Raw materials
for dispersions and resins

Local. Global. Integrated.


Operating in 17 countries, in 39 different locations, PCC SE currently employs over 3 300 people.

About Us

The PCC Group is an international capital structure made up of dozens of companies operating in three major sectors of the economy. Chemicals, Energy and Logistics. The organisations within the PCC Group are both business units engaged in production activities and service companies operating simultaneously for the external market. The PCC Group is centrally managed by the German company PCC SE and comprises more than 74 companies at 39 locations in 17 countries around the world. One of the key elements of PCC SE's strategy is the dynamic development of the chemicals business by exploiting the potential of new market segments and diversifying the portfolio of raw materials and chemical formulations in line with current trends in various industries. Every day, our specialists work on the stable growth and development of their organisations, making the PCC Group stronger and building a solid business platform for all contractors interested in reliable and long-term cooperation.

PCC ROKITA SA
PCC PCG OXYALKYLATES
IRPC

Polyols

- Polyether polyols
- Polyester polyols
- Prepolymers
- Polyurethane Systems

PCC ROKITA SA

Chlorine

- Chlorine
- MCAA
- Other Chlorine Downstream Product

PCC ROKITA SA

Phosphorus

- Phosphorus derivatives
- Naphthalene derivatives
- Polycarboxyethers (PCE)

PCC EXOL SA
PCC CHEMAX INC
PCC PCG OXYALKYLATES

Surfactants

- Anionic surfactants
- Cationic surfactants
- Nonionic surfactants
- Amphoteric surfactants (betaines)
- Chemical formulation

PCC SYNTEZA

Alkylphenols

- Nonylphenol
- Dodecylphenol
- Tristyrylphenol

PCC CONSUMER PRODUCTS SA

Consumer Products

- Household & industrial Cleaners, Detergents and Personal Care Products

PCC ROKITA SA

Energy

- Renewable Energy
- Conventional Energy

PCC INTERMODAL SA

Logistics

- Intermodal transport
- Road Haulage
- Rail Transport

PCC BAKKISILICON HF.

Silicon

- Microsillica
- Silicon Metal

PCC SE

Holding & Projects

- Portfolio Management
- Project Development

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01 / Introduction

Emulsion polymerization is a process 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).

A big advantage of water-based products over solvent-borne is the reduction of environmental impact due to the much lower level of VOC (volatile organic compounds) contained in formulations. Another significant advantage is easy to use and often not classified as hazardous labeling. There are many process variations in emulsion polymerization. In the batch process, the reaction is initiated when all portions of reagents are present in the reactor.

In the semi-continuous process - some reagents are added to the reactor at the beginning of the process and the remaining ingredients are dosed in controlled portions. Another process is the emulsion polymerization with pre-emulsion where monomers, water and surfactants are mixed together to form an emulsion which is dosed during the synthesis.

Seeded emulsion polymerization is a process where a dispersed small amount of suspended fine particles of latex (seeds) is added to the reactor followed by feeding monomers, surfactants and initiators; the polymerization process starts in swelled latex particles. The seeds in latex suspension may be also prepared in situ as a first step of the emulsion polymerization.

The role of surfactants in emulsion polymerization

Anionic and nonionic surfactants are commonly used in emulsion polymerization as emulsifiers and latex stabilizers. Typical concentration of surfactants is in range from a few tenth to 5%. Anionic surfactants may be used as a single emulsifier or often in combination with nonionic surfactants.

Nonionic formulations are rarely used alone, mainly due to the tendency of forming solutions with greater particle sizes. Even if a nonionic surfactant consists of a primary emulsifier, a small amount of anionic surfactant is often used to ensure lower particle size.

A proper combination of nonionic and anionic emulsifiers is very important to provide good performance of the polymer dispersion. Anionic surfactants control particle size, ensuring a good polymerization rate and electrostatic stability, whereas nonionic surfactants improve mechanical and electrolytic stability, ensuring also the resistance to freeze-thaw cycles.

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

As the reaction progresses the dimensions the micelles increase rapidly and when the limit values are achieved, they break and form polymer particles. Each polymer particle is covered with surfactants to prevent their agglomeration. Using a mixture of anionic and nonionic surfactants is very common in emulsion polymerization as it helps to stabilize the formulation for specific applications and ensures polymer dispersion stability during transport and storage. There are various types of latex stabilization using anionic and nonionic surfactants.

Various types of latex stabilization using anionic and nonionic surfactants.

Anionic surfactants are absorbed into polymer particles and surround them with electric charges. The electrostatic layer forms an energy barrier for other particles preventing their agglomeration.

Anionic surfactants have the ability to stabilize small particles of a dispersion by electrostatic repulsion thus they are often used during the nucleation process. The main disadvantage of anionic surfactants is their high sensitivity to the presence of electrolytes.

Nonionic surfactants ensure latex stabilization by adsorption on polymer particles, covering them by long polyethylene glycol chains, forming a steric barrier between other polymer particles.

The steric forces are not as strong as electrostatic ones, resulting in increased dimensions of particles. However, steric stabilization is far less sensitive to electrolytes and freezing.

02 / Emulsifiers

Anionic emulsifiers

Anionic surfactants are absorbed onto polymer particles and surround them with electric charges. The electrostatic layer forms an energy barrier for other particles preventing their agglomeration. Anionic surfactants have the ability to stabilize small particles of a dispersion by electrostatic repulsion thus they are often used during the nucleation process. The main disadvantage of anionic surfactants is their high sensitivity to the presence of electrolytes.

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Product characteristics					Product group						
Product name	Description	CAS	Appearance	Active substance content, %	Vinyl acetate & copolymers	Styrene acrylics	Acrylics	Styrene butadiene rubber	Polyvinyl chloride	APE - free	Post-polymerization stability
ABSNa 25	Sodium Dodecylbenzenesulfonate	68411-30-3	liquid	24 – 26	●	●	●	●	o	●	
ABSNa 30	Sodium Dodecylbenzenesulfonate	68411-30-3	liquid	28 – 32	●	●	●	●	o	●	
ABSNa 50	Sodium Dodecylbenzenesulfonate	68411-30-3	paste	48 – 52	●	●	●	●	o	●	
ABSNa 60	Sodium Dodecylbenzenesulfonate	68411-30-3	paste	59 – 61	●	●	●	●	o	●	
ROSULfan A	Ammonium Lauryl Sulfate	90583-11-2	liquid	26 – 28	●	●	●	o	●	●	
ROSULfan A33	Ammonium Lauryl Sulfate	90583-11-2	viscous liquid	32 – 34	●	●	●	o	●	●	
ROSULfan L	Sodium Lauryl Sulfate	85586-07-8	liquid	27.5 – 30	●	●	●	o	●	●	
ROSULfan L15 CM	Sodium Lauryl Sulfate	85586-07-8	liquid	14.5 – 15.5	●	●	●	o	●	●	
ROSULfan LP	Sodium Lauryl Sulfate	85586-07-8	powder	min. 91	●	●	●	o	●	●	
SULFOROKAnol® IT2030	Sodium Trideceth Sulfate (20EO)	150413-26-6	liquid	28 – 30	●	●	●		o	●	o
SULFOROKAnol® L227/1	Sodium Laureth Sulfate (2EO)	68891-38-3	liquid	26.5 – 28	●	●	●		●	●	
SULFOROKAnol® A325/1	Ammonium Laureth Sulfate (3EO)	32612-48-9	viscous liquid	24 – 26	●	●	●		●	●	
SULFOROKAnol® L327/1	Sodium Laureth Sulfate (3EO)	68891-38-3	liquid	27 – 29	●	●	●		●	●	
SULFOROKAnol® L430/1	Sodium Laureth Sulfate (4EO)	68891-38-3	liquid	30 – 32	●	●	●		●	●	

● highly recommended o recommended

Product characteristics					Product group						
Product name	Description	CAS	Appearance	Active substance content, %	Vinyl acetate & copolymers	Styrene acrylics	Acrylics	Styrene butadiene rubber	Polyvinyl chloride	APE - free	Post-polymerization stability
SULFOROKAnol® L725/1	Sodium Laureth Sulfate (7EO)	68891-38-3	liquid	24 – 26	•	•	•		o	•	
SULFOROKAnol® L1230/1	Sodium Laureth Sulfate (12EO)	68891-38-3	liquid	29 – 31	•	•	•		o	•	o
SULFOROKAnol® L3030/1	Sodium Laureth Sulfate (30EO)	68891-38-3	liquid	32 – 34	•	•	•			•	o
SULFOROKAnol® UD727	Alcohols C11 Ethoxylated (7EO) Sulfate, sodium salt	219756-63-5	liquid	26 – 28	•	•	•			•	
SULFOROKAnol® TSP95	Alkylarylphenol Ethoxylated Sulfate, Ammonium Salt	119432-41-6	viscous liquid	min. 91	•	•	•	o		•	o
SULFOROKAfenol® N2030	Sodium Nonylphenol Ethoxylated Sulfate	9014-90-8	liquid	31 – 33	•	•	•	o			o
Sulfosuccinate D5	Mono-alkyl Sulfosuccinate, disodium salt	68630-97-7	liquid	29 – 32	•	•	•		o	•	
Sulfosuccinate DB5	Mono-alkyl sulfosuccinate, disodium salt	68815-56-5	liquid	29 – 32	•	•	•		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	•	•	
ROKAdis 600	Tridecyl Ether Phosphate	73038-25-2	liquid	min. 99	•	•	•			•	
ROKAdis 600A/25	Tridecyl Ether Phosphate, ammonium salt	69029-43-2	liquid	24 – 26	•	•	•			•	
ROKAdis 900	Tridecyl Ether Phosphate	73038-25-2	liquid	min. 99	•	•	•			•	
ROKAdis 900A/25	Tridecyl Ether Phosphate, ammonium salt	69029-43-2	liquid	24 – 26	•	•	•			•	
ROKAdis 900K/25	Tridecyl Ether Phosphate, potasium salt	68186-36-7	liquid	24 – 26	•	•	•			•	
EXOfos PT-E	Tristyrylphenol Ethoxylated Phosphate	90093-37-1	viscous liquid	min. 91	•	•	•	o		•	o
EXOfos PT-25K	Tristyrylphenol Ethoxylated Phosphate, potassium salt	163436-84-8	liquid	99	•	•	•	o		•	o
EXOsoft PC35	Potassium Cocoate	61789-30-8	liquid	34 – 35		o	o	o		•	
EXOsoft PO30	Potassium Oleate	143-18-0	liquid	25 – 28		o	o	o		•	
Rodys K	Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	9084-06-4	liquid	25 – 32				•		•	
Rodys R	Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	9084-06-4	liquid	37 – 39				•		•	
Rodys P	Naphthalenesulfonic acid, polymer with formaldehyde, potassium salt	9069-79-8	liquid	44 – 46				•		•	

• 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 special emulsifiers as well as latex additives.
Our product range covers ethoxylates and alkoxylates of nonylphenol, fatty alcohols, acids and vegetable oils, fatty amines and amides, block copolymers of ethylene oxide and propylene oxide.

We manufacture our products based on alcohols derived from both – petrochemical and natural sources with an extensive range of carbon chains distribution ranging from C9-C18. With an 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 oleochemical feedstocks are available upon request.

Product characteristics						Product group							
Product name	Description	CAS	Appearance	HLB	Active substance content, %	Vinyl acetate & copolymers	Styrene acrylics	Acrylics	Styrene butadiene rubber	Polyvinyl chloride	APE - free	Low foam	Post-polymerization stability
ROKAnol® EH18/80	2-ethylhexanol (18 EO)	26468-86-0	liquid	17.2	78 – 82	●	●	●			●		o
ROKAnol® IT10	Alcohols, C13, branched (10EO)	69011-36-5	liquid	13.8	min. 99.5	●	●	●	o	o	●		
ROKAnol® IT15/40	Alcohols, C13, branched (15EO)	69011-36-5	liquid	14.7	39 – 41	●	●	●	o	o	●		o
ROKAnol® IT20	Alcohols, C13, branched (20EO)	69011-36-5	wax	16.3	min. 99	●	●	●	o	o	●		o
ROKAnol® IT20/80	Alcohols, C13, branched (20EO)	69011-36-5	liquid	16.3	78 – 82	●	●	●	o	o	●		o
ROKAnol® IT28/70	Alcohols, C13, branched (28EO)	69011-36-5	liquid	17.2	68 – 72	●	●	●	o	o	●		o
ROKAnol® IT40/70	Alcohols, C13, branched (40EO)	69011-36-5	liquid	18.0	68 – 72	●	●	●	o	o	●		o
ROKAnol® IT100/35	Alcohols, C13, branched (100EO)	69011-36-5	liquid	19.1	34.0 – 36.0	●	●	●	o	o	●		o
ROKAnol® K18	Alcohols, C16-18 unsaturated (18EO)	9005-04-3	paste/wax	15.8	min. 99.0	●	●	●	o	o	●		o
ROKAnol® L10/80	Alcohols, C12-14 (10EO)	68439-50-9	liquid	13.8	77 – 81	●	●	●	o	o	●		o
ROKAnol® L12S/80	Alcohols, C12-14 (2EO)	68439-50-9	liquid	14.8	78 – 82	●	●	●	o	o	●		o
ROKAnol® L30/65	Alcohols, C12-14 (30EO)	68439-50-9	viscous liquid	18.0	64 – 66	●	●	●	o	o	●		o
ROKAnol® O18	Alcohols, C16-18 unsaturated (18EO)	9004-98-2	paste	15.6	min. 99.0	●	●	●	o	o	●		o
ROKAnol® O20	Alcohols, C16-18 unsaturated (20EO)	9004-98-2	paste	16.3	min. 99.0	●	●	●	o	o	●		o
ROKAnol® O20/20	Alcohols, C16-18 unsaturated (20EO)	9004-98-2	liquid	16.3	19 – 21	●	●	●	o	o	●		o

● highly recommended   o recommended

Product characteristics						Product group							
Product name	Description	CAS	Appearance	HLB	Active substance content, %	Vinyl acetate & copolymers	Styrene acrylics	Acrylics	Styrene butadiene rubber	Polyvinyl chloride	APE - free	Low foam	Post-polymerization stability
ROKAnol® O23/70	Alcohols, C16-18 unsaturated(23EO)	9004-98-2	liquid	16.7	68 – 71	●	●	●			●		o
ROKAnol® SAE7	Alcohols, C11-C15 secondary (7EO)	68131-40-8	liquid	12.9	min. 99.0	o	o	o	o	o	●		
ROKAnol SAE12	Alcohols, C11-C15 secondary (12EO)	68131-40-8	liquid	14.6	min. 99.5	●	●	●	o	o	●		o
ROKAnol SAE40W/70	Alcohols, C11-C15 secondary (40EO)	68131-40-8	liquid	18.0	68.5 – 71.5	●	●	●	o	o	●		o
ROKAnol® T18	Alcohols, C16-18 (18EO)	68439-49-6	wax	15.8	min. 99.0	●	●	●	o	o	●		o
ROKAnol® T25 flakes	Alcohols, C16-18 (25EO)	68439-49-6	flakes	16.0	min. 99	●	●	●			●		o
ROKAnol® T25/25	Alcohols, C16-18 (25EO)	68439-49-6	liquid	16.0	24 – 26	●	●	●	o	o	●		o
ROKAnol UD21/70	Alcohols, C11, branched and linear (21EO)	127036-24-2	liquid	16.8	68 – 72	●	●	●	o	o	●		o
ROKAnol® UD28/70	Alcohols, C11, branched and linear (28EO)	127036-24-2	liquid	17.2	69 – 71	●	●	●	o	o	●		o
ROKAnol® UD40/70	Alcohols, C11, branched and linear (40EO)	127036-24-2	liquid	18.2	69 – 71	●	●	●	o	o	●		o
EXOemul® EP287	Alcohols, C9-16 (28EO)	97043-91-9	liquid	–	68 – 72	●	●	●	o	o	●		o
ROKAnol® TSP16	Tristyrylphenol (16EO)	99734-09-5	viscous liquid	13.0	min. 99	●	●	●	o		●		o
ROKAnol® TSP20	Tristyrylphenol (20EO)	99734-09-5	liquid/paste	14.0	min. 99.5	●	●	●	o		●		o
ROKAnol® TSP25/80	Tristyrylphenol (25EO)	99734-09-5	liquid	14.9	79 – 81	●	●	●	o		●		o
ROKAnol® TSP40/20	Tristyrylphenol (40EO)	99734-09-5	liquid	16.4	19 – 21	●	●	●	o		●		o
ROKAnol TSP60	Tristyrylphenol (60EO)	99734-09-5	wax	17.4	Min. 99	●	●	●	o		●		o
ROKAcet R26	Castor Oil (26EO)	61791-12-6	liquid	11.0	min. 99.0	●	●	●	o	o	●		
ROKAcet R40	Castor Oil (40EO)	61791-12-6	paste	13.0	min. 99.0	●	●	●	o	o	●		
ROKAfenol N8LA	Nonylphenol (EO/PO)	37251-69-7	liquid	12.0	min. 99.0	●	●	●	o	o			
ROKAfenol N40*	Nonylphenol (40EO)	127087-87-0	wax	17.8	min. 99	●	●	●	o				
ROKAfenol D22	Dodecylphenol (22EO)	9014-92-0	wax	16.4	min. 99	●	●	●	o				o
ROKAmer 1010	PEG/PPG Copolymer	9003-11-6	wax	16.6	min. 99.0	o	o	o			●	●	
ROKAmer 1010/50	PEG/PPG Copolymer	9003-11-6	viscous liquid	16.6	>50	o	o	o			●	●	

● highly recommended   o recommended

* available only outside of EU

03 / Defoamers

ROKAmers and EXOantifoam series

Surfactants, especially anionic ones, have a strong tendency to create and stabilize foam during and after the emulsion polymerization process. Defoamers are commonly used in the process to avoid foam formation.

Depending on the nature of the emulsifiers, viscosity, and final application of the polymeric dispersion, PCC Exol offers defoaming agents based on PEG/PPG copolymers silicone and mineral oil free and silicone emulsions.

Product name	Description	CAS	Appearance	Active substance content, %	FDA	BFR	EU 10/2011	Swiss ordinance
ROKAmer PP2000	PEG/PPG Copolymer	9003-11-6	clear liquid	min. 99.5	173.340 175.105 175.300 176.170 176.180 176.210	XIV XXXVI	•	Annex 2 Annex 9 Annex 10
ROKAmer 2000	PEG/PPG Copolymer	9003-11-6	clear or slighltly turbid liquid	min. 99	175.320 176.170 176.180 176.200 176.210 177.1680 178.3570	XIV XXXVI	•	Annex 2 Annex 9 Annex 10
ROKAmer 2100	PEG/PPG Copolymer	9003-11-6	clear liquid	min. 99	172.808 173.340 175.105 176.170 176.180 175.320 176.200 176.210 177.1200 177.1680	XIV XXXVI	•	Annex 2 Annex 9 Annex 10
EXOantifoam S100	Silicone emulsion	-	white emulsion	-	-	-	-	-


CORROSIVE
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04 / Antioxidants & thermal stabilisers

Rostabil series – short-life thermal stabilizers efficaciously provide protection against yellowing phenomenon. Considered as effective secondary stabilizers exhibit synergistic effect in conjunction with primary antioxidants. Rostabil stabilizers might be used either during synthesis or processing of various resins.

Product name	Chemical name	Appearance	Density at 20°C [g/cm^3]	Hazen colour	Refractive index, $n^{20}D$	Acid value, mgKOH/g
Rostabil TNF	tris (nonylphenyl) 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


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05 / Polyols for the production of PU Resins

The PCC Group offers polyols used in the production of polyurethanes, used as coating materials in formulations of paints and printing inks.

The offer includes polypropylene glycols (PPG) with a molecular weight ranging from 450 to 18.000 g/mol.

Product name	Description	Hydroxyl number, mg KOH/g	Viscosity at 25°C [mPa·s]	Molecular weight (g/mol)	Theoretical funcionality
Polikol 600	Polyoxoethylene glycol	170 – 200	–	600	2
Polikol 1500	Polyoxoethylene glycol	70 – 80	–	1500	2
Rokopol D200	Polyoxopropylene glycol	495 – 535	45 – 65	220	2
Rokopol D450	Polyoxopropylene glycol	230 – 270	60 – 80	450	2
Rokopol D1002	Polyoxopropylene glycol	108 – 116	130 – 170	1000	2
Rokopol D2002	Polyoxopropylene glycol	53 – 59	280 – 380	2000	2
PolyU L 8000	Polyoxopropylene glycol	13 – 15	2600 – 3600	8000	2
PolyU L 12000	Polyoxopropylene glycol	9 – 11	4000 – 8000	12000	2
PolyU L 18000	Polyoxopropylene glycol	5 – 7	19000 – 27000	18000	2
Rokopol DE2020	EO/PO block copolymer	53 – 59	280 – 400	2000	2
Rokopol DE4020	EO/PO block copolymer	21 – 31	700 – 900	4000	2
Rokopol DE4030	EO/PO block copolymer	26 – 30	700 – 1200	4000	2
Rokopol C800	Glycerol etoxylated	700	180 – 280	700	3
Rokopol G400	Propoxylated glycerin	370 – 400	250 – 400	400	3
Rokopol G441	Propoxylated/ethoxylated glycerin	330 – 360	250 – 310	500	3
Rokopol G500	Propoxylated glycerin	290 – 310	240 – 340	560	3
Rokopol G700	Propoxylated glycerin	225 – 250	220 – 270	700	3
Rokopol G1000	Propoxylated glycerin	155 – 165	200 – 300	1000	3
Rokopol F3000	Propoxylated glycerin	45 – 50	460 – 520	3000	3
Rokopol F3600	Propoxylated/ethoxylated glycerin	45 – 50	540 – 620	3600	3
Rokopol M5000	Propoxylated/ethoxylated glycerin	33 – 37	700 – 960	4800	3
Rokopol M5020	Propoxylated/ethoxylated glycerin	33 – 38	700 – 1000	4800	3
Rokopol M6000	Propoxylated/ethoxylated glycerin	27 – 29	1050 – 1250	6000	3
Rokester C1520	Castor oil based polyester polyol	150 – 165	2000 – 3300	–	3
Rokester C1610	Castor oil based polyester polyol	155 – 170	1000 – 1400	–	3

06 / Flame retardants

Roflam 6 acts as an internal flame retardant. The product contains reactive hydroxyl group, allowing for easy incorporation with various polurea and polyurethane resins, including PU dispersions recommended for waterborne transparent varnishes. Among other liquid flame retardants Roflam 6 stands out for its higher phosphorus content, directly enhancing its performance.

Product name	Description	CAS	Active substance content, %	Viscosity at 25°C [mPa·s]	Density at 20°C [g/cm³]	Phosphorus content	Hydroxyl number, mg KOH/g
Roflam 6	N,N-bis(2-hydroxyethyl) aminomethane phosphonic acid diethyl ester	2781-11-5	min. 99.5	100 – 300	1.16 – 1.17	12.2%	400 – 460

Starting formulation for intumescent PU dispersion

Component	grams	% pphm
Polyetherpolyol (OH No. = 110)	150	21.1
Polyesterpolyol (OH No. = 110)	50	7.0
DMPA	35	4.9
Roflam 6	150	21.1
IPDI	325	45.8
Acetone (optional)	165	
Triethylamine	22.4	
Water	1225	
Ethylene diamine	16	

Procedure

1. Mix Roflam 6, polyetherpolyol and polyesterpolyol at 70°C
2. Add DMPA and mix until homogenous appearance
3. Add IPDI at 80°C and check NCO content after 2 hour (add acetone if viscosity rises too high). The target content of NCO should be around 4.5%.
4. Cool down to 60°C and add triethylamine for neutralization
5. Cool down to 50°C and add reaction mixture slowly under vigorous stirring to water. Keep the temperature 23°C during the process.
6. Add ethylene diamine quickly after dispersion step under vigorous stirring to avoid hot spots
7. If acetone used: remove the solvent during the distillation.

07 / Emulsifiers in applications

Acrylic dispersion - evaluation of selected anionic surfactants

The influence of selected anionic surfactants on particle size, chemical stability and water resistance was investigated in the series of acrylic dispersions. The samples of dispersion were prepared according to following recepie:

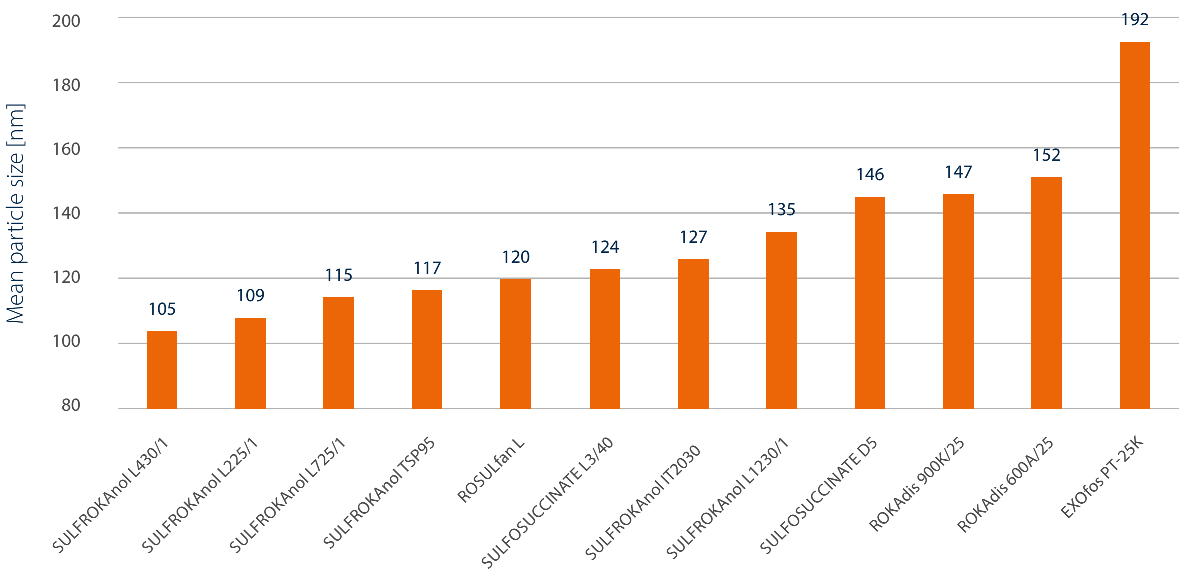
Component	grams	% pphm
Reactor charge		
Water	242.30	
SULFOROKAnol L430/1	3.17	0.20
$FeSO_4*7H_2O$	0.03	
Preemulsion		
Water	152.00	
SULFOROKAnol L430/1	**28.50**	
Sodium acetate	4.00	**1.80**
Methyl methacrylate	247.00	52.00
2-Ethylhexyl acrylate	218.50	46.00
Acrylic acid	9.50	2.00
Water to clean	13.34	
Initiator solution I		
Ammonium persulfate	2.38	0.50
Water	33.25	
Initiator solution II		
Sodium bisulfite	1.58	0.33
Water	33.25	
pH Adjustment		
Ammonia solution Solution (15%)	10.20	
Biocide		
CIT/MIT 3:1	1.00	
Total weight	1000	

Procedure

1. Add the REACTOR CHARGE to the reaction flask and heat up to 72°C.
2. Prepare preemulSION and solution of INITIATOR I and INITIATOR II.
3. Start metering the PREEMULSION and the INITIATOR I and II over 3 hours, keeping the temperature in range of 72 – 74 °C.
4. After the addition hold the temperature at 72 – 74°C for 60 min.
5. Cool below 50°C, adjust pH with ammonia solution and add the biocide.
6. After cooling down to ambient temperature discharge and filter obtained dispersion, and collect coagulum from the filter.

Influence on particle size

Mean particle size was determined by DLS method. The results are shown in the following graph:



Influence on chemical stability

2-3 droplets of analyzed dispersion were added to $CaCl_2$ solution. Stability of the dispersion was rated as "excellent" when no observed coagulum was formed.

	ROSULfan L	SULFOROKAnol L225/1	SULFOROKAnol L430/1	SULFOROKANOL L725/1	SULFOROKAnol L1230/1	SULFOROKANOL IT2030	SULFOROKAnol TSP95
2.5% $CaCl_2$	o	o	●	●	●	●	●
5% $CaCl_2$	o	o	●	●	●	●	●
10% $CaCl_2$	o	o	o	o	●	●	●
15% $CaCl_2$	o	o	o	o	●	●	●
20% $CaCl_2$	o	o	o	o	●	●	●

● excellent o poor

The ethoxylation degree of an emulsifier has influence on chemical stability of the dispersion. Exhibit highly ethoxylated surfactants like SULFOROKAnol L1230/1, SULFOROKAnol IT2030 or a SULFOROKAnol TSP95.

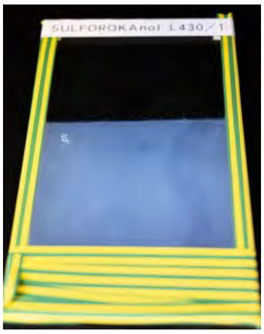
Influence on water resistance

Samples of dispersions were mixed with 4% by weight of coalescent and applied on glass plates. The plates were conditioned for one week at ambient temperature and subsequently immersed in distilled water for 48 hours. After that time milkiness of the film was examined.

ROSULfan L

SULFOROKAnol L225/1

SULFOROKAnol L430/1



SULFOROKAnol L725/1

SULFOROKAnol L1230/1

Anionic emulsifiers have strong influence on water resistance. The best results are achieved for SULFOROKAnol L430/1, L725/1 and L1230/1.

Acrylic dispersion - evaluation of selected nonionic surfactants

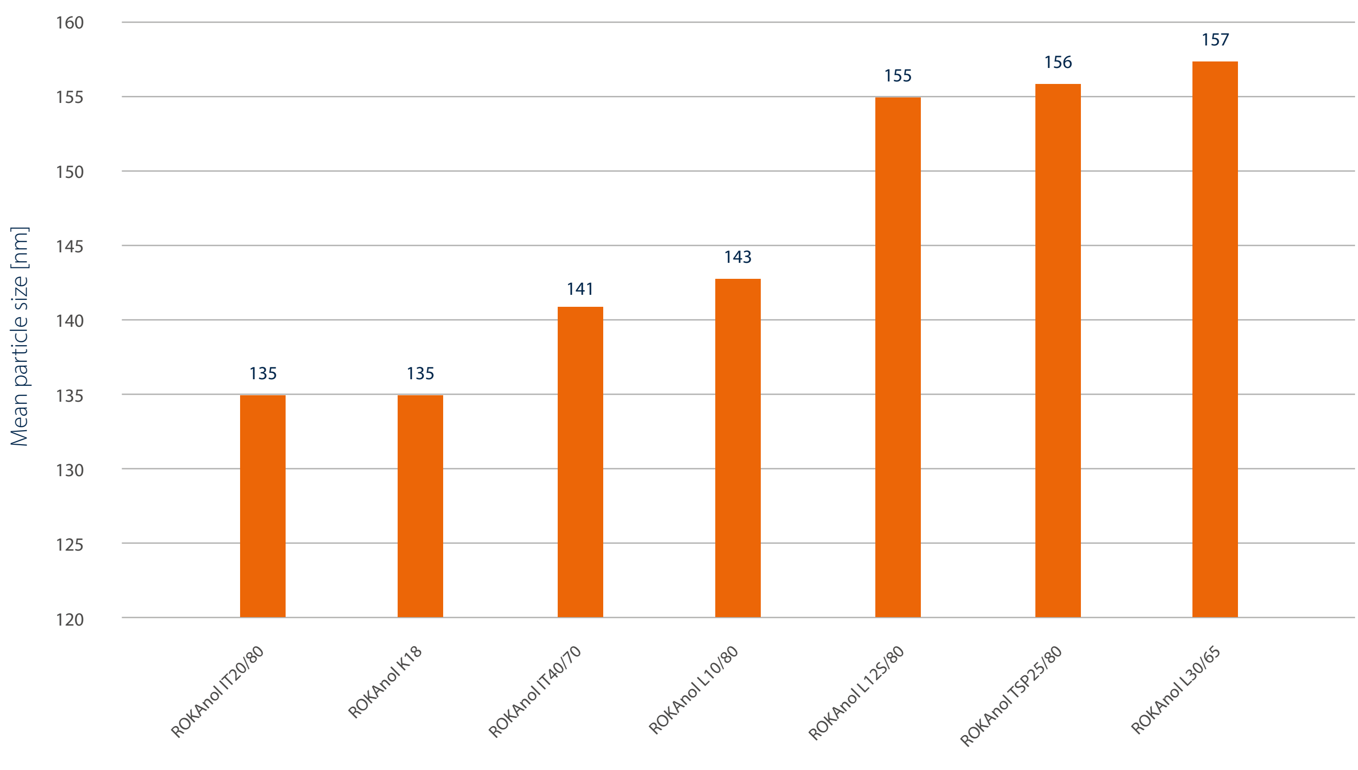
Component	grams	% pphm
Reactor charge		
Water	252.00	
ROSULfan L	1.25	0.08
$FeSO_4*7H_2O$	0.03	
Preemulsion		
Water	173.00	
Rosulfan L	11.15	0.72
ROKAnol L12S/80	**8.70**	**1.50**
Sodium acetate	1.80	1.50
Methyl methacrylate	261.00	56.00
2-Ethylhexyl acrylate	200.00	43.00
Methacrylic acid	4.70	1.00
Water to clean	11.59	
Initiator solution I		
Ammonium persulfate	2.33	0.50
Water	32.60	
Initiator solution II		
Sodium bisulfite	1.55	0.33
Water	32.60	
pH Adjustment		
NH4OH Solution (15%)	4.70	
Biocide		
CIT/MIT 3:1	1.00	
Total weight	1000	

Procedure

1. Add the REACTOR CHARGE to the reaction flask and heat up to 72°C.
2. Prepare preemulSION and solution of INITIATOR I and INITIATOR II.
3. Start metering the PREEMULSION and the INITIATOR I and II over 3 hours, keeping the temperature in range of 72 – 74 °C.
4. After the addition hold the temperature at 72 – 74°C for 60 min.
5. Cool below 50°C, adjust pH with ammonia solution and add the biocide.
6. After cooling down to ambient temperature discharge and filter obtained dispersion, and collect coagulum from the filter.

Influence on particle size

Mean particle size was determined by DLS method. The results are shown in the following graph:



Influence on chemical stability

2-3 droplets of analyzed dispersion were added to $CaCl_2$ solution. Stability of the dispersion was rated as "excellent" when no observed coagulum was formed.

	ROKAnol IT20/80	ROKAnol L10/80	ROKAnol L12S/80	ROKANOL IT40/70	ROKAnol K18	ROKAnol L30/65	ROKAnol TSP25/80
2.5% $CaCl_2$	●	●	●	●	●	●	●
5% $CaCl_2$	●	●	●	●	●	●	●
10% $CaCl_2$	o	o	o	●	●	●	●
15% $CaCl_2$	o	o	o	o	o	●	●
20% $CaCl_2$	o	o	o	o	o	o	●

● excellent o poor

Highly ethoxylated surfactants like ROKAnol L30/65 and ROKAnol IT40/70 provide good chemical resistance.

The best results are achieved for ROKAnol TSP25/80.

Vinyl-acrylic dispersion – evaluation of selected nonionic surfactants

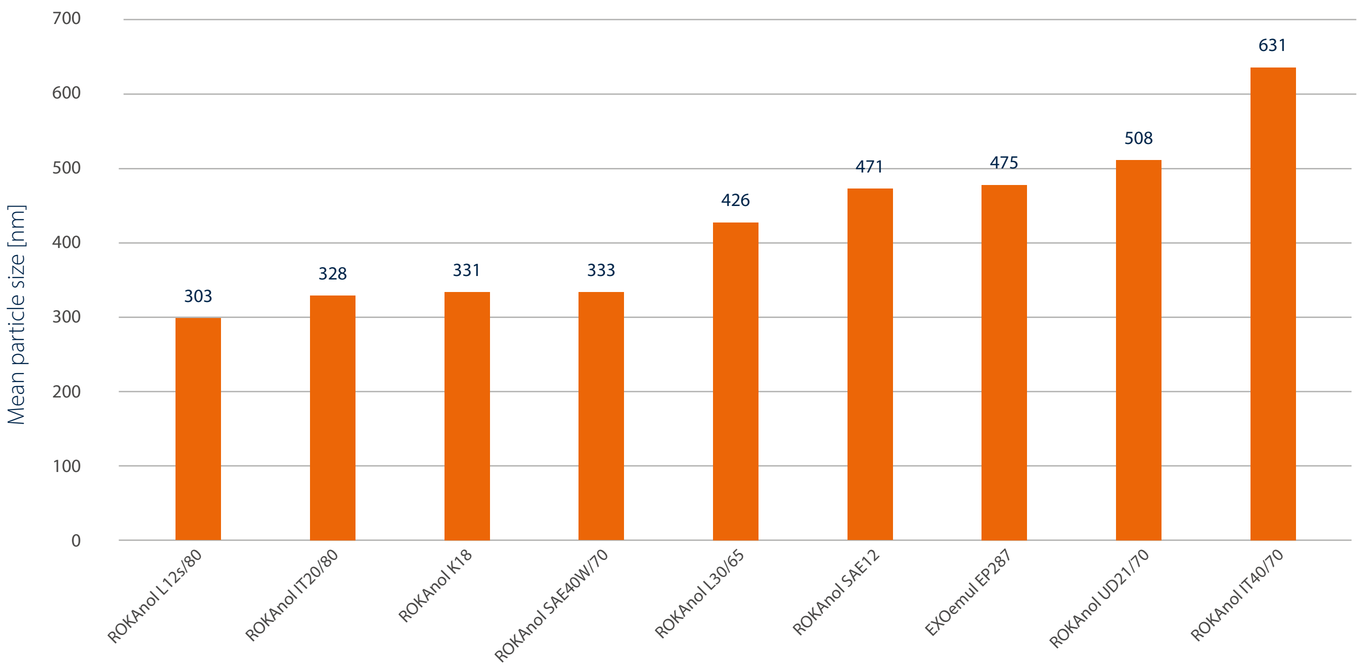
Component	grams	% pphm
Reactor charge		
Water	419.00	
PVA 6-88	2.30	0.50
PVA 18-88	7.40	1.60
ROKAnol IT20/80	23.20	4.00
Sodium acetate	1.90	
Monomers		
Vinyl acetate	351.00	75.70
Butyl acrylate	113.00	24.30
Initiator		
Ammonium persulfate	2.30	0.50
Water	78.90	
Biocide		
CIT/MIT 3:1	1.00	

Procedure

1. Add the REACTOR CHARGE to the reaction flask and heat up to 76 °C.
2. Prepare mixture of MONOMERS and solution of INITIATOR.
3. Start metering the MONOMERS and the INITIATOR I and II over 5 hours, keeping the temperature in range of 75 – 77 °C.
4. After the addition hold the temperature at 75 – 77 °C for 1 hour.
5. Add INITIATOR III and INITIATOR IV simultaneously over 30 minutes.
6. Cool below 35°C and add the biocide.
7. After cooling down to ambient temperature discharge and filter obtained dispersion, and collect coagulum from the filter.

Influence on particle size

Mean particle size was determined by DLS method. The results are shown in the following graph:



ROKAnol L12S/80, IT20/80, K18 and SAE40W/70 provide smaller particle size, below 400 nm.

Influence on wet scrub resistance

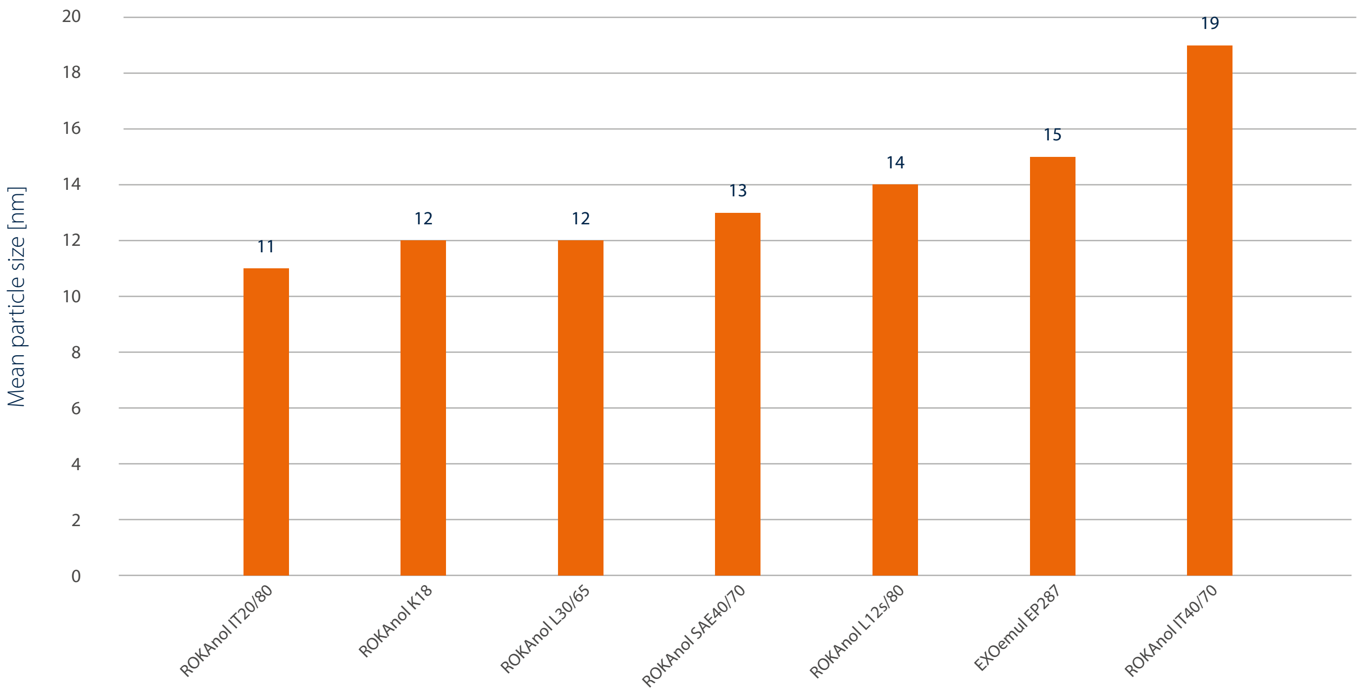
Obtained dispersions were used to prepare samples of white interior coatings with the composition presented In following table:

Raw material	Loadings (%wt)
Water	17.2
EXOdis PC540i	0.6
EXOdis PC185	0.2
Defoamer	0.2
Titanium white	14
Plastorit 0000	5
Calplex 2	10
Socal P-2	7
Talc M15	7
Dorkafill H	7
Water	1.1
Hydroxyethylcellulose (1% aqueous solution)	10
VA dispersion	20
Polyether thickener	0.4
Biocide	0.1
Defoamer	0.2

Procedure

1. Mix components 1-4
2. Add slowly components 5-10 under the agitation, mix until obtain homogeneous liquid.
3. Grind until obtain proper fineness of grind.
4. Add components 11-16 to pigment slurry, mix until obtain homogeneous liquid.

For obtained coatings wet-scrub resistance were analyzed according to ISO 11998. Results are shown on following graph:



ROKAnol IT20/80, K18 and L30/65 improve wet-scrub resistance in white interior coating formulation.

Styrene-acrylic dispersion – influence of anionic emulsifiers on anticorrosive properties

Phosphate esters are known as effective anionic emulsifiers that provide some anticorrosive properties. However, in comparison with sulfates and sulfonates, they result in dispersions with larger particle sizes. These products can also deteriorate the adhesion of polymeric films.

To overcome these issues, a combination of phosphate esters with an appropriate sulfate or sulfonate surfactant is recommended. The following example demonstrates the performance of a mixture of ROKAdis 900K/25 and SULFOROKAnol TSP95 in a styrene-acrylic dispersion.

Component	grams	% pphm
Reactor charge		
Water	221.00	
ROKAdis 900K/25	1.78	0.10
SULFOROKAnol TSP95	0.50	0.10
$FeSO_4$*$7H_2O$	0.03	
Preemulsion		
Water	191.00	
ROKAdis 900K/25	16.00	0.90
SULFOROKAnol TSP95	4.46	0.90
ROKAnol IT20/80	11.30	2.00
Methacrylamide	5.80	1.30
Styrene	252.00	56.00
Butyl acrylate	185.00	41.10
Acrylic acid	7.00	1.60
Sodium acetate	3.00	
Water to clean	13.17	
Initiator solution I		
Ammonium persulfate	2.71	0.60
Water	32.00	
Initiator solution II		
Sodium bisulfite	1.81	0.40
Water	32.00	
Initiator solution III		
Bruggolite FF6	0.32	0.07
Water	4.96	
Initiator solution IV		
t-butyl hydroperoxide (70%)	0.45	0.07
Water	4.51	
pH Adjustment		
NH4OH Solution (15%)	8.00	
Biocide		
CIT/MIT 3:1	1.00	

Procedure

1. Add the REACTOR CHARGE to the reaction flask and heat up to 72°C.
2. Prepare Pre-emu and solution of INITIATOR I and INITIATOR II.
3. Start metering the PREEMULSION and the INITIATOR I and II over 3 hours, keeping the temperature in range of 72 – 74°C.
4. After the addition hold the temperature at 72 – 74°C for 30 minutes.
5. Add INITIATOR III and INITIATOR IV simultaneously over 30 minutes.
6. Cool below 50°C, adjust pH with ammonia solution and add the biocide.
7. After cooling down to ambient temperature discharge and filter obtained dispersion, and collect coagulum from the filter.

Influence on flash rust and adhesion to steel

Samples of dispersions were mixed with 4% by weight of coalescent and 0.2% by weight of anti-flash rust inhibitor and then applied on steel plates. After evaporation of water the flash-rust under dry film was examined. Then the plates were conditioned for one week at ambient temperature and adhesion using cross-cut method was determined. The results are presented in the following pictures:

Appearance after evaporation of water

SLES

ROKAdis 900K/25

ROKAdis 900K/25 + SULFOROKAnol TSP95

Adhesion after one week at ambient temperature

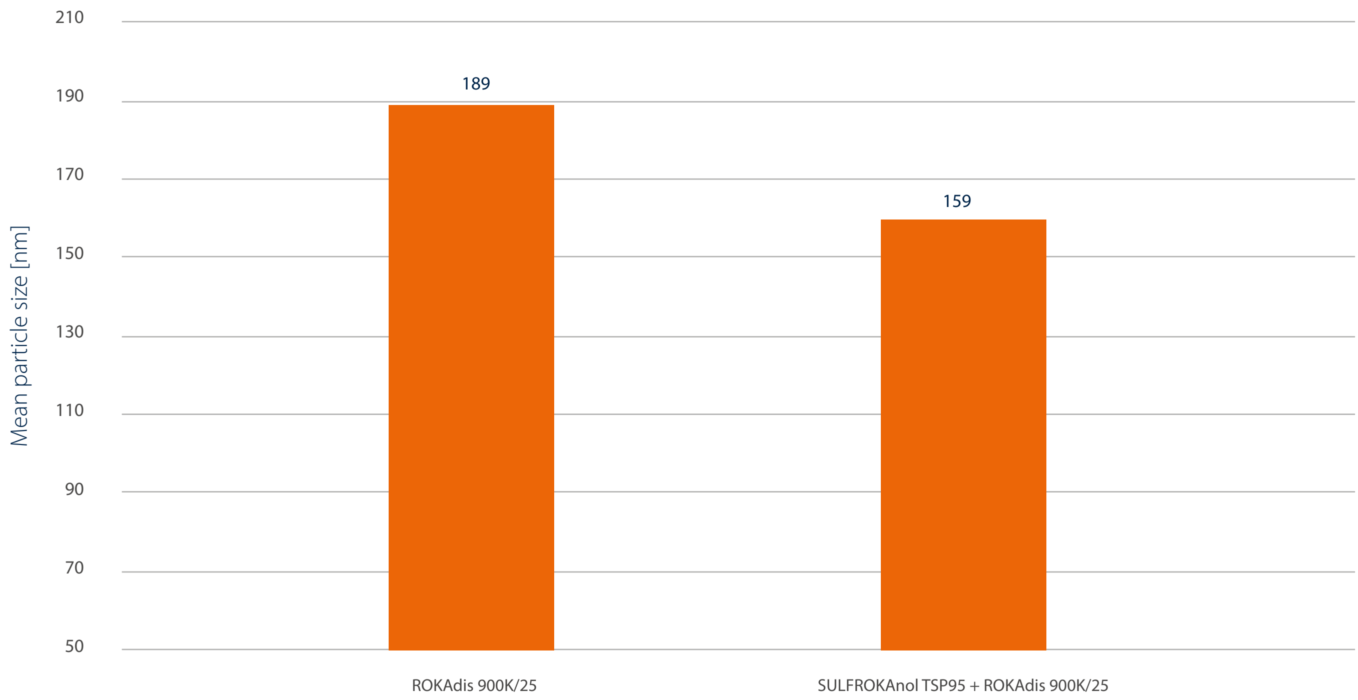
ROKAdis 900K/25

ROKAdis 900K/25 + SULFOROKAnol TSP95

Incorporation of ROKAdis 900K/25 as a single emulsifier as well as in combination with SULFOROKAnol TSP95 provides a synergistic effect with anti-flash rust inhibitor, preventing flash rust after the film-forming process. The combination of ROKAdis 900K/25 and SULFOROKAnol TSP95 also provides very good adhesion to the steel, which is poor when only the phosphate ester is applied.

Particle size comparison

Mean particle size was determined by DLS method. Results are shown in the following graph:



The addition of SULFOROKAnol TSP95 allows to achieve lower particle size of the dispersion.

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