recommended</th>
<th>recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>☐</td>
</tr>
</tbody>
</table>

Figure 1
Advantages for your product:
  • Easy handling  
  • No sagging  
  • No dripping  
  • Excellent storage stability  
  • No settling

Advantages for your production processes:
  • Easy to meter  
  • Easy to disperse  
  • Universally applicable

LAPONITE products
LAPONITE RD is a fully synthetic, inorganic product with a precisely controlled chemical composition. It has a powerful stabilizing effect. Other outstanding features are its superior whiteness and its ability to form transparent gels. LAPONITE RDS and S482 have been modified in a way that makes these powdered products particularly easy to disperse.

LAPONITE SL25 is a ready-for-use aqueous dispersion at 25% solids content.

OPTIGEL C products
OPTIGEL C products are natural smectites and can be stored as a powder or as a pre-gel. They produce a high yield point in aqueous and water-soluble systems. This is why OPTIGEL C products significantly improve stabilisation of systems and help to prevent settling and sagging without raising the apparent viscosity.

Modified OPTIGEL products
OPTIGEL LX, WA, WM, WX and W724 are organically modified. They increase the viscosity and give aqueous and water-soluble systems a thixotropic behavior. All OPTIGEL products are easy to disperse and are excellent stabilizers and anti-sagging agents.
OPTIGEL/LAPONITE – Mode of Action

OPTIGEL and LAPONITE products from Rockwood are smectite based rheological additives for water-borne systems.

Smectites are a group of layered silicate minerals, which occur naturally, but can also be produced synthetically. Smectites have a platelet structure. The platelets are very thin, about 1 nm. The platelet diameter is about 500 – 1000 nm (1 µm) for natural smectites (OPTIGEL products) and 25 – 50 nm for synthetic smectites (LAPONITE products).

These stacks then separate into their individual platelets when added to water and dispersed under high shear conditions.

House-of-cards structure
The surfaces of individual OPTIGEL/LAPONITE platelets are negatively charged, but their edges are either neutral or even positively charged. Because their overall charge is predominantly negative, the platelets repel each other in the suspension, a process that distributes them evenly throughout the solution.

The difference in charge between their edges and their surfaces then generates a slight edge to face attraction between the platelets. Small amounts of divalent cations as Ca$^{2+}$ or Mg$^{2+}$ can further contribute to this interaction. These cations can link two platelets together at the edges this increasing the platelets size. This and the edge to face interaction produces a house-of-cards-like structure, which results in a gel formation.

Yield point and thixotropy
The stability of the gel reflects the bonding strength between platelets. When external forces (such as a stirrer, paint brush, roller) act on the gel, the house of cards collapses and the gel returns to its fluid state. Once the external force is reduced, the card house reforms and the liquid again behaves like a gel. OPTIGEL/LAPONITE produces what is known as a yield point. This means, a minimum force is required before a substance starts to flow.
Additionally, the gel exhibits thixotropic behavior. The greater the stirring force acting on the gel, the more completely the card-house structure will collapse, i.e., the thinner the liquid will become. After stirring, the card-house structure will reform within a short period of time and the viscosity will return to its original level.

Associative/Newtonian thickeners in the OPTIFLO product line, on the other hand, behave differently, exhibiting virtually no yield point and remain highly viscous, even when vigorously stirred.

**OPTIGEL/LAPONITE – Advantages**

**Benefits of the yield point**
The formation of a yield point reduces sagging. This makes it possible to apply thick coats of paint in one application step without negative side effects such as beading, dripping or sagging.

This is achieved by the stabilizing effect of the OPTIGEL card-house structure, which completely rebuilds shortly after applying the paint.

The yield point significantly improves storage stability. It keeps pigments and fillers in suspension and prevents heavier pigments from settling and lighter pigments from floating up to the surface.

Thixotropic behavior alone would not have this effect—while it may slow down the settling process, it does not prevent it. The system must also have a yield point.

A yield point likewise reduces liquid separation (syneresis).

**OPTIGEL/LAPONITE Reduces Sagging**

**OPTIGEL/LAPONITE Reduces Settling and Syneresis**
# OPTIGEL/LAPONITE – Product Overview

<table>
<thead>
<tr>
<th>Product Description</th>
<th>LAPONITE</th>
<th>OPTIGEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Synthetic Layered Silicate</td>
<td>Activated smectites</td>
</tr>
<tr>
<td>Product</td>
<td>Powder</td>
<td>Liquid</td>
</tr>
<tr>
<td>Whiteness (Elrepho R 457) [%]</td>
<td>&gt; 90</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>Favorable dispersibility</td>
<td>△</td>
<td>△</td>
</tr>
</tbody>
</table>

## Rheological Effect

| Swelling | △ | △ | △ | △ | O | O | △ | △ | △ | △ | △ | △ | △ | △ |
| Thixotropic/pseudoplastic behavior | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| Yield point | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| Stabilization | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| Anti-settling effect | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| Anti-sagging effect | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |

## Resistance

| To organic solvents | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| To changes in temperature | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| To high concentrations of electrolytes | O | O | O | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ | △ |
| Preservatives necessary | | | | | **check** | | **check** | | **check** | | | | | | |
| pH stability | 3-13 | 3-13 | 3-13 | 3-13 | 3-13 | 2-13 | 2-13 | 6-13 | 4-13 | 5-11 | 6-11 | 5-11 | 2-13 | 5-11 |

## Quantity Typically Required [%]

|                   | 0.1-2 | 0.5-8 | 0.3-3 | 0.5-5 | 0.3-3 | 0.5-5 | 0.1-2 | 0.3-2 | 0.1-2 | 0.3-2 | 0.1-1 |

▲ very high   △ high    O average

*figure 7*
OPTIGEL/LAPONITE – Major Applications

<table>
<thead>
<tr>
<th>LAPONITE RD</th>
<th>Thixotropic thickeners and stabilizers for latex paints (e.g., solid paint); water-borne metallics or clear coats; wood coatings; adhesives</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAPONITE RDS</td>
<td></td>
</tr>
<tr>
<td>LAPONITE S482</td>
<td></td>
</tr>
<tr>
<td>LAPONITE SL25</td>
<td></td>
</tr>
<tr>
<td>OPTIGEL CK</td>
<td>Universal, thixotropic thickener for water-soluble systems; stabilizer for latex paints, ceramics</td>
</tr>
<tr>
<td>OPTIGEL CL</td>
<td>Thixotropic anti-settling agent/stabilizer for paints, ceramics</td>
</tr>
<tr>
<td>OPTIGEL CG</td>
<td>Economical, thixotropic thickener for paints and building chemicals</td>
</tr>
<tr>
<td>OPTIGEL CMO</td>
<td>Thixotropic thickener and stabilizer for paints and technical applications; compatible with large amounts of electrolytes</td>
</tr>
<tr>
<td>OPTIGEL LX</td>
<td>Highly effective thickener for flat and semi-gloss latex paints, silicon resin paints and adhesives</td>
</tr>
<tr>
<td>OPTIGEL WA</td>
<td>Effective thickener for flat and semi-gloss latex paints, water-soluble paints, additive for the building industry and cleansers</td>
</tr>
<tr>
<td>OPTIGEL WM</td>
<td>Highly effective, universal thickener for semi-gloss latex paints, water-soluble paints, adhesives and textile auxiliaries</td>
</tr>
<tr>
<td>OPTIGEL WX</td>
<td>Effective thickener for flat and semi-gloss latex paints, water-soluble paints, silicate paints and printing inks</td>
</tr>
<tr>
<td>OPTIGEL W724</td>
<td>Highly effective thickener for semi-gloss and high PVC latex paints, water soluble coatings and anti-corrosion primers (i.e. 2K PUR, 2K Epoxy)</td>
</tr>
</tbody>
</table>
Products and Applications

BYK Additives

Product Range Additives:
- Additives to improve surface slip, leveling, and substrate wetting
- Adhesion promoters
- Defoamers and air release agents
- Processing additives
- Rheological additives
- UV absorbers
- Viscosity depressants
- Wax additives
- Wetting and dispersing additives for pigments and extenders

BYK-Che mie GmbH
P.O. Box 10 02 45
46462 Wesel
Germany
Tel +49 281 670-0
Fax +49 281 65735

info@byk.com
www.byk.com/additives

Application Areas:

Coatings Industry:
- Architectural Coatings
- Automotive Coatings
- Industrial Coatings
- Can Coatings
- Coil Coatings
- Wood & Furniture Coatings
- Powder Coatings
- Leather Finishes
- Protective & Marine Coatings

Plastics Industry:
- Ambient Curing Systems
- PVC Plastisols
- SMC/BMC
- Thermoplastics

BYK Instruments

BYK offers a complete line of testing instruments to meet your needs in many application areas:
- Gloss/Appearance
- Color

Portable or stationary laboratory equipment – including easy-to-use quality control software.

BYK instruments – the complete solution for the coatings and plastics industry.

BYK-Gardner GmbH
P.O. Box 970
82534 Geretsried
Germany
Tel +49 8171 3493-0
Fax +49 8171 3493-140

info.byk.gardner@altana.com
www.byk.com/instruments

ACTAL®, ADJUST-4®, ADVITROL®, BENTOLITE®, CLAYSTONE®, CLOSITE®, COPISIL®, FULACOLOR®, FULCAT®, FULgEL®, FULMONT®, GARAMITE®, GELWHITE®, LAPONITE®, MINERAL COLLOID®, OPTIBENT®, OPTIFLO®, OPTIGEL®, PERMONT®, PURE THIX®, RHEOCIN®, RHEOTIX®, RIC-SYN®, SCA®, TIXOGEL®, Y25® are registered trademarks of BYK Additives.

ANTI-TERRA®, BYK®, BYK®-DYNWET®, BYK®-SILCLEAN®, BYKANDOL®, BYKETOL®, BYKJET®, BYKOLAST®, BYKUMEN®, CARBOBYK®, DISPERBYK®, DISPERPLAST®, LACTIMON®, NANOBYK®, PAPERBYK®, SILBYK®, VISCOBYK®, and Greenability® are registered trademarks of BYK-Chemie.

AQUACER®, AQUAMAT®, AQUATIX®, CERACOL®, CERAFAX®, CERAFLOUR®, CERAMAT®, CERATIX®, CERAY®, HORDIAMER®, and MINERPOL® are registered trademarks of BYK-Cera.

SCONA® is a registered trademark of BYK Kometra.

This information is given to the best of our knowledge. Because of the multitude of formulations, production, and application conditions, all the above-mentioned statements have to be adjusted to the circumstances of the processor. No liabilities, including those for patent rights, can be derived from this fact for individual cases.

This issue replaces all previous versions – Printed in Germany