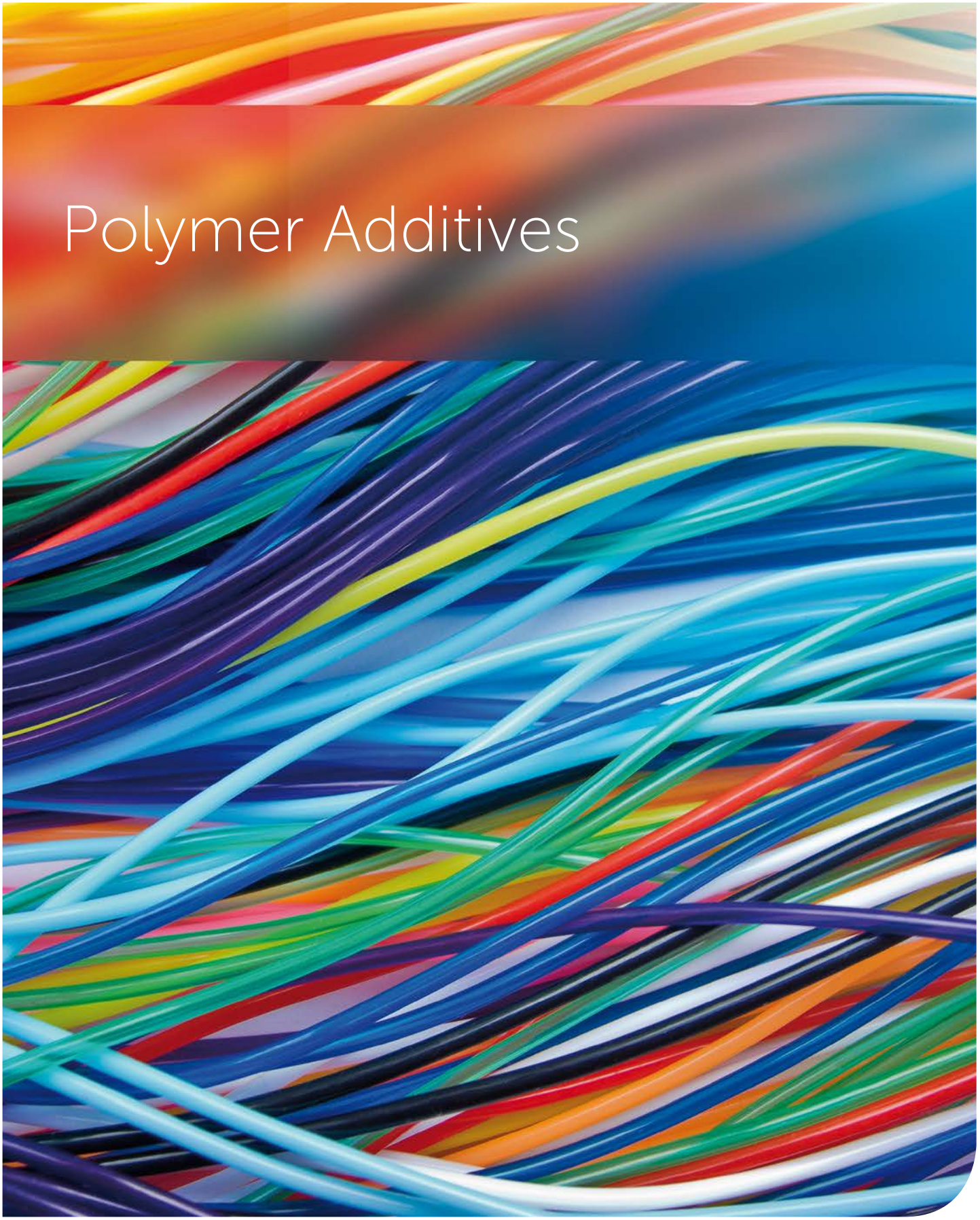
# Polymer Additives



pcc

More than Chemistry

# Table of Contents

## POLYMER ADDITIVES PRODUCT GROUPS


The high quality and chemical purity of PCC Group products guarantees stability and repeatability of production processes for our customers.

# Monochlorobenzene

MCB is used as a solvent for different kinds of advanced polymers, e.g., dichloro diphenyl sulphone (intermediate for engineering polymers with applications in the aviation, automobile and baby bottles industries), high-performance polymers, like PPSU - Polyphenylsulfone, PES - polyethersulfone, PSU).

PCC Rokita SA is one of two manufacturers of chlorobenzenes in Europe. The products from our manufacturing plants are of the highest global quality and meet the requirements of all possible applications.

| COMMERCIAL NAME | CHEMICAL FORMULA | OTHER COMMERCIAL NAMES | FORM | CONCENTRATION | QUALITY | CHARACTERISTIC | PACKAGING | MAIN APPLICATIONS |
|---|---|---|---|---|---|---|---|---|
| Monochlorobenzene | $C_6H_5Cl$ | Chlorobenzene, MCB, phenyl chloride | liquid | 99.9% | very high | Product of chlorobenzene plant | Steel drums 220 kg, road tank cars, iso-tanks, rail tank cars | Solvent for different kinds of advanced polymers |

# Flame Retardants – Roflam series

**Roflam series** - phosphorus-based flame retardants (FR), due to a unique flame retarding profile are assessed as one of the most efficient FR groups. Phosphorus-based FR, both chlorinated and non-halogenated are considered as an ideal choice giving a perfect balance of process ability, flame retardancy and physical properties. Roflam products are recommended as fire safety solutions for building and construction applications, the furniture and textile industry as well as for various applications in the transport sector. This range of products is especially recommended for polyurethanes as well as epoxy, unsaturated polyester and vinyl resins.

Flammability aspects of polymeric materials always play an important role in many applications. Roflam products as phosphorous containing compounds cause charring on the polymer surface, prevent the oxygen feeding to the flame and retard flame propagation. Therefore, they enhance fire resistance properties. This type of flame retardants is used in many types of polyurethane foams. The Roflam series reduces flammability of conventional and high resilience flexible PU foams used in upholstered furniture as well as many bedding components (e.g., mattresses, pillows). It enables to pass fire tests in the furniture industry whilst retaining good mechanical properties of flexible foams. They also provide fire resistant performance in combustion modified flexible PU foams as well as fire resistant semi-rigid and rigid PU foams used in the transport sector. Moreover, its low VOC means that it fulfils automotive requirements.

Fire safety is also an important issue in the building industry. For this reason, rigid and semi-rigid PU foams, mainly used in thermal and acoustic insulations, structural panels and decorative elements need to be fire resistant. Thanks to using Roflam products good fire classification of construction materials (e.g., according to DIN 4102-1) can be achieved. The other application of Roflam series is intumescent coatings. Their excellent fire resistant properties provides impressive performance in passive fire protection systems related to protection of steel structural elements from hydrocarbon and jet fire exposure. These solutions are used in the petrochemical, power generation, oil and gas industry (e.g., offshore installations) as well as any industrial plant and architectural applications, e.g., buildings, airports, bridges etc.

## Key features:

- Provides an excellent flame retardant profile
- Boosts the beneficial influence on mechanical properties
- Demonstrates suitable miscibility with liquids
- Leads viscosity reduction
- Exhibits good compatibility
- Possesses low VOCs emission
- Known as 'easy to use'

## Key applications:

- Buildings & Construction
- Transportation
- Marine coatings
- Offshore installations
- Adhesives
- Chemical anchors

## Roflam series – typical properties

| PRODUCT NAME | CHEMICAL NAME | APPEARANCE | DENSITY (at 25°C), g/mL | VISCOSITY, mPa•s | ACID VALUE, mgKOH/g | PHOSPHORUS CONTENT | CHLORINE CONTENT | KEY FEATURES |
|---|---|---|---|---|---|---|---|---|
| Roflam P | Tris(2-chloro-1-methylethyl) phosphate | homogenous, clear liquid | 1.28 | 66 | max 0.10 | 9.5% | 32.5% | highly effective, viscosity reduction |
| Roflam P LO | | | 1.28 | 66 | max 0.10 | 9.5% | 32.5% | highly effective, viscosity reduction, low VOC emission |
| Roflam B7 | Phenol, isobutylenated, phosphate (3:1) | homogenous, clear liquid | 1.17 | 78 | max 0.10 | 8.5% | - | halogen free |
| Roflam B7L* | | | 1.12 | 310 | max 0.10 | 7.4% | - | halogen free, low VOC emission |
| Roflam F5 | Phenol, isopropylated, phosphate (3:1) | homogenous, clear liquid | 1.18 | 58 | max 0.10 | 8.5% | - | halogen free |
| Roflam F6* | | | 1.17 | 69 | max 0.10 | 8.3% | - | halogen free |
| Roflam F9 | | | 1.14 | 103 | max 0.10 | 7.6% | - | halogen free |
| Roflam F12 | | | 1.12 | 120 | max 0.10 | 7.1% | - | halogen free |
| Roflam 6 | N,N-bis-(2-hydroxyethyl) aminomethane phosphonic acid diethyl ester | yellow to brown liquid | 1.16 | 200 | max 8.0 | 12.2% | - | halogen free, high phosphorous content, reactive |

* available upon request

## Roflam series – applications

| PRODUCT GROUP | FLEXIBLE & SEMI-RIGID PU FOAMS | RIGID & ONE COMPONENT PU FOAMS | C.A.S.E. | EPOXY / UNSATURATED POLYESTER / VINYL ESTER RESINS |
|---|---|---|---|---|
| Roflam P | | • | • | • |
| Roflam P LO | • | | | |
| Roflam 6 | | • | • | • |
| Roflam B7 | • | • | • | • |
| Roflam B7L | • | | | |
| Roflam F5 | | • | • | • |
| Roflam F6 | | • | • | |
| Roflam F9 | • | | • | |
| Roflam F12 | • | | • | |

# Plasticizers – Roflex series

**The Roflex series** is specialty polymer additives based on phosphorus esters. This product range exhibits an outstanding flame retarding profile with an excellent plasticizing performance especially in the PVC industry. The Roflex series is preferable for flexible and transparent application where substitute inorganic powder flame retardants. Due to great compatibility with non-flame retarding plasticizers they can be used simultaneously leading to a better economics. Moreover, the Roflex series provides low migration from plastics in comparison with traditional phthalate plasticizers.
During plastics processing Roflex non-phthalate plasticizers effectively penetrate into polymeric matrix cause chains movement resulting in material flexibility. Simultaneously they provide excellent flame retardancy. Therefore Roflex series are irreplaceable wherever flame retarding profile and excellent plasticizing performance are desirable.

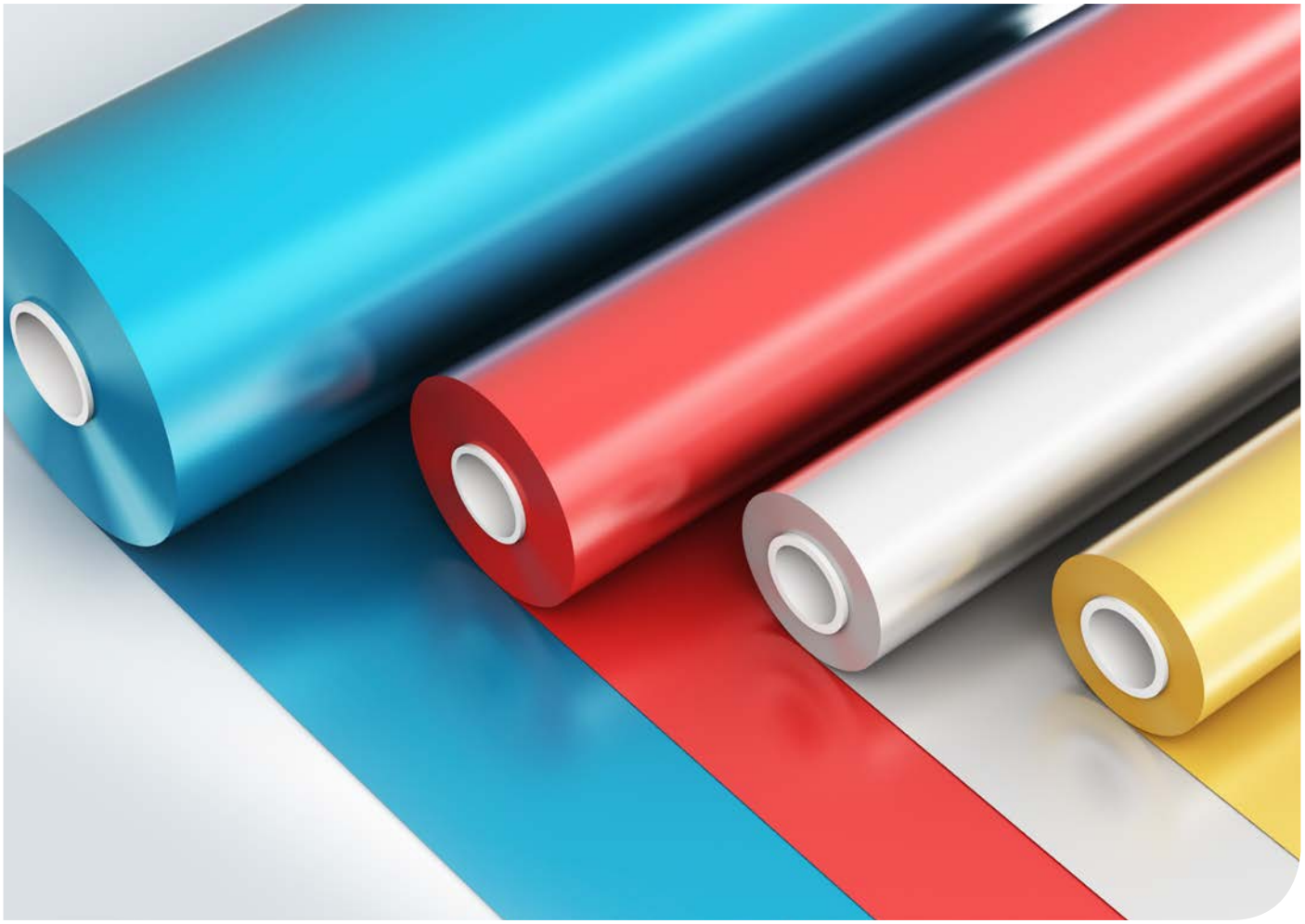
Roflex plasticizers are dedicated mostly to the PVC flexible industry. They are widely used in extrusion processes (wires & cables insulation), calendering (foils, coverings) and casting (coated textiles, artificial leathers, film screens). Additionally they could be used in rubber industry, providing effectiveness in the plasticizing effect and flame retardancy in elastomers.

## Key features:

- Present excellent plasticizing performance
- Demonstrate outstanding flame retarding profile
- Sustain low migration level
- Exhibit suitable compatibility with non FR plasticizers

## Key applications:

- Conveyor belts
- Film screens
- Tarpaulins
- Flexible ducting
- Coated textiles
- Transparent foils
- Floorings
- Artificial leathers
- Wires and cables



## Roflex series – typical properties

| PRODUCT NAME | CHEMICAL NAME | APPEARANCE | DENSITY (at 25°C), g/mL | VISCOSITY, mPa•s | FLASH POINT, °C | SOLVENTS |
|---|---|---|---|---|---|---|
| Roflex 50 | phenol, isopropylated, phosphate (3:1) | homogenous, clear liquid | 1.17 | 53 | 235 | Methanol, ethanol, acetone |
| Roflex 65 | | | 1.16 | 69 | 238 | |
| Roflex 95 | | | 1.13 | 97 | 243 | |
| Roflex NHP | | | 1.08 | 120 | 245 | |
| Roflex T70 | phenol, isobutylenated, phosphate (3:1) | | 1.18 | 72 | 240 | |

# Thermal & processing stabilizers - Rostabil series

**The Rostabil series** comprises secondary antioxidants based on organophosphites. Mainly, they are employed as effective thermal and processing stabilizers. Thanks to good inhibitation of polymer degradation they ensure colour control during processing and curing cycles.
The degradation process is usually caused by heat, humidity or UV radiation. From a chemical point of view degradation (ageing process) is due to cracking of chemical bonds between carbon atoms in the polymeric matrix. This leads to deterioration of mechanical and visual properties resulting in yellowing or bleeding on the surface of plastic end products. Specially designed stabilizers protect polymers against degradation maintaining excellent physical properties during processing and the life cycle.

Products exhibit a synergistic effect with hindered phenol and amine stabilizers (primary antioxidants) during processing thermosets and rubbers. They are recommended to be used with metal soaps heat stabilizers to eliminate bleeding and yellowing effect in the PVC industry.

## Key features:

- Sustain excellent protection against degradation
- Provide brighter, more consistent colours
- Improve clarity in unpigmented compounds
- Reduce discoloration of polymers containing pigments
- Ensure high performance at low loading levels for more cost effective formulations

## Key applications:

- Ducting pipes
- Window frames
- Technical foils
- Wires and cables
- Roof membranes
- Household appliances
- Rubber belts
- Mattresses foams
- Car tires

## Rostabil series – typical properties

| PRODUCT NAME | CHEMICAL NAME | APPEARANCE | DENSITY (at 25°C), g/mL | HAZEN COLOUR | REFRACTIVE INDEX, $n^{20}D$ | ACID VALUE, mgKOH/g |
|---|---|---|---|---|---|---|
| Rostabil TNF* | tris (nonyl) phenyl phosphite | slightly coloured, homogenous liquid | 0.97 | max 150 | 1.53 | max 0.3 |
| Rostabil DPDP* | isodecyl diphenyl phosphite | clear liquid | 1.04 | max 100 | 1.52 | max 0.1 |
| Rostabil DDPP* | diisodecyl phenyl phosphite | | 0.95 | max 100 | 1.48 | max 0.1 |
| Rostabil TDP* | tris (isodecyl) phosphite | | 0.88 | max 50 | 1.45 | max 0.1 |
| Rostabil TTDP* | tris (isotridecyl) phosphite | | 0.88 | max 100 | 1.46 | max 0.2 |
| Rostabil TPP* | triphenyl phosphite | | 1.18 | max 50 | 1.59 | max 0.5 |

* available upon request

## Rostabil series – applications

| PRODUCT GROUP | PU FOAMS | EPOXY / UNSATURATED POLYESTER / VINYL ESTER RESINS | RUBBERS | RIGID & FLEXIBLE PVC |
|---|---|---|---|---|
| Rostabil TNF | • | • | • | • |
| Rostabil DPDP | • | • | • | • |
| Rostabil DDPP | • | • | • | • |
| Rostabil TDP | | | | • |
| Rostabil TTDP | | | | • |
| Rostabil TPP | | • | • | |

# Dispersing agents – Dyspergator series

Two thirds of rubber produced annually is synthetic, produced from various petroleum-based monomers. The most common synthetic rubbers are styrene-butadiene rubbers (SBR) derived mainly from emulsion copolymerisation of styrene and 1.3-butadiene. As a result of the process the latex particles, made of mainly individual polymer chains, are formed and are stopped from coagulating with each other because they are surrounded by particles of a dispersant. The best choice for a dispersing agent is a polynaphthalenesulfonate sodium salt, built of inorganic hydrophilic groups (sulphate groups) and a hydrophobic organic chain. The charge on these molecule repels particles of latex electrostatically and allows to carry the process safe and efficiently.

PCC Rokita is a producer of polynaphthalenesulfonate salts widely used in synthetic rubber production sold under the brand name Dyspergator series. We offer them both as liquids and as powders. Thanks to the careful and well-established process of their synthesis our products are characterized by a very low level of free naphthalene and free formaldehyde and of metal ions (calcium and iron).

## Key features:

- Inhibit particles agglomeration
- Provide excellent water based dispersion
- Possess low level both free formaldehyde and free naphthalene

## Key applications:

- Tire production
- Footwear production
- Hoses
- Flooring
- Cable insulations
- Consumer goods
- Industrial rubbers (e.g., conveyor belts)

## Dyspergator series – typical properties

| PRODUCT NAME | APPEARANCE | DENSITY AT 25°C, g/mL | pH | DRY MATTER, % (w/w) | SULPHATES, % (w/w) | WATER CONTENT, % (w/w) |
|---|---|---|---|---|---|---|
| Dyspergator R | dark brown liquid | 1.20 - 1.21 | 6.5 - 8.5 | min 37 | max 4 | - |
| Dyspergator Oskar | brown liquid, small amounts of precipitate is acceptable | 1.15 - 1.17 | 7.0 - 9.0 | min 30 | max 5 | - |
| Dyspergator RP* | powder with a colour of light brown | - | 6.5 - 8.5 | min 92 | max 15 | max 8 |
| Dyspergator SBRP* | powder with a colour of light brown | - | 7.0 - 9.0 | min 92 | max 15 | max 8 |

* available upon request

Emulsion polymerization is a process that is used to manufacture polymer dispersions, also called latexes, for a wide variety of formulations including water-based paints, coatings for wood, nonwoven, adhesives, sealants, rubbers. All of these applications are often called CASE (coatings, adhesives, sealants, elastomers).

The big advantage of water-based products over solvent-borne is to reducing environmental impact due to much lower level of VOC (volatile compounds) in formulations. Another significant advantage is that it is easy to use and often there is no need for labeling as a hazardous product.

There are numerous process variations in emulsion polymerization. The batch process is just the start of the polymerization, with all portions of reagents present in the reactor. Continous process – parts of reagents are added to the reactor and the remainder are fed under controlled rates. Emulsion polymerization via preemulsion – a monomer mixture, water and surfactants are mixed together to form an emulsion which is fed during the emulsion polymerization course. Seeded emulsion polymerization – a small amount of fine particle-sized latex is added to the reactor followed by feeding monomers, surfactants and initiantors; the polymerization process starts in swelled latex particles. Seed latex can also be prepare in situ as a first step of emulsion polymerization .

## The role of surfactants in emulsion polymerization

Anionic and nonionic surfactants are common used in emulsion polymerization as emulsifiers and latex stabilizers. The concentration of surfactants are in the range from a few tenth to 5%. Anionic surfactant can be used as a sole emulsifier or often in combination with nonionics. Nonionic surfactants are rarely used alone mainly due to the tendency to rising particles size of polymer dispersion. Even if nonionic surfactant consist primary emulsifier the small amount of anionic is common used to ensure lower particle size. The combination of nonionic and anionic emulsifier is very important to provide good performance of the polymer dispersion. Anionic surfactants is used to control particle size and ensure good polymerization rate and electroststic stability, nonionics impart mechanical, electrolitycal stability and freeze-thaw resistance.

Surfactants plays a many roles in emulsion polymerization process and are essential for latex manufacturing. Surfactants reduce the interfacial tension between insoluble monomers and water and form small monomer droplets in aqueous matrix. Surfactants have the tendency to form a micelles which are play essential function during nucleation step of emulsion polymerization.

They help to solubilize monomers and provide the right sites where the polymerization occurs. With the progress of emulsion polymerization dimensions of micelle are rising rapidly and when achieved the limit values it breaks and form polymer particles. Each polymer particles are covered by surfactants witch prevent to approaching molecules to close distance. The usage of anionic and nonionic surfactant blends are very common in emulsion polymerization and help to stabilize the formulation for specific application and ensure polymer dispersion stability during transport and storage.

## The different in latex stabilization nature by anionic and nonionic surfactants.

Anionic surfactants are adsorbed on polymer particles and surround them by electric charges. The electric layer form a energy barrier for other particles preventing their agglomeration. Anionic surfactants have the ability to stabilized small particles of dispersion by electrostatic repulsion thus they often used during nucleation process. The most weakness of anionic surfactants are very sensitivity to presence of salts.

Nonionic surfactants ensure the latex stabilization by adsorbing on polymer particles and covering them by long polyethylene glycol ethers chains, which constitute steric hindrance for other polymer particles. The steric forces act for smaller distance and provide weaker stability for a latex during emulsion polymerization. Steric stabilization are far less sensitive to ions and freezing.

# Anionic emulsifiers

We manufacture both sulfate and sulfonate products at our modern sulfonation plant located in Poland. Our plant gives us a broad level of flexibility in meeting customer's specific needs in respect of using new oleochemical feedstock and product purity requirements (unsulfated matter, inorganic salts content).

## Sulfates and sulfonates

### Rosulfan L and D

**Sodium salt of lauryl C12-C14 alcohol sulfate(SLS)**
**Sodium salt of decyl C10 alcohol sulfate**

Sodium lauryl and decyl alcohol sulfates are derived from natural oleochemical feedstock. The SLS is commonly used emulsifier in emulsion polymerization for most monomer systems – acrylic, styrene-acrylic, vinyl acetate, EVA. Products with different alcohol distribution are also available.

## Alkyl ether sulfates

### Sulforokanol L series

**Alkyl ether sulfate; with the range 1-12 EO**

We supply alkyl ether sulfates based on different alcohols feedstock: natural C12-C14, C12-C16 and synthetic C12-C15, with varying degrees of ethoxylation. The products are available as a solution and concentrated pastes. Products with a higher ethoxylation degree ensure both electrostatic and steric stabilization to latex particles significantly improved colloidal stability. Alkyl ethers sulfates have a better hard water tolerance then fatty alcohol sulfates. They can be used as a sole emulsifier or with other anionic and nonionic surfactant systems for all acrylic, styrene-acrylic, vinyl-acrylic, EVA lattices.

### ABSNa and ABS

**Alkyl benzene sulfonate (sodium salt)**

Alkyl benzene sulphonate surfactants are derived from linear C10-C13 alkylate feedstock with high 2-phenyl content. Linear alkylbenzene sulphonate shows excellent acid/alkali stability and quite good hard water stability. The acid form of the product can be used as intermediate for various kind of salts.
Product is compatible with many polymers like styrene-butadiene rubber, styrene-acrylic, polyvinyl and vinylydene chloride, EVA.

# Sulfosuccinates

## Sulfosuccinate L3/40

**Etoxylated fatty alcohols sulfosuccinates**

Monoester of ethoxylated (4EO) lauryl alcohol and sulfosuccinic acid, sodium salt is an efficient anionic surfactants for most monomer systems – acrylic, styrene-acrylic, vinyl acetate, EVA. Gives very good electrostatic stabilization and small particle size dispersion. Can be used in combination with nonionic surfactants in order to improve mechanical stability and freeze-thaw and reduce particle size.
Products based on different degree of ethoxylation and fatty alcohols feedstock are also available.

## Sulfosuccinate DOSS

**Dioctyl sulfosuccinate (sodium salt)**

Diester of 2-ethyl hexyl alcohol is excellent wetting and leveling agent for binders and coating formulations. Has very low dynamic surface tension and migrate rapidly to interfactes. Sulfosuccinate DOSS as co-emulsifier in emulsion polymerization process provides also excellent emulsification capabilities for hydrophobic mnonomers like styrene, 2-ethylhextl acrylate, butyl actylate.

## Anionic emulsifiers - product list

| PRODUCT CHARACTERISTIC | | | | | | PRODUCTS GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT | Description | CAS | Appearance | HLB | Active | Vinyl acetate & copolymers | Styrene Acrylics | Acrylics | Styrene butadiene rubber | Polyvinyl chloride | Nitrile rubber | Chloroprene rubber | APE - free | Post-polymerization stability |
| ABSNA 30 | Sodium Dodecylbenzenesulfonate | 68411-30-3 | Liquid | - | 28-32 | ● | ● | o | ● | ● | ● | ● | ● | |
| ROSULFAN A | Ammonium Lauryl Sulfate | 931-558-1 | Liquid | - | 26-28 | o | ● | ● | ● | ● | | | ● | |
| ROSULFAN L | Sodium Lauryl Sulfate | 85586-07-8 | Liquid | - | 27.5-30 | o | ● | ● | ● | ● | | | ● | |
| SULFOROKANOL L225/1 | Sodium Laureth Sulfate + 2 EO | 68891-38-3 | Liquid | - | 26-28 | o | ● | ● | ● | ● | | | ● | |
| SULFOROKANOL L270/1 | Sodium Laureth Sulfate + 2 EO | 68891-38-3 | Paste/Liquid gel | - | 26-28 | o | ● | ● | ● | ● | | | ● | |
| SULFOROKANOL L327/1 | Sodium Laureth Sulfate + 3 EO | 13150-00-0 | Liquid | - | 27-29 | o | ● | ● | ● | ● | | | ● | |
| SULFOROKANOL L370/1 | Sodium Laureth Sulfate + 3 EO | 13150-00-0 | Paste/Liquid gel | - | 27-29 | o | ● | ● | ● | ● | | | ● | |
| SULFOROKANOL L1230/1A | Sodium Laureth Sulfate + 12 EO | 9004-82-4 | Liquid | - | 29-31 | ● | ● | ● | ● | o | | | ● | o |
| SULFOSUCCINATE L3/40 | Disodium Laureth Sulfosuccinate | 68815-56-5 | Liquid | - | min. 38 | ● | ● | ● | o | | | | ● | |
| SULFOSUCCINATE DOSS 70GP | Di (2ethylhexyl)sulfosuccinic acid, sodium salt | 577-11-7 | Liquid | - | min. 70 | o | o | o | o | ● | o | o | | |

● highly recommended o recommended

# Nonionic emulsifiers

PCC Exol manufactures a broad range of nonionic products for emulsion polymerization. The product portfolio includes both commodity and speciality emulsifiers and latex additives. Our product range covers ethoxylates and alcoxylates of nonylphenol, fatty alcohols, acids and vegetable oils, fatty amines and amides and block copolymers of ethylene oxide and propylene oxide.

We manufacture our product based on alcohols derived from both - petrochemical and natural sources with extensive range of carbon chains distribution ranging from C9-C18. Owing to the appropriate method of conducting the reaction with ethylene oxide, it is possible to obtain a range of products with various ethoxylation degrees. Products based on other olechemical feedstock are possible to make upon request.

## Fatty alcohol ethoxylates and alcoxylates

### Rokanol L, series

**Lauryl alcohol ethoxylates and alcoxylates**

Rokanol L is the common used enviromential friendly alternative for nonylphenol ethoxylates. Products are available in various degree of ethoxylation and propoxylation ranging from 2 to 50. Rokanol L10/80 is the standard alternative for ethoxylated nonylphenol (10EO), gives good emulsification capability and latex performance of styrene-acrylic and full acrylic binders. Higher ethoxylates of lauryl alcohol e.g., Rokanol L30A (30EO) can be used as latex post-stabilisers to improve stabilization of various kind of polymers lattices or as emulsifier for p-VAc.
Typically we recommend to use our Rokanols in combination with various anionic surfactants.

### Rokanol ID and IT series

**Isodecyl and Iso-tridecyl alcohol ethoxylates**

Ethoxylates of synthetic fully branched isotridecanol and isodecanol are more soluble in water and possess lower foaming capacity and a higher cloud-point then linear type of ethoxylates. Rokanol IT0 and IT12 are suitable as an alternative for NPEs for most commonly used monomer systems including styrene and acrylates.

### Rokanol T, K and O series

**C16-C18 unsaturated and saturated alcohol ethoxylates**

Linear fatty alcohols ethoxylates with C16-C18 carbon chains distribution are excellent emulsifiers for emulsion polymerization. Rokanol T18, K18, K21 and O20 are effective emulsifiers for polymerization of vinyl acetate and copolymer. The differences between Rokanols T, K and O is in the iodine value of oleochemical feedstock. Rokanol T is completely saturated but the other K and O are based on partly unsaturated fatty alcohols. The unsaturation degree influences slightly on HLB value and emulsification efficiency and viscosity of obtained polymer dispersions. Rokanol K21 and K18 can be also used as post-additives to improve freeze-thaw stability. Other degree of ethoxylation is possible to make based on this oleochemical feedstock.

# Fatty alkohol ethoxylates and alcoxylates - product list

| PRODUCT CHARACTERISTIC | | | | | | PRODUCTS GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT | Description | CAS | Appearance | HLB | Active | Vinyl acetate & copolymers | Styrene Acrylics | Acrylics | Styrene butadiene rubber | Polyvinyl chloride | Nitrile rubber | Chloroprene rubber | APE - free | Low foam | Post-polymerization stability |
| ROKANOL DB11W | Alcohols, C12-15 + 11 EO | 68131-39-5 | Oily liquid/ Paste | 13.6 | min. 90.0 | | • | o | o | o | | | • | | |
| ROKANOL ID8 | Alcohols, C10-Iso + 8 EO | 68439-45-2 | Liquid | 13.8 | min. 99.5 | | • | o | o | o | | | • | | |
| ROKANOL IT8 | Alcohols, C13, branched + 8 EO | 69011-36-5 | Liquid/Paste | 12.8 | min. 99.5 | | • | o | o | o | | | • | | |
| ROKANOL IT9 | Alcohols, C13, branched + 9 EO | 69011-36-5 | Oily liquid/ Paste | 13.2 | min. 99.0 | | • | o | o | o | | | • | | |
| ROKANOL IT10 | Alcohols, C13, branched + 10 EO | 69011-36-5 | Liquid | 13.8 | min. 99.5 | | • | o | o | o | | | • | | |
| ROKANOL IT12 | Alcohols, C13, branched + 12 EO | 69011-36-5 | Liquid/Paste | 14.5 | min. 99.0 | | • | o | o | o | | | • | | |
| ROKANOL K14 | Alcohols, C16-18 unsaturated + 14 EO | 9005-04-3 | Paste/Wax | 14.0 | min. 99.0 | | • | o | o | o | | | • | | |
| ROKANOL K18 | Alcohols, C16-18 unsaturated + 18 EO | 9005-04-3 | Paste/Wax | 15.8 | min. 99.0 | • | • | • | o | o | | | • | | • |
| ROKANOL K21 | Alcohols, C16-18 unsaturated + 21 EO | 9005-04-3 | Paste/Wax | 16.5 | min. 99.5 | • | • | • | o | o | | | • | | • |
| ROKANOL L10/80 | Alcohols, C12-14 + 10 EO | 68551-12-2 | Viscous liquid | 13.8 | min. 80.0 | | • | o | o | o | | | • | | o |
| ROKANOL L22 | Alcohols, C12-14 + 22 EO | 68551-12-2 | Wax | 17.0 | min. 99.7 | o | • | • | o | o | | | • | | o |
| ROKANOL L30A | Alcohols, C12-14 + 30 EO | 68551-12-2 | Wax | 18.0 | min. 99.7 | • | • | • | o | o | | | • | | • |
| ROKANOL L30A/65 | Alcohols, C12-14 + 30 EO | 68551-12-2 | Viscousl iquid | 18.0 | 64-66 | • | • | • | o | o | | | • | | • |
| ROKANOL L80/50W | Alcohols, C12-14 + 10EO/PO | 68551-12-2 | Viscous liquid | 17.6 | 47-51 | • | • | • | | o | | | • | o | o |
| ROKANOL O18 | Alcohols, C16-18 unsaturated + 18 EO | 9004-98-2 | Paste | 15.6 | min. 99.0 | • | • | • | o | o | | | • | | • |
| ROKANOL O20 | Alcohols, C16-18 unsaturated + 20 EO | 9004-98-2 | Paste | 16.3 | min. 99.0 | • | • | • | o | o | | | • | | • |
| ROKANOL T12 | Alcohols, C16-18 + 12 EO | 68439-49-6 | Wax | 13.5 | min. 99.5 | | • | • | o | o | | | • | | |
| ROKANOL T18 | Alcohols, C16-18 + 18 EO | 68439-49-6 | Wax | 15.8 | min. 99.0 | • | • | • | o | o | | | • | | • |

• highly recommended  o recommended

# Fatty acids and vegetable oils ethoxylates

## Rokacet R and S series

**Stearic acid and castor oil ethoxylates**

Ethoxylates of stearic acid and castor oil are used as emulsifiers, stabilizers and dispersants for many water-based coating formulations. As post-additives to lattices they improve freeze-thaw stability and electrolite tolerance. They have have very good emulsification capabilities for many types of solvents, fatty acids, waxes.

## Rokacet R and S series - product list

| PRODUCT CHARACTERISTIC | | | | | | PRODUCTS GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT | Description | CAS | Appearance | HLB | Active | Vinyl acetate & copolymers | Styrene Acrylics | Acrylics | Styrene butadiene rubber | Polyvinyl chloride | Nitrile rubber | Chloroprene rubber | APE - free | Post-polymerization stability |
| ROKACET S24 | Stearate + 24EO | 9004-99-3 | Wax | 15.8 | min 99.0 | • | • | o | o | o | | | • | o |
| ROKACET R40 | Castoroil + 40EO | 61791-12-6 | Paste | 13.0 | min 99.0 | | • | • | o | o | | | • | o |
| ROKACET R70 | Castoroil +70EO | 61791-12-6 | Paste | 15.4 | min 99.0 | • | • | • | o | o | | | • | • |

# Alkyl phenol ethoxylates and alcoxylates

## Rokafenol N series

**Nonylphenol ethoxylates**

Nonylphenol ethoxylates ensure excellent steric stabilization to latex, improve resistance against freeze-thaw, temperature and possess hard water tolerance. Rokafenols N can be used in combination with various anionic surfactants including ABSNa, Rosulfan L, Sulfosuccinate L3/40 and Sulforokanols L. Our nonylphenol ethoxylates are available in various degrees of ethoxylation, ranging from 4-40. The good control of process production ensures a low PEG level and narrow ethoxylates distribution in our NPE products

## Rokafenol N series - product list

| PRODUCT CHARACTERISTIC | | | | | | PRODUCTS GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT | Description | CAS | Appearance | HLB | Active | Vinyl acetate & copolymers | Styrene Acrylics | Acrylics | Styrene butadiene rubber | Polyvinyl chloride | Nitrile rubber | Chloroprene rubber | APE - free | Post-polymerization stability |
| ROKAFENOL N10 | Nonylphenol+10EO | 127087-87-0 | Oily liquid | 13.3 | min 99.0 | | ● | o | o | o | | ● | | |
| ROKAFENOL N12 | Nonylphenol+12EO | 127087-87-0 | Oily liquid | 14.0 | min 99.0 | | ● | o | o | o | | ● | | |
| ROKAFENOL N14 | Nonylphenol+14EO | 127087-87-0 | Oily liquid | 15.0 | min 99.0 | o | ● | o | o | o | o | ● | | |
| ROKAFENOL N22 | Nonylphenol+22EO | 127087-87-0 | Paste/Wax | 16.2 | min 99.0 | ● | ● | ● | o | o | ● | ● | | |
| ROKAFENOL N22/30 | Nonylphenol+22EO | 127087-87-0 | Liquid | 16.2 | 25-26.5 | ● | ● | ● | o | o | ● | ● | | |
| ROKAFENOL N40/70 | Nonylphenol+30EO | 127087-87-0 | Wax | 17.6 | 69-71 | ● | ● | ● | o | o | ● | ● | | ● |
| ROKAFENOL N40 | Nonylphenol+40EO | 127087-87-0 | Liquid | 17.8 | min 99.0 | ● | ● | ● | o | o | ● | ● | | ● |

# PEG/PPG block copolymers

## Rokamers

**PEG/PPG block copolymers**

Nonionic surfactants composed of 3-block segments of PEG/PPG/PEG have versatile properties and application performance depends on the molecular weight and ratio of ethylene oxide to propylene oxide in the molecule. Products with low EO contents (Rokamer 2000) show defoaming behavior, whereas products with higher EO content (Rokamer 1010) act as emulsifiers and dispersants.

## PEG/PPG block copolymers - product list

| PRODUCT CHARACTERISTIC | | | | | | PRODUCTS GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT | Description | CAS | Appearance | HLB | Active | Vinyl acetate & copolymers | Styrene Acrylics | Acrylics | Styrene butadiene rubber | Polyvinyl chloride | Nitrile rubber | Chloroprene rubber | APE - free | Low foam | Post-polymerization stability |
| ROKAMER 2100 | PEG/PPG Copolymer | 9003-11-6 | Clear liquid | 3.4 | min. 99 | o | o | o | o | o | | | • | • | |
| ROKAMER 2330 | PEG/PPG Copolymer | 9003-11-6 | Viscous liquid | 4.9 | min. 99 | o | o | o | o | o | | | • | • | |
| ROKAMER 2950 | PEG/PPG Copolymer | 9003-11-6 | Viscous liquid or semi-liquid paste | 8.1 | min. 99 | o | o | o | o | o | | | • | • | |
| ROKAMER 1010 | PEG/PPG Copolymer | 9003-11-6 | Wax | 16.6 | min. 99 | o | • | • | o | o | o | | • | • | |
| ROKAMER 1010/50 | PEG/PPG Copolymer | 9003-11-6 | Viscous liquid | 16.6 | >50 | o | • | • | o | o | o | | • | • | |
| ROKAMER 2000 | PEG/PPG Copolymer | 9003-11-6 | Clear or turbid liquid | 2.4 | min. 99 | o | o | o | o | o | | | • | • | |
| ROKAMER 2600 | PEG/PPG Copolymer | 9003-11-6 | Clear or turbid liquid | 5.6 | min. 99 | o | o | o | o | o | | | • | • | |

# Evaluation PCC Exol products in applications

## Styrene/acrylic latex

This a recipe for low MFFT styrene-acrylic dispersion that can be used as a binder for decorative paints. Sulfosuccinate L3/40 provides good pre-emulsion stability within whole emulsion polymerization process and ensures small particle size of the final dispersion.
Sulforokanol L1230/1A provides both electrostatic and steric stabilization, gives higher particle size and narrow distribution.
Nonionic APEO-free surfactants - Rokanol L and K series ensures excellent electrolyte tolerance and can be used as alternatives for nonylphenol ethoxylates (APEO) emulsifiers.
Particles size of the latex can be regulated by amount of Sulfosuccinate L3/40 or Sulforokanols in water as initial charge.

| Reactor Charge | grams | % pphm |
|---|---|---|
| **Initial charge** | | |
| Water | 262.68 | 54.55 |
| **Sulfosuccinate L3/40** | **optional** | **0-0.4** |
| **Initiator solution I** | | |
| Water | 3.95 | 0.82 |
| Ammonium persulfate | 0.25 | 0.05 |
| **Pre-emulsion** | | |
| Water | 164.17 | 34.09 |
| **Rokanol L10/80 (80%)** | **8.41** | **1.4** |
| **Sulfosuccinate L3/40** | **11.98** | **1.0** |
| Styrene | 190.44 | 39.55 |
| Butyl acrylate | 279.09 | 57.95 |
| Acrylamide | 7.22 | 1.5 |
| Acrylic acid | 4.79 | 1.0 |
| **Initiator solution II** | | |
| Water | 35.52 | 7.38 |
| Ammonium persulfate | 2.28 | 0.47 |
| **Chaser** | | |
| Peroxan BHP-70 | 0.66 | 0.14 |
| Water | 8.17 | 1.7 |
| Bruggolite FF6 | 0.47 | 0.1 |
| Water | 8.17 | 1.7 |
| **pH Adjustment** | | |
| $NH_4OH$ Solution (25%) | 6.07 | 1.26 |

### Procedure

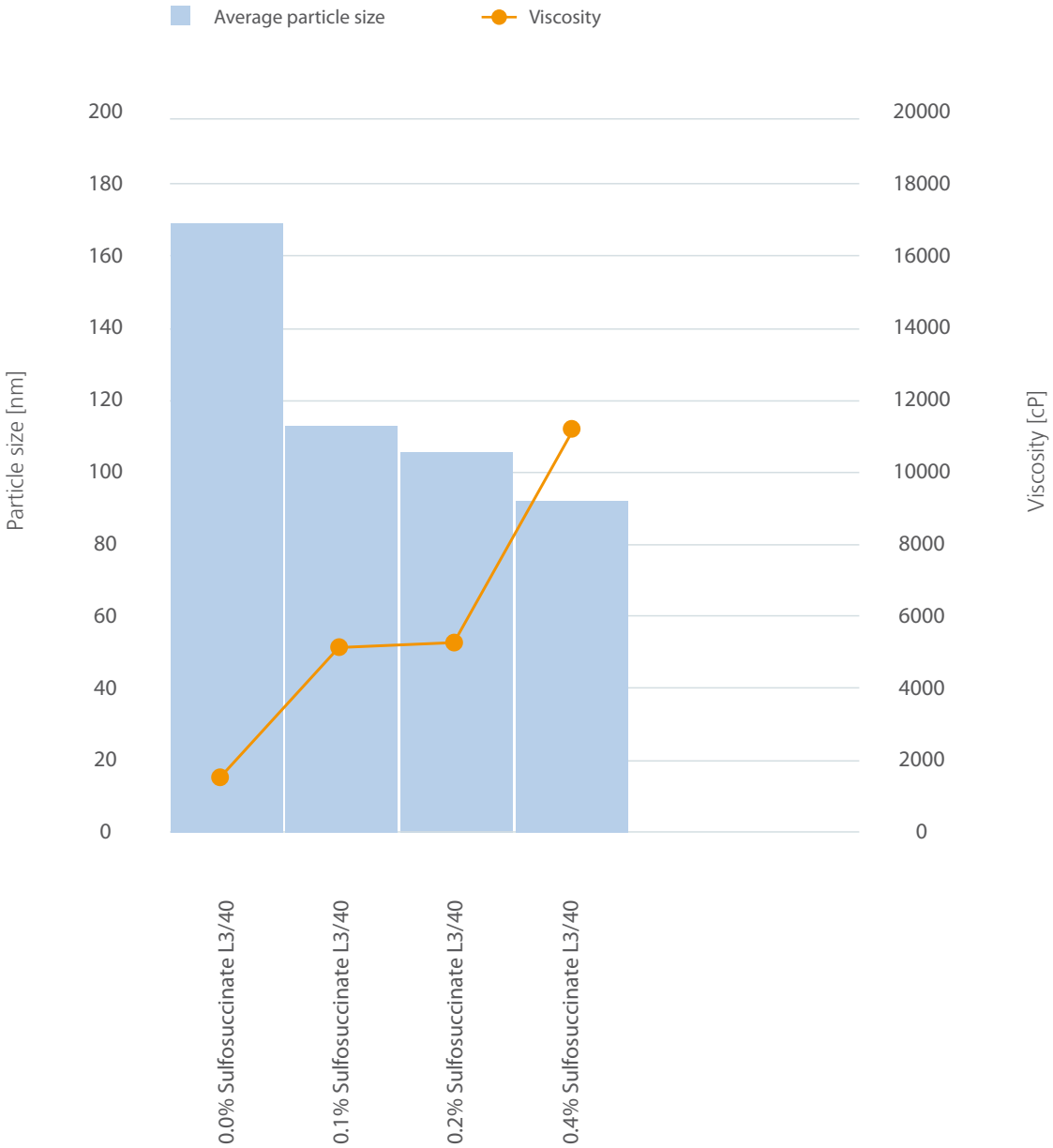
- Add water to reaction flask and heat to 85°C.
- Add initiator solution in one shot and charge 7% wt. of pre-emulsion.
- Hold for 15 min at 85°C to prepare seed latex.
- Start metering pre-emulsion and Initiator Solution II over 4 hours.
- After addition hold for 90 min at 85°C.
- Cool down to 55°C and start feed solution of Bruggolite FF6 and solution of Peroxan BHP-70 for 30 min.
- Cool down to 30°C. adjust pH to 7-8 with ammonium hydroxide solution.

### Latex properties

| | | Sulfosuccinate L3/40 in initial charge | | | |
|---|---|---|---|---|---|
| Properties | Units | 0.0% | 0.1% | 0.2% | 0.4% |
| pH | Peroxan BHP-70 | 7.5 | 6.2 | 5.6 | 7.8 |
| Solids | % | 49.7 | 49.9 | 52.2 | 50.5% |
| Viscosity | cP | 1812 | 5900 | 6100 | 11200 |
| Wet coagulum 100 mesh | % | 0.01 | 0.08 | 0.09 | 0.44 |
| MTTF | °C | <1 | <1 | <1 | <1 |
| Average particle size | nm | 172 | 115 | 106 | 95 |

# Influence of the concentration of anionic emulsifier in seed step emulsion polymerization on particle size and viscosity of styrene-acrylic acrylic dispersion

Particle size of Sulfosuccinate L3/40– containing styrene-acrylic dispersion. The higher amount of anionic emulsifier in the reactor during the first step of seeded emulsion polymerization contributes to lowering particle size of dispersion and rising viscosities. You can shape the properties of the final dispersion by changing the concentration of Sulfosuccinate L3/40 in the emulsion polymerization process.



# APEO replacements in styrene-butyl acrylate dispersion

A series of nonionic surfactants was evaluated as nonylphenol alternatives in the above styrene-acrylate recipe.

| | | APEO- FREE EMULSIFIERS | | | | | APEO EMULSIFIERS | |
|---|---|---|---|---|---|---|---|---|
| Properties | Units | Rokanol L10/80 | Rokanol IT12 | Rokanol K21 | Rokanol L30A/65 | Sulforokanol 1230/1A* | NPE-10 | NPE-20 |
| pH | | 7.5 | 8.7 | 8.7 | 7.8 | 8.7 | 8.4 | 7.8 |
| Solids | % | 49.7 | 50.9 | 49.8 | 49 | 50.7 | 49.9 | 50.0 |
| Viscosity | cP | 1812 | 3335 | 2040 | 1850 | 3250 | 1026 | 2850 |
| Wet coagulum 100 mesh | % | 0.01 | 0.02 | 0.3 | 0.07 | 0.09 | 0.02 | 0.13 |
| MTTF | °C | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Average particle size | nm | 172 | 148 | 158 | 144 | 267 | 161 | 152 |
| Chemical stability | | | | | | | | |
| 10% $CaCl_2$ | ● Excellent<br>○ Poor | ● | ● | ● | ● | ● | ● | ● |
| 20% $CaCl_2$ | | ○ | ○ | ○ | ● | ● | ○ | ● |
| 30% $CaCl_2$ | | ○ | ○ | ○ | ● | ● | ○ | ● |
| 40% $CaCl_2$ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Water resistance** | | ● ● | ● ● | ● ● | ● ● ● | ● ● | ● ● | ● ● |

* Instead of anionic surfactant - Sulfosuccinate L3/40

** Wet coatings at 200 microns thickness was dried for 96 hour s at 20°C and immersed into distilled water to evaluate the condition of whiting according to the following standard:

- ● whitened in 30 minutes
- ● ● not whitened in 30 minutes but slightly whited during 2 hour
- ● ● ● not whitened in 2 hours but slightly whited during 4 hours
- ● ● ● ● not whitened in a 4-hour period

# Vinyl actate/n-butyl acrylate latex

Anionic emulsifiers were compared in vinyl acetate/butyl acrylate dispersion. Sulforokanol L1230/1A provide better water resistance than standard low-molecular SLES.

| Reactor Charge | grams | % pphm |
|---|---|---|
| **Initial charge** | | |
| Water | 406.97 | 85.7 |
| **Sulforokanol L225/1** | 38.09 | 2.0 |
| **Rokanol L30A/65** | 14.66 | 2.0 |
| Mowiol 18-88 | 9.52 | 2.0 |
| Sodium carbonate | 1.43 | 0.3 |
| **Initiator solution I** | | |
| Water | 34.28 | 7.2 |
| Ammonium persulfate | 3.17 | 0.7 |
| **Pre-emulsion** | | |
| Vinyl acetate | 380 | 80.0 |
| Butyl acrylate | 95 | 20.0 |
| **Chaser** | | |
| Peroxan BHP-70 | 0.67 | 0.1 |
| Water | 7.94 | 1.7 |
| Bruggolite FF6 | 0.6 | 0.1 |
| Water | 7.94 | 1.7 |

## Procedure

- Add water to reaction flask and heat to 65°C.
- Add 25% solution of initiator (APS) and charge 10% wt. of monomer.
- Hold for 15 min at 85°C to prepare seed latex.
- Start metering preemulsion and Initiator Solution II over 4 hours.
- After addition hold for 90 min. in 85°C.
- Cool down to 55°C and start feed solution of Bruggolite FF6 and solution of Peroxan BHP-70 for 30 min.

## Latex properties

| Properties | Units | Sulforokanol L225 | Sulforokanol L1230/1A |
|---|---|---|---|
| pH | | 3.5 | 3.7 |
| Solids | % | 50.4 | 49.6 |
| Viscosity | cP | 4853 | 760 |
| Wet coagulum 100 mesh | % | 0.5 | 0.1 |
| Chemical stability | | | |
| 10% $CaCl_2$ | ● Excellent<br>○ Poor | ● | ● |
| 20% $CaCl_2$ | | ● | ● |
| 30% $CaCl_2$ | | ● | ● |
| 40% $CaCl_2$ | | ● | ● |
| Water resistance[2] | | ● | ● ● |

* Instead of anionic surfactant - Sulfosuccinate L3/40

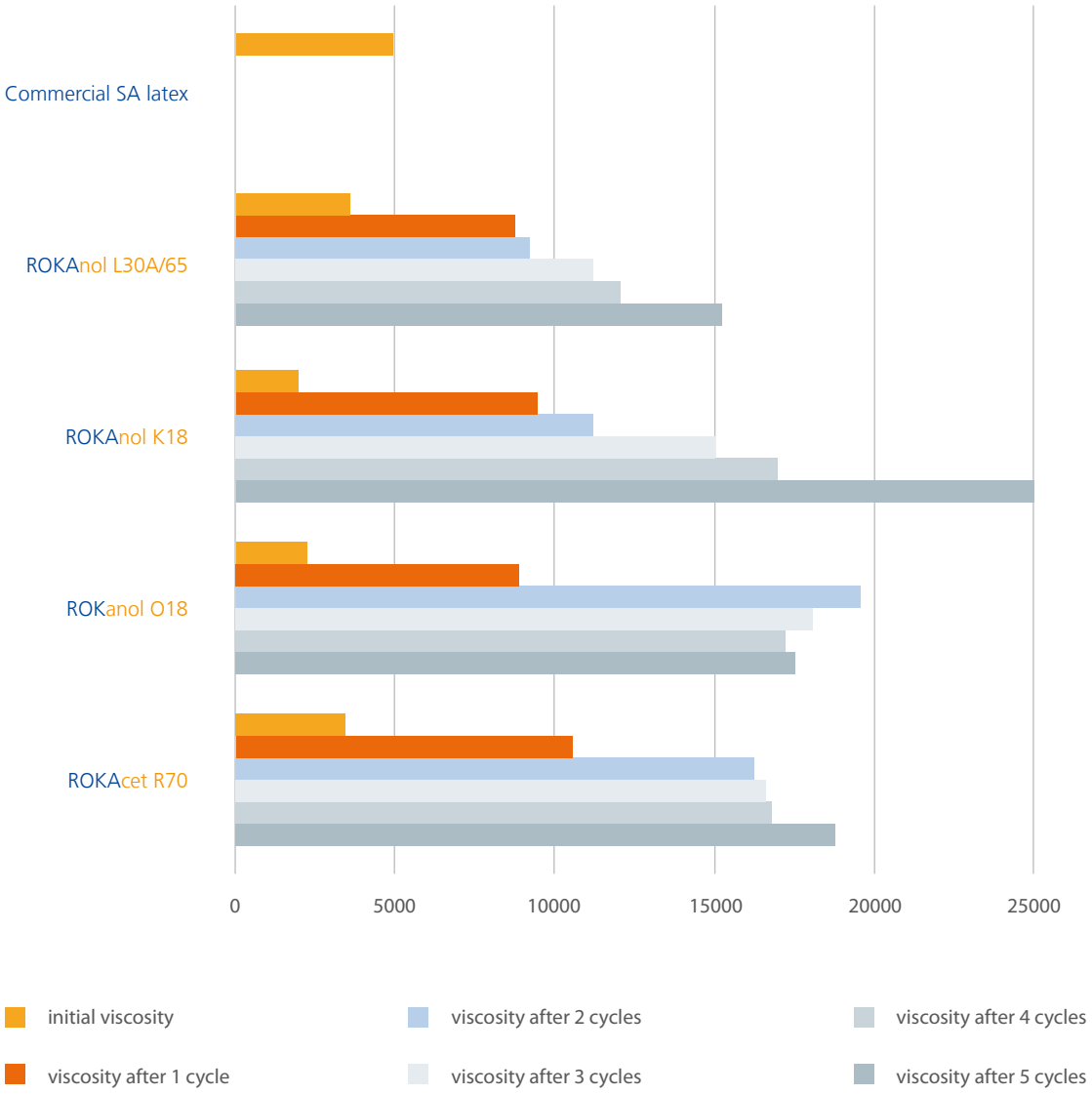
** Wet coatings at 200 microns thickness was dried for 96 hour s at 20°C and immersed into distilled water to evaluate the condition of whiteningaccording to the following standard:

- ● whited in 30 minutes
- ● ● not whited in 30 minutes but slightly whited during 2 hour
- ● ● ● not whited in 2 hours but slightly whited during 4 hours
- ● ● ● ● not whited during 4 hour passed

# Post-addition of surfactants to improve dispersion performance

Several surfactants have been added at a level of 1% pphm to the common styrene-butylacrylate dispersion. Such addition allows to improve colloidal stability against freezing. Viscosity changes, after every freeze-thaw cycle, are shown in the diagram below:

## Latex viscosity after freeze-thaw cycles




Without the additive, the latex was coaugulated after the first cycle. Addition of nonionic product prevents this negative effect, appropriate application properties of dispersion are allowed to remain. The best results (the lowest viscosities after every cycle) are ensured by using Rokanol L30A/65. For this reason to this reason this product is strongly recommended as a post-additive to improve freeze-thaw stability.

# Antistats

**Antistats may be** applied to the polymer compound externally or internally. In both cases atmospheric water is attracted to the surface thus allowing a pathway for static dissipation. If internal, the antistat must migrate to the surface (bloom) prior to absorbing moisture and makes the surface more conductive. If external, the antistat must be applied in a separate operation.

## Antistats - product list

| Product | CAS Number | Ionic Nature | Physical Form | Description | Chemistry |
|---|---|---|---|---|---|
| Chemstat® 122 | 61791-31-9 | Cationic | Liquid | POE (2) Cocoamine | Amine |
| Chemstat® 122/60DC | Mixture | | Powder | POE (2) Cocoamine on Silica | Amine |
| Chemstat® 182 | 61791-44-4 | Cationic | Liquid/Paste | POE (2) Tallow Amine | Amine |
| Chemstat® 182LC | 61791-44-4 | Cationic | Liquid/Paste | POE (2) Tallow Amine | Amine |
| Chemstat® 182/67DC | Mixture | Cationic | Powder | POE (2) Tallow Amine on Silica | Amine |
| Chemstat® 1880 | Proprietary | Nonionic | Flake | Ester | Ester |
| Chemstat® 1880/PWDR | Proprietary | Nonionic | Powder | Ester | Ester |
| Chemstat® 1890 | Proprietary | Nonionic | Liquid | Ester | Ester |

| %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|
| 100 | PP, PE | Internal Antistat | Chemstat® 122 is a fast blooming internal, migratory antistat that performs effectively in PE and PP polymers. Available in an easy to handle liquid form, the product eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene, polypropylene, and ABS resins. Chemstat® 122 is a vegetable derived antistat which functions at low use levels and has broad FDA approval. |
| 60 | PP, PE | Internal Antistat | Chemstat® 122/60DC is a fast blooming internal, migratory antistat that performs effectively in PE and PP polymers. Available in an easy to handle powder form, the product eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene, polypropylene, and ABS resins. Chemstat 122/60DC is a vegetable derived antistat which functions at low use levels and has broad FDA approval. |
| 100 | PE | Internal Antistat | Chemstat® 182 was developed as an internal antistatic agent for use in polyethylene including HDPE, LLDPE and LDPE. This animal derived antistat performs effectively at low use levels and has broad FDA approvals. Chemstat® 182 may also improve pigment dispersibility. |
| 100 | PE | Internal Antistat | Chemstat® 182LC was developed as an internal antistatic agent for use in polyethylene including HDPE, LLDPE and LDPE. This low colour, animal derived antistat performs effectively at low use levels and has broad FDA approvals. Chemstat® 182LC may also improve pigment dispersibility. |
| 67 | PE | Internal Antistat | Chemstat® 182/67DC was developed as an internal antistatic agent for use in polyethylene including HDPE, LLDPE and LDPE. This animal derived antistat is offered in an easy to use powder form and performs effectively at low use levels and has broad FDA approvals. Chemstat® 182/67DC may also improve pigment dispersibility. |
| 100 | PP, PE | Internal Antistat | Chemstat® 1880 was developed for use in polyolefin systems requiring effective antistatic protection and may be used in indirect food contact situations. Chemstat® 1880 is an easy to handle flaked solid containing no phenol derivatives or amine based components. The material provides long term antistatic protection and performs effectively and at 30% RH. This material also functions as an efficient antifog in agricultural film. |
| 100 | PP, PE | Internal Antistat Antifog | Chemstat® 1880/PWDR was developed for use in polyolefin systems requiring effective antistatic protection and may be used in indirect food contact situations. Chemstat® 1880/PWDR is an easy to handle powder containing no phenol derivatives or amine based components. The material provides long term antistatic protection and performs effectively and at 30% RH. This material also functions as an efficient antifog in agricultural film. |
| 100 | PP, PE | Internal Antistat | Chemstat® 1890 was developed for use in polyolefin systems needing effective antistatic protection and may be used in indirect food contact situations. Chemstat® 1890 is an easy handling liquid containing no phenol derivatives or amine based components. This products provides long term antistatic performance and functions effectively in liquid colour systems. |

# Antistats - product list

| Product | CAS Number | Ionic Nature | Physical Form | Description | Amide/Amine/ Ester/PEG/Quat |
|---|---|---|---|---|---|
| Chemstat® 1900 | Proprietary | Nonionic | Liquid/Paste | Ester | Ester |
| Chemstat® 1910 | Proprietary | Nonionic | Paste/Solid | Ester | Ester |
| Chemstat® 2218 | Proprietary | | Solid | Surfactant Mixture | |
| Chemstat® 3820 | 68071-95-4 | | Liquid | Quaternary Compound | Quat |
| Chemstat® 273-C | 61791-31-9 | Cationic | Liquid | POE (2) Cocoamine | Amine |
| Chemstat® 273-E | 10213-78-2 | Cationic | Solid | POE (2) Stearyl Amine | Amine |
| Chemstat® 273-EP | 10213-78-2 | Cationic | Pastille | POE (2) Stearyl Amine | Amine |
| Chemstat® 830/60DC | Mixture | | Powder | Antistat on Silica | |
| Chemstat® G-118/42K | 67701-33-1 | Nonionic | Flake | Glycerol Monostearate | GMS |

| %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|
| 100 | PP, PE | Internal & External Antistat | Chemstat® 1900 was developed as an antistat and antifog for a variety of high glass transition temperature polymers including PET. Chemstat® 1900 may be used at levels ranging from 0.5% to 3.0% depending on the desired functionality, processing conditions and resin properties. This amine free antistat has broad FDA approval. |
| 100 | PP, PE | Internal & External Antistat | Chemstat® 1910 was developed as an antistatic material for PET that is suitable for blow molding as well as sheet applications. This product has broad FDA approvals and may be used from 0.1% to 3.0% depending on the application and processing conditions. The chemistry operates effectively under high temperature conditions. |
| 100 | PP, PE | Internal Antistat | Chemstat® 2218 provides long term, quick blooming antistatic properties for PE and PP resins. |
| 100 | PP, PE | External Antistat | Chemstat®3820 is a water soluble cationic antistat suitable for external application to a variety of substrates. The product operates at low concentration and is readily soluble in multiple diluents. |
| 100 | PP, PE | Internal Antistat | Chemstat® 273-C eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene and polypropylene resins. It imparts excellent antistat properties at low use levels and is a fast blooming, plant derived material. This easy to handle liquid may also improve pigment dispersibility and has broad FDA approvals. |
| 100 | PP, PE | Internal Antistat | Chemstat 273-E is an internal antistat which is effective in both film and molded products, and was designed primarily for polypropylene resins. This chemistry exhibits good thermal stability and performs efficiently at low use levels. |
| 100 | PP, PE | Internal Antistat | Chemstat 273-EP is an internal antistat which is effective in both film and mold products, and was designed primarily for the polypropylene resins. The product is offered in a pastille form for ease of handling and exhibits good thermal stability and performs efficiently at low use levels. |
| 60 | PP, PE | Internal Antistat | Chemstat® 830/60DC functions as both an internal antistat and lubricant for polyethylene, polypropylene and polystyrene resins.<br>The chemistry combines a quick blooming component for fast antistatic properties and a slow blooming component to extend performance time. The easy to handle powder provides efficient antistatic properties at low RH. |
| 100 | PP, PE | Internal Antistat, Lubricant, Mold Release | Chemstat® G-118/42K is a glycerol monostearate with a 42% minimum alpha monoester content. It is derived from natural fats and oils. Its primary use is as an internal lubricant in polyolefins, but it also imparts temporary antistat protection, mold release and viscosity modifier properties. The chemistry provides fast blooming, short term antistatic properties and provides efficacy at low RH |

# Antistats - product list

| Product | CAS Number | Ionic Nature | Physical Form | Description | Amide/Amine/ Ester/PEG/Quat |
|---|---|---|---|---|---|
| Chemstat® G-118/52K | 67701-33-1 | Nonionic | Flake | Glycerol Monostearate | GMS |
| Chemstat® HTSA #218/ VIT | Mixture | Nonionic | Solid | Fatty Acid Ester | Ester |
| Chemstat® LD-100 | 120-40-1 | Nonionic | Solid | Lauric Diethanolamide | Amide |
| Chemstat® LD-100/30DC | 120-40-1 | Nonionic | Powder | Lauric Diethanolamide on Silica | Amide |
| Chemstat® LD-100/60DC | 120-40-1 | Nonionic | Powder | Lauric Diethanolamide on Silica | Amide |
| Chemstat® P-400 | 25322-68-3 | Nonionic | Liquid | Polyethylene Glycol | PEG |
| Chemstat® PS-101 | 68037-49-0 | | Pastille | Aliphatic Sulfonate | |
| Chemstat® SE-20 | Proprietary | Nonionic | Liquid | Fatty Acid Ester | Ester |

| %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|
| 100 | PP, PE | Internal Antistat, Lubricant, Mold Release | Chemstat G-118/52K is a glycerol monostearate with 52% minimum alpha-monoester content. Chemstat®G-118/52K is used as an antistat agent, internal mold release agent, flow modifier and an internal lubricant in polyolefin resins. The material is fast blooming and provides excellent short term antistatic properties. |
| 100 | PP | Internal Antistat, Slip Agent | Chemstat® ®HTSA#218/VIT was developed as an anti-stat for polypropylene film applications. This material has broad FDA approvals and offers good functionality at low concentrations. |
| 100 | PP, PE | Internal Antistat | Chemstat® LD-100 was developed as an internal antistat for polyethylene and polypropylene resins providing long term results. Chemstat® LD-100 is recommended as an antistat when relative humidity conditions of <40% are present and when ethoxylated amines cannot be used. Chemstat® LD-100 eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene and polypropylene resins. The material meets Military Specification MIL-B-81705C and has FDA approval. |
| 30 | PP, PE | Internal Antistat | Chemstat® LD-100/30DC was developed as an easy to handle antistat for polyethylene and polypropylene resins providing long term results. Chemstat® LD-100/30DC is recommended as an antistat when relative humidity conditions of <40% are present and when ethoxylated amines cannot be used. Chemstat® LD-100/30DC eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene and polypropylene resins. The material meets Military Specification MIL-B-81705C and has FDA approval. |
| 60 | PP, PE | Internal Antistat | Chemstat® LD-100/60DC was developed as an easy to handle antistat for polyethylene and polypropylene resins providing long term results. Chemstat® LD-100/60DC is recommended as an antistat when relative humidity conditions of <40% are present and when ethoxylated amines cannot be used. Chemstat® LD-100/60DC eliminates electrostatic problems in extrusion, injection, and blow molding of polyethylene and polypropylene resins. The material meets Military Specification MIL-B-81705C and has FDA approval. |
| 100 | PE | Internal Antistat, Lubricant | Chemstat® P-400 was developed as an lubricant/internal antistat for polyethylene resins where it may be used at a 1.5 - 4.0% loading by weight. This product has excellent thermal stability and broad FDA approval. |
| 100 | PP, PE | Internal & External Antistat | Chemstat® PS-101 is an aliphatic sulfonate that may be used as a long acting internal antistatic agent which is effective in most thermoplastics film. This chemistry exhibits good thermal stability and is offered in a pastille form. Chemstat® PS-101 improves pigment dispersibility and gloss, and is recommended for polystyrene and rubber modified polystyrene. |
| 100 | PP, PE | External Antistat | Chemstat® SE-20 was developed as an external antistat for use with thermoplastics. The material has good thermal stability and broad FDA clearances. Recommended use level is 2 - 5% in an aqueous solution for topical applications |

# Antifogs

**Antifogs** prevent the formation of water droplets on the surface of a film. This is achieved by incorporating an additive designed to have controlled incompatibility with the polymer matrix and chemical functionality that allows it to sheet the water droplets. The best antifog for a specific application will depend on polymer type, film thickness, use temperature and lifetime of film. FDA requirements should be identified prior to evaluation.

## Antifogs - product list

| Product | CAS Number | Ionic Nature | Physical Form |
|---|---|---|---|
| Chemstat® AF-322 | Mixture | Nonionic | Liquid |
| Chemstat® AF-687 | Proprietary | Nonionic | Liquid |
| Chemstat® AF-710 | Mixture | Nonionic | Luquid |
| Chemstat® AF-1820 | Mixture | Nonionic | Solid |
| Chemstat® AF-1873 | Mixture | Nonionic | Paste |
| Chemstat® AF-1879 | Mixture | Nonionic | Solid |

| Description | Amide/Amine/ Ester/PEG/Quat | %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|---|---|
| Surfactant Mixture | Ester | 100 | PP, PE, EVA | Hot & Cold Antifog | Chemstat® AF-322 is an internal antistat which is effective in both film and molded products; and may be used for polypropylene resins. This material provides both hot and cold antifog performance. |
| Surfactant Blend | Ester | 100 | PP, PE, PS | Hot & Cold Antifog | Chemstat® AF-687 is recommended primarily as an external anti-fog agent for PS films and acts as a hot and cold antifog for PE resins. Use levels of 1.0-2.0% are recommended as starting points and carry broad FDA approvals. |
| Surfactant Blend | Ester | 100 | PP, PE, EVA, PVC, PS | Hot & Cold Antifog | Chemstat® AF-710 is recommended for food wrap film applications as a hot and cold antifog. The product carries broad FDA approvals. Recommended use levels based on polymer type are as follows: Polyethylene: 0.5%-2.0%, EVA: 0.5%-2.0%, PVC 3.0%-4.0%, and polystyrene: 2.0%-3.0% |
| Surfactant Blend | Ester | 100 | PP, PE, EVA | Hot & Cold Antifog | Chemstat® AF-1820 was developed as a fast migrating, amine free, phenol free antifog for LLDPE and PP with excellent short and long term performance. The recommended use level of Chemstat® AF-1820 is 1.0-2.0%. The chemistry also provides some antistatic properties in films. |
| Surfactant Blend | Ester | 100 | PP, PE | Hot & Cold Antifog | Chemstat® AF-1873 was developed as a fast migrating, amine free, phenol free hot antifog for clarified polypropylene (CPP). Chemstat® AF-1873 does not interfere with the clarifying mechanism and also provides good antistatic performance. The recommended use level of Chemstat® AF-1873 is 1.5-2.5%. |
| Surfactant Blend | Ester | 100 | PE, PS | Hot & Cold Antifog | Chemstat® AF-1879 was developed as a fast migrating, amine free, phenol free cold antifog for polystyrene with excellent short term for cold fog applications performance. This chemistry exhibits excellent thermal stability and broad FDA approvals. The recommended use level of Chemstat® AF-1879 is 2.0-4.0%. |

# Slip agents

**Slip agents** provide surface lubrication during and immediately after processing. Slip agents function by exuding to the surface of the plastic and provide a coating which lowers the coefficient of friction. In addition, they reduce the ability of a plastic sheet or film from adhering to itself by minimizing tack. Slip agents have anti-block properties and play a role during processing preventing the polymer from adhering to metal. The reduced friction facilitates processing on high speed packaging equipment as well as easing consumer use of plastic film products.

## Slip agents - product list

| Product | CAS Number | Ionic Nature | Physical Form |
|---|---|---|---|
| Chemstat® HTSA #18-20M | 301-02-0 | Nonionic | Bead |
| Chemstat® HTSA #22-20M | 112-84-5 | Nonionic | Powder |
| Chemstat®HTSA #3/Bead | 10094-45-8 | Nonionic | Bead |
| Chemstat® HTSA #1A | 16260-09-6 | Nonionic | Bead |

# Pigment dispersants

**Pigment dispersants** are used in high content dispersions of colorants in carrier resins or liquid systems. The dispersion of a pigment is a process by which the pigment particles are "wetted" down by the resin in the liquid or molten stage. How well the pigment disperses depends on the temperature at which the two materials are mixed, the particle size of the pigment, and the molecular weight of the polymer. The mixing time and equipment are very important and dispersion is the key to successful coloring.

## Pigment dispersants - product list

| Product | CAS Number | Ionic Nature | Physical Form |
|---|---|---|---|
| Maxsperse® W-3000 | Proprietary | | Flake |
| Maxsperse® W-85 | 577-11-7 | Anionic | Powder |
| Maxsperse® 8900/100M | 123-26-2 | Nonionic | Flake |
| Maxsperse® 8913 | 106-15-0 | Nonionic | Flake |

| Description | Amide/ Amine/ Ester/PEG/ Quat | %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|---|---|
| Oleamide | Amide | 100 | PP, PE | Slip Agent | Chemstat® HTSA#18-20M is designed to modify the surface properties of LDPE and PP film. This chemistry is fast blooming allowing for rapid results. Chemstat® HTSA#18-20M may be used as slip and antiblock agent in polyolefins and other polymers. The chemistry is thermally stable to 195°C. |
| Erucamide | Amide | 100 | PP, PE | Slip Agent, Mold Release | Chemstat® HTSA#22-20M is designed to modify the surface properties of LDPE and PP film. It also provides excellent mold release properties for a wide range of polymers. Chemstat® HTSA #22-20M is a slow blooming primary amide that provides longer term performance than alternate chemistries. This chemistry reduces both the block tendency and the co-efficient of friction and is thermally stable up to 220°C. It may also improve melt flow characteristics and increase scratch resistance. |
| Stearyl Erucamide | Amide | 100 | PP, PE | Slip Agent | Chemstat HTSA #3/Bead is designed for use in most thermoplastics, to impart improved characteristics including slip, antiblocking, and mold release. It is designed for plastic materials having process temperatures in excess of 300°C. Chemstat HTSA #3/Bead can be successfully incorporated into high clarity thermoplastic film without impairment of the optical properties with no evidence of slip additive "plate out". |
| Oleyl Palmitamide | Amide | 100 | PP, PE | Slip Agent, Internal Antistat | Chemstat® HTSA #1A is a specially synthesized, nitrogenous organic compound, designed for use as a slip additive for thermoplastics – particularly BOPP film. Due to the chemical composition of Chemstat® HTSA #1A, it also imparts anti-block, antistat and mold release characteristics. |

| Description | Amide/ Amine/ Ester/PEG/ Quat | %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|---|---|
| Proprietary Surfactant | | 100 | PP, PE | Pigment Dispersant | Maxsperse® W-3000 is a polyolefin wax developed for use as a pigment dispersant for use in manufacturing colour concentrate masterbatches. This material is offered in an easy to use flake form and has broad FDA approval. |
| Sodium Dioctyl Sulfosuccinate Mixture | | 85 | PP, PE | Pigment Dispersant | Maxsperse®W-85 is an easy-to-handle free-flowing powdered wetting agent for use in most polyolefins. This material functions primarily as a dispersant for a wide range of inorganic pigments. |
| Fatty Amide | Amide | 100 | PP, PE, PS | Lubricant, Mold Release, Pigment Dispersant | Maxsperse® 8900/100M was developed as a dispersing agent for use in most polyolefins. It is most effective for white and black pigments. In high impact polystyrene, Maxsperse 8900/100M improves appearance and colour development of extruded and molded parts. It is offered in a free flowing powder form. |
| Fatty Acide Amide | Amide | 100 | PP, PE, PS | Lubricant, Mold Release, Pigment Dispersant | Maxsperse® 8913 was developed primarily as a dispersant for organic pigments and other additives when compounding polyolefins. It works particularly well in carbon black and polypropylene. In addition to dispersant properties, Maxsperse® 8913 also provides slip, anti-block and lubricating properties to a variety of polymer resins. Molded and extruded products exhibit improved gloss and a reduced tendency to pick up electrostatic charges on the surface. These added properties are attributable to the unique molecular structure of this product. |

# Lubricants

**Lubricants** are used as processing aides particularly in rigid and flexible PVC. They can either be incorporated into the polymer compound or applied externally to the polymer surface. A lubricant works by providing a considerable decrease in resistance to movement of chains or segments of a polymer, without disproportionate change in observable properties. Ease of internal rotation is the key to polymer flow. Internal lubricants reduce friction between polymer molecules, leading to lower melt viscosity and low energy input needed for processing. Internal lubricants are usually chemically compatible with the polymer. External lubricants are generally incompatible with the polymer and act to reduce friction at the interface of the polymer and surface of the processing equipment.

## Lubricants - product list

| Product | CAS Number | Ionic Nature | Physical Form |
|---|---|---|---|
| Chemstat HTSA #54 | 115-83-3 | Nonionic | Bead |
| Chemstat HTSA #54P | 85116-93-4 | Nonionic | Powder |
| Maxomer® Lube-E2SA-B | Mixture | Nonionic | Bead |
| Maxomer® Lube-EBO | 110-31-6 | Nonionic | Bead |
| Maxomer® Lube-FESA | Mixture | | Powder |
| Chemstat® G-118/9501 | 68990-53-4 | Nonionic | Powder |
| Chemstat® G-118/GTS | 555-43-1 | Nonionic | Powder |

# Corrosion inhibitors

**Corrosion inhibitors** can be used as additives in packaging films and containers to minimize corrosion on metal parts including ferrous, steel, copper and galvanized materials. The corrosion inhibitor is incorporated into the polymer during processing and migrates to the surface before volatilizing in the airspace between the metal and the polymer.

## Corrosion inhibitors - product list

| Product | CAS Number | Ionic Nature | Physical Form |
|---|---|---|---|
| Chemstat® CI-1020/60DC | Mixture | Cationic | Powder |

| Description | Amide/ Amine/ Ester/PEG/ Quat | %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|---|---|
| Pentaerythritol Tetrastearate | | 100 | PP, PE | Lubricant, Slip Agent | Chemstat® HTSA #54 is an effective lubricant for polycarbonate, thermoplastic polyesters and other engineering thermoplastics which require high processing temperatures. This product is Nitrogen free and also provides antiblocking, slip and mold release properties. |
| Pentaerythritol Tetrastearate | | 100 | PP, PE | Lubricant, Slip Agent | Chemstat® HTSA #54P is an effective lubricant for polycarbonate, thermoplastic polyesters and other engineering thermoplastics which require high processing temperatures. This product is Nitrogen free and also provides antiblocking, slip and mold release properties. |
| Fatty Acid Amide | Amide | 100 | PS | Lubricant, Mold Release, Pigment Dispersant | Maxomer® Lube-E2SA-B is effective as a lubricant in PVC, polystyrene, ABS, and some engineering resins. It also functions as a mold release agent in PVC, polystyrene, and polyesters. The high molecular weight chemistry also serves as a pigment dispersant on polyolefin processing. |
| Fatty Acid Amide | Amide | 100 | PS | Lubricant, Mold Release, Pigment Dispersant | Maxomer® Lube EBO is used primarily as a slip agent in film manufacturing. It is particularly suitable in polymers like PVC, polyamide, polycarbonate and polypropylene. This chemistry is often used to raise the melt flow of polystyrene and imparts antiblocking properties to a variety of resins. |
| Ferric Stearate | Amide | 100 | PP, PE | Photo Degradation Agent | Maxomer® Lube-FESA performs as a photo degradation agent in polyolefins |
| Glycerol Monostearate | GMS | 100 | PP, PE | Lubricant, Mold Release, Internal Antistat, Antifog | Chemstat® G-118/9501 is a distilled, (96% minimum monoester content) glycerol monostearate derived from fully hydrogenated vegetable oil. Chemstat® G-118/9501 is recommended for internal use as an antistat and antifog in flexible PVC applications as well as general polyolefins. Chemstat® G-118/9501 is also used externally in polymer systems requiring surface coating of the additive directly onto the resin pellets. The product is effective as a processing aid in EPS applications. This product is typically used at levels of 0.2% to 0.5%. |
| Glycerol Tristearate | GTS | 100 | PP, PE | Lubricant, Internal Antistat | Chemstat®G-118/GTS is a Glycerol Tristearate and is primarily used as a lubricant in polystyrene applications. This material is a free flowing white powder with a melt point above 60°C. |

| Description | Amide/ Amine/ Ester/PEG/ Quat | %, Active Content | Polymer Type | Application | Features and Benefits |
|---|---|---|---|---|---|
| Surfactant Blend | Mixture | 60 | PP, PE | Corrosion Inhibitor | Chemstat® CI-1020/60DC is an internal, migratory vapor phase corrosion inhibitor for use in extruded products and is designed primarily for use in polyolefin resins. This material is an easily handled free flowing powder possessing strong internal lubricating properties. The recommended loading of Chemstat® CI-1020/60DC is 0.33 - 3.0% |

# Notes for guidance concerning the functional parameters and notation used in the catalogue

## HLB (Hydrophilic-Lipophilic Balance)

The hydrophilic-hydrophobic balance is a parameter that determines the ratio of the content of the hydrophilic group and that of the hydrophobic group in a particle. The validity scope of the HLB number for non-ionic surface-active compounds is included within the range of 0 to 20 and is the measure of the share of the hydrophilic group in the particle.

$$HLB = 20 \cdot \frac{\text{molecular mass of hydrophilic part}}{\text{molecular mass of compound}}$$

On the other hand, for aqueos solution of ionic surface active agents acquire additional transformations increasing their degree of hydrophilicity, the value of the HLB number goes up to 40.

HLB for ester type compounds (polyoxyethylenated fatty acids):

$$HLB = 20 \cdot \left(1 - \frac{LZ}{LK}\right)$$

where:

**LZ** saponification number of oxyethylenation product, mgKOH/g

**LK** acid number of acids subjected to oxyethylenation, mgKOH/g

On the basis of the HLB scale, the range of the utility fitness of surface-active agents can be determined.

## Cloud point

Cloud point is an indicator determining the behaviour of water or other organic solutions of nonoionic surfactants. Solutions of surfactants become cloudy during heating and revert to a clear solution at a certain temperature when cooled - this temperature is defined as 'cloud point'.

Depending on the temperature range at which the solution becomes cloudy, five determination methods are discriminated:

**Method A** – aqueous solution (10 - 90°C)

**Method B** – solution of NaCl 50g/l (>90°C)

**Method C** – solution of NaCl 100g/l (>90°C)

**Method D** – solution 45g of butyl diglycol/water (<10°C)

**Method E** – solution 25 g of butyl diglycol/water (<10°C)

| HLB NUMBER | EO CONTENTS IN PRODUCT, % | PRODUCT APPLICATION |
|---|---|---|
| 1-3 | 5-15 | Anti-foaming agent |
| 4-6 | 20-30 | Emulsifier W/O |
| 7-11 | 35-55 | Wetting agent |
| 8-18 | 40-90 | Emulsifier W/O |
| 10-15 | 50-75 | Detergent |
| 10-18 | 50-90 | Solubilizer |

# PCC Group
# We build value through sustainable innovation


Each project or venture with a long-term success story shares one common thing – it's based on in-depth market research and on the knowledge acquired through years of experience. It is knowledge and experience that enables us to constantly aim higher and deliver greater value through dynamic and sustainable world-wide development of the PCC Group.

The companies, operating as a part of the PCC Group, act with responsibility and care. We only embark on new business challenges when we are certain that we have the skills and knowledge to achieve success. We operate in three major markets: chemicals, energy and logistics. Several dozen business units, managed by PCC SE, work in synergy to generate the greatest possible competitive advantage in both local and international markets. Each day nearly three thousand professionals contribute their energy, and effort, to secure the sustainable develop-

ment of the PCC Group. The key element of our strategy is to ensure the development of each individual business unit through taking advantage of innovative technology and new market applications. We achieve our goals in a sustainable and responsible way – we care about the environment and the society within which we operate.
We are always ready to reach our strategic goals. Efficient and dynamic management helps our employees to fully develop their potential and therefore enhances the overall PCC Group value. Joint enterprises and individual initiatives of our companies are the results of the entrepreneurship culture promoted within the PCC Group.

Our philosophy is built on simple values - integrity, trust and reliability. We believe that following those principles is the only way to build a long-term competitive advantage.

The PCC Group currently employs nearly 3300 people. We operate in 17 countries, in 39 different locations around the world. Our portfolio includes eight basic segments. Individual operational responsibility is assigned to seven of them - Polyols, Surfactants, Chlorine, Specialty Chemicals, Consumer Products, Energy and Logistics. Each of these segments is supported by 19 business units, all under the management of the PCC Group.

## The divisions, segments and business units of the PCC Group

| Divisions | Segments | Business units |
|---|---|---|
| Chemicals | Polyols | • Polyols<br>• Polyurethane Systems |
| | Surfactants | • Anionic Surfactants<br>• Non-ionic Surfactants<br>• Amphoteric Surfactants (Betaines) |
| | Chlorine | • Chlorine<br>• MCAA<br>• Other Chlorine Downstream Products |
| | Speciality Chemicals | • Phosphorus and Naphthalene Derivatives<br>• Alkylphenols<br>• Chemicals and Commodities Trading<br>• Quartzite |
| | Consumer Products | • Household and Industrial Cleaners, Detergents and Personal Care Products<br>• Matches and Firelighters |
| Energy | Energy | • Renewable Energies<br>• Conventional Energies |
| Logistics | Logistics | • Intermodal Transport<br>• Road Haulage<br>• Rail Transport |
| Holding | Holding | • Portfolio Management<br>• Projects<br>• Services |

# PCC Group - Industrial Park in Brzeg Dolny, Poland

## PCC Rokita SA

**PCC Rokita Capital Group, 22 companies, including:**
**PCC Rokita SA**
PCC Prodex Sp. z o.o.
PCC Prodex GmbH (Germany)
PCC PU Sp. z o.o.
IRPC PCC Co. Ltd. (Thailand)
PCC Therm Sp. z o.o.

## PCC EXOL SA

**PCC EXOL Capital Group, 5 companies, including:**
**PCC EXOL SA**
PCC Chemax Inc. (the USA)
PCC EXOL Kimya Sanayi Ve Ticaret Limited Şirketi (Turkey)

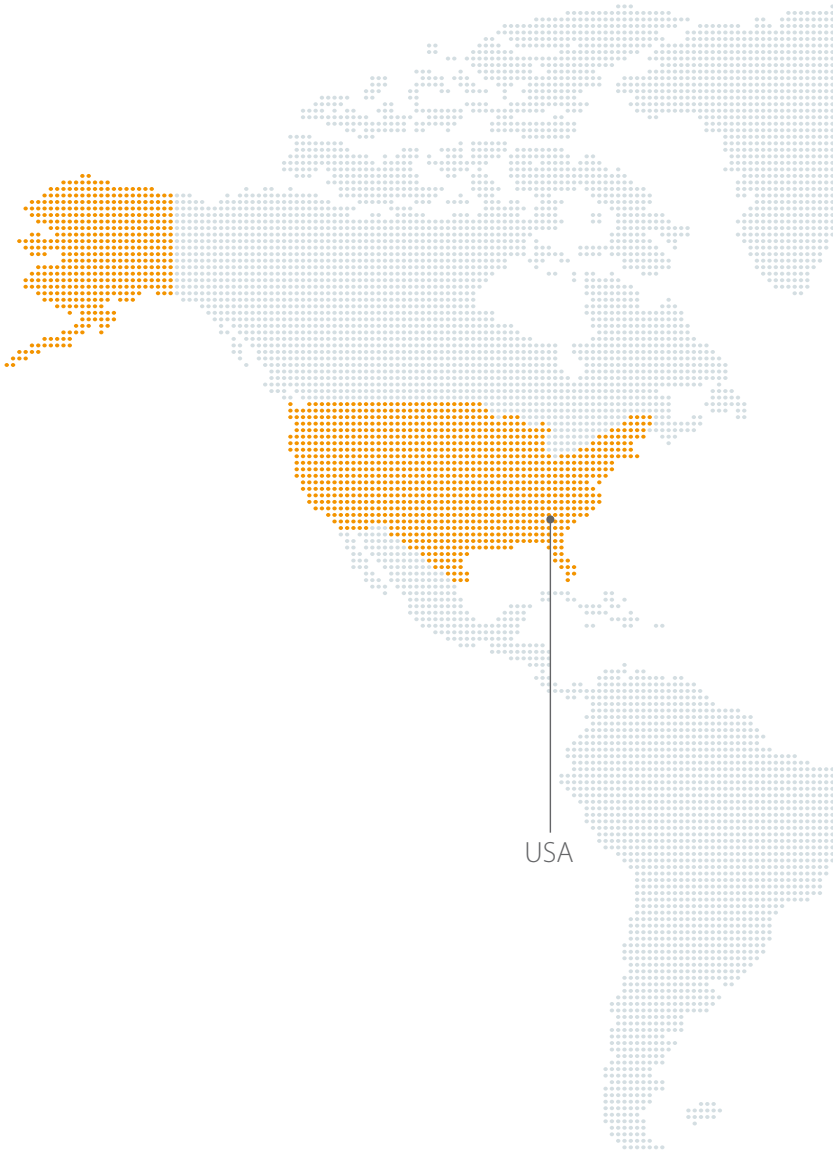
## PCC CP Kosmet Sp. z o.o.

**Capital Group PCC CP Kosmet, 3 companies, including:**
**PCC CP Kosmet Sp. z o.o.**
OOO PCC Consumer Products Navigator (Belarus)
OOO PCC Consumer Products (Russia)

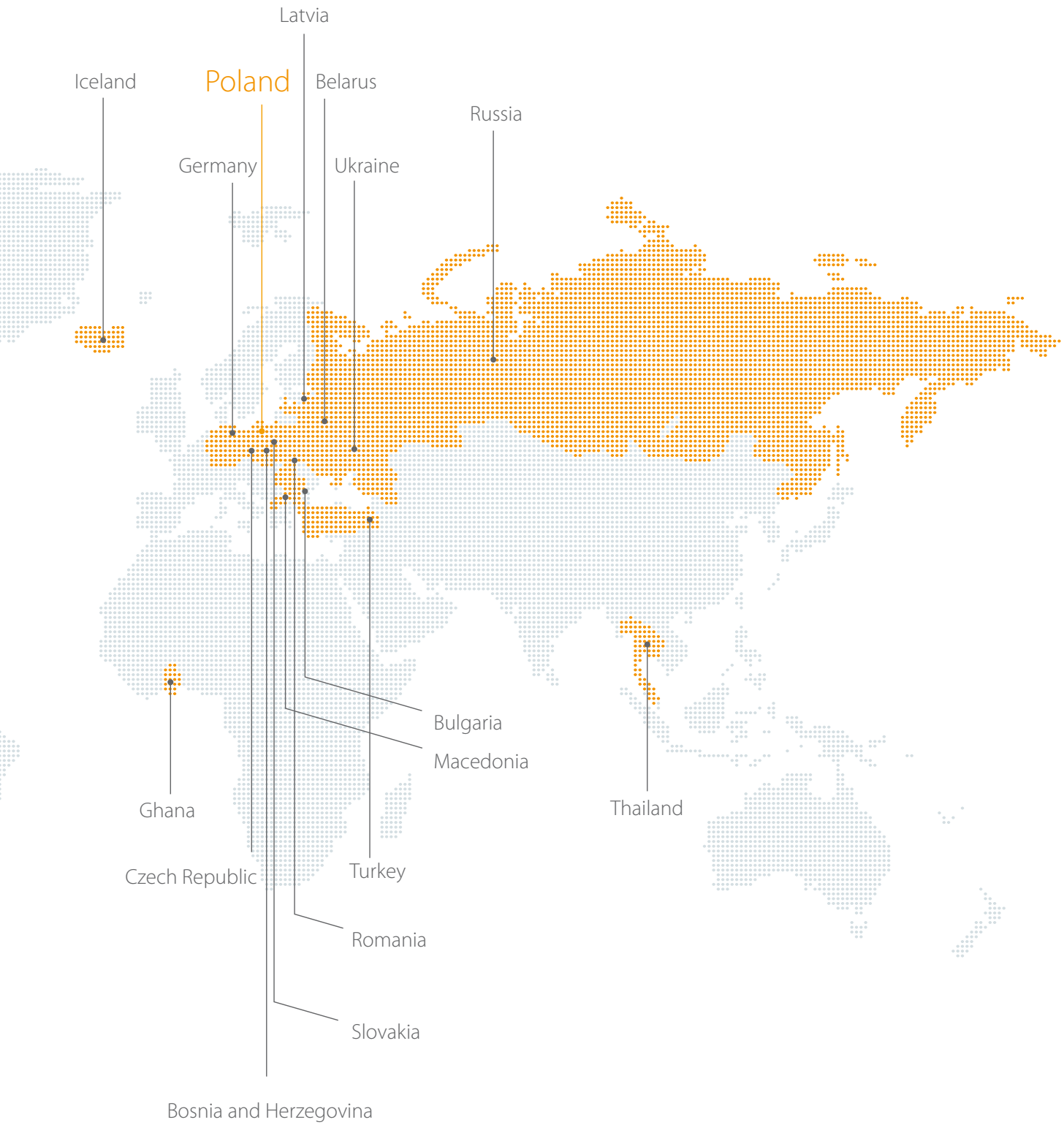
## PCC MCAA Sp. z o.o.

## PCC Autochem Sp. z o.o.

## PCC Intermodal SA



# PCC Group in the world



In accordance with our environmental concerns, this publication from the PCC Group was printed on Cocoon Silk - an ecological double-sided-coated matt paper. This paper is made of 100% waste paper via environment-friendly technology. The FSC® Certificate confirms that the raw materials used during the paper production process come from well-managed forests or other certified and controlled sources.

| TEXT PAGES | |
|---|---|
| Brand | Cocoon Silk |
| Grammage | 150 |
| Number of pages | 32 |
| **COVER PAGES** | |
| Brand | Cocoon Silk |
| Grammage | 250 |
| Number of pages | 4 |
| **PUBLICATION** | |
| Size (cm) | 21 x 29.7 |
| Quantity | 200 |

By using Cocoon Silk rather than non-recycled paper, the environmental impact was reduced by:

| | |
|---|---|
| 33 | kg of landfill |
| 4 | kg $CO_2$ and greenhouse gases |
| 45 | km travel in the average European car |
| 1 262 | litres of water |
| 71 | kWh of energy |
| 54 | kg of wood |

Carbon footprint data evaluated by Labelia Conseil in accordance with the Bilan Carbone® methodology. Calculations are based on a comparison between recycled paper used versus a virgin fibre paper - according to the latest European BREF data (virgin fibre paper) available.

PCC Group
Sienkiewicza 4
56-120 Brzeg Dolny, Poland
products@pcc.eu

Please visit our capital group business platform:
**www.products.pcc.eu**



PCC
More than Chemistry