



# EXObit Series

Surfactants for Bituminous Emulsions

Local. Global. Integrated.

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



# About Us

PCC Exol SA is a major player in the European surfactants market. In the eastern and central-eastern part of the continent, it is the undisputed leader in its industry. Most of the production facilities and the company's headquarters are located in Brzeg Dolny, Poland. Here we develop, test and manufacture a wide range of anionic, non-ionic and amphoteric surfactants and speciality industrial formulations.

New products are continuously added to the portfolio in response to market trends and individual customer requirements. The surfactants produced at the plants have a very wide range of industrial applications. They

are used as wetting agents, emulsifiers, auxiliaries in paper, metallurgy and many other industries, as well as in household chemicals, personal care products and textiles.

PCC EXOL pays special attention to the issue of sustainable development, which is one of the key elements of the company's strategy. In order to strengthen its competitive position in the surfactants market, the company is committed to promoting responsible production and consumption throughout the value chain. The concept of sustainable development is therefore a key aspect of all the company's management and operational processes.

<b>PCC ROKITA SA</b> <b>PCC PCG</b> <b>OXYALKYLATES</b> <b>IRPC</b>	<b>PCC</b> <b>ROKITA SA</b>	<b>PCC</b> <b>ROKITA SA</b>	<b>PCC EXOL SA</b> <b>PCC CHEMAX INC</b> <b>PCC PCG OXYALKYLATES</b>	<b>PCC</b> <b>SYNTEZA</b>
<b>Polyols</b> 	<b>Chlorine</b> 	<b>Phosphorus</b> 	<b>Surfactants</b> 	<b>Alkylphenols</b> 
<ul style="list-style-type: none"> <li>• Polyether polyols</li> <li>• Polyester polyols</li> <li>• Prepolymers</li> <li>• Polyurethane Systems</li> </ul>	<ul style="list-style-type: none"> <li>• Chlorine</li> <li>• MCAA</li> <li>• Other Chlorine Downstream Product</li> </ul>	<ul style="list-style-type: none"> <li>• Phosphorus derivatives</li> <li>• Naphthalene derivatives</li> <li>• Polycarboxyethers (PCE)</li> </ul>	<ul style="list-style-type: none"> <li>• Anionic surfactants</li> <li>• Cationic surfactants</li> <li>• Nonionic surfactants</li> <li>• Amphoteric surfactants (betaines)</li> <li>• Chemical formulation</li> </ul>	<ul style="list-style-type: none"> <li>• Nonylphenol</li> <li>• Dodecylphenol</li> <li>• Tristyrylphenol</li> </ul>
<b>PCC CONSUMER PRODUCTS SA</b>	<b>PCC</b> <b>ROKITA SA</b>	<b>PCC</b> <b>INTERMODAL SA</b>	<b>PCC</b> <b>BAKKISILICON HF.</b>	<b>PCC</b> <b>SE</b>
<b>Consumer Products</b> 	<b>Energy</b> 	<b>Logistics</b> 	<b>Silicon</b> 	<b>Holding &amp; Projects</b> 
<ul style="list-style-type: none"> <li>• Household &amp; industrial Cleaners, Detergents and Personal Care Products</li> </ul>	<ul style="list-style-type: none"> <li>• Renewable Energy</li> <li>• Conventional Energy</li> </ul>	<ul style="list-style-type: none"> <li>• Intermodal transport</li> <li>• Road Haulage</li> <li>• Rail Transport</li> </ul>	<ul style="list-style-type: none"> <li>• Microsilica</li> <li>• Silicon Metal</li> </ul>	<ul style="list-style-type: none"> <li>• Portfolio Management</li> <li>• Project Development</li> </ul>

## Asphalt emulsification

Emulsification of asphalt in water creates an asphalt/bituminous emulsion by breaking molten asphalt into tiny droplets, which are then suspended in water and kept stable by an emulsifying agent (a surfactant) that coats the droplets, preventing them from recombining. This is achieved using a high-speed mechanical device like a dissolver or colloid mill.

### Proper emulsification process



### Incorrect emulsification process



## Stability of emulsion

The resulting liquid, which can range from milky to heavy cream in consistency, is used in cold processes for waterproofing or road construction and maintenance, with the asphalt eventually breaking free from the water to adhere to aggregate materials. However, it is important that during storage emulsion remains stable.

### Stable emulsion



### Unstable emulsion



## EXObit series

EXObit is a new series of additives for the asphalt industry. It is a series of surfactants used primarily as emulsifiers for bituminous emulsions. The use of EXObit series products allows for the production of stable, high-quality emulsions. In addition to their role as emulsifiers, EXObit series products can also act as viscosity modifiers, stabilizers, or wetting agents. The selection of the appropriate emulsifier depends, among other things, on the type of filler in the formulation.

Product name	Surfactant type	CAS number	Concentration [%]	Function
EXObit E-K40	Amphoteric	97862-59-4	40	Flagship product Main emulsifier Viscosity modifier (strong thickener)
EXObit E-K3B	Amphoteric	66455-29-6	30	Main emulsifier Viscosity modifier (medium thickener)
EXObit E-D7	Nonionic	68131-39-5	90	Main or co-emulsifier for standard formulations (especially containing bentonite)
EXObit E-S9	Nonionic	84133-50-6	100	Main or co-emulsifier for more specialized formulations Stabilizer for diluted emulsions
EXObit E-SD7	Nonionic	-	90	Budget version of E-S9 Co-emulsifier for anionic/amphoteric emulsifiers Stabilizer
Rokamid KAD	Nonionic	68155-07-7	100	Co-emulsifier for anionic/amphoteric emulsifiers Stabilizer thanks to viscosity modification (strong thickener)
Rokamid MRZ4	Nonionic	85536-23-8	93	Co-emulsifier for anionic/amphoteric emulsifiers Wetting agent

## Various bituminous emulsions types and their applications

Bituminous emulsion type	Filler	Application	During emulsification process	Ready-made emulsion
<b>Mineral filled</b>	Activated or unactivated bentonite	Waterproofing Prime coating		
<b>Synthetic filled</b>	Water dispersion of styrene-butadiene-carboxylic copolymer	Adhesive Waterproofing		
<b>Not filled</b>	-	Tack coats Fog seals Slurry seals		

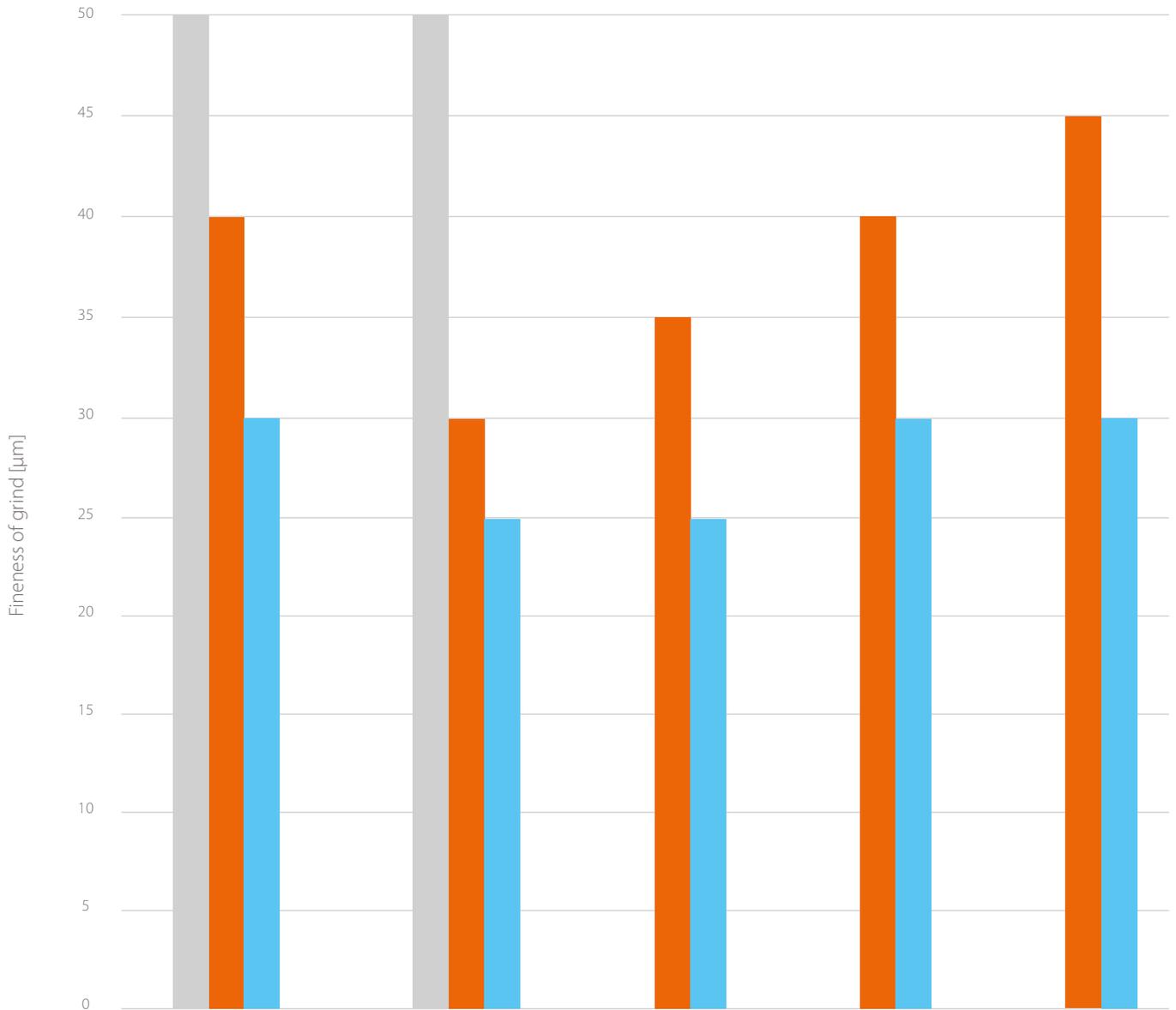


## Formulations for different type of bituminous emulsions

Bituminous emulsion type	Formulation	
	Emulsion component	Content in emulsion, %
<b>Mineral filled</b>	Asphalt 160/220	46.9
	Bentonite (unactivated or activated)	3.1
	*50% NaOH (only with activated bentonite)	0.2
	Water	48.2
	Emulsifier	1.6
<b>Synthetic filled</b>	Asphalt 160/220	47.6
	Water dispersion of styrene-butadiene-carboxylic copolymer	24.9
	50% NaOH	0.3
	Water	23.8
	Emulsifier	2.5
<b>Not filled</b>	Stabilizer/co-emulsifier	0.8
	CIT/MIT	0.1
	Asphalt 79-85	60.1
	Emulsifier	2.0
	Co-emulsifier	2.0
<b>Not filled</b>	Water	35.7
	50% NaOH	0.2

## Emulsifiers for mineral filled bituminous emulsions with bentonite

The dependence of the fineness of grind on the concentration and type of emulsifier in the mineral filled bituminous emulsion

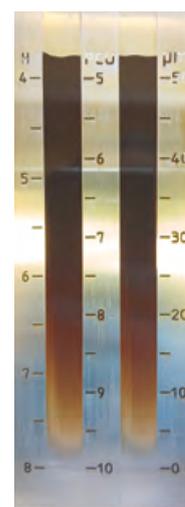
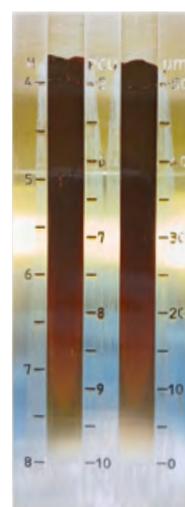
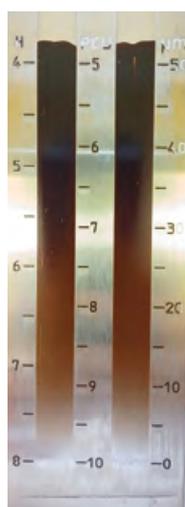
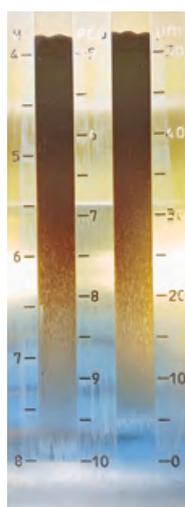


	EXObit E-D7	EXObit E-S9	EXObit E-SD7	EXObit E-K40	EXObit E-K3B
0.80%	50	50	No emulsification	No emulsification	No emulsification
1.60%	40	30	35	40	45
3.10%	30	25	25	30	30

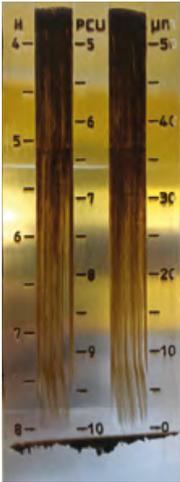
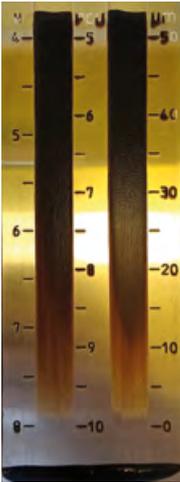
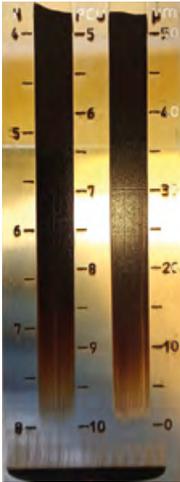
The lower the degree of dispersion of asphalt particles in a water, the higher the quality of the bituminous emulsion.

## Emulsifiers for synthetic filled bituminous emulsions with HEC

Product name	EXObit E-K40	EXObit E-K3B	ROKAmid KAD	ROKAmid MRZ4
Content [%]	2.5	2.5	2.5	2.5
Fineness of grind [ $\mu\text{m}$ ]	40	30	25	15



## Emulsifiers for not filled bituminous emulsions

Specifications	Emulsion number 1	Emulsion number 2	Emulsion number 3
Main emulsifier – <b>EXObit E-K3B</b> [%]	1.5	2.0	2.0
Co-emulsifier – <b>Rokamid KAD</b> [%]	1.5	2.0	-
Co-emulsifier – <b>EXObit E-D7</b> [%]	-	-	2.0
Fineness of grind [µm]	50	40	20
<b>Conclusions</b>	Stable emulsion, but not so well dispersed, dosage of emulsifier and co-emulsifier must be higher	Stable emulsion, much better dispersed	Change of co-emulsifier – stable emulsion, the best fineness of grind
			

## Summary

Type of emulsion	Basic emulsion (not filled)	Basic mineral filled emulsion (unactivated bentonite)	Advanced mineral filled emulsion (activated bentonite)	Synthetic filled emulsion (SBR-modified) with HEC
<b>Application</b>	Primer Soil stabilization (with cement – 2K)	Cheap antimoisture protection	Waterproofing vertical coating (tixotropic)	High-quality adhesives Applied to wet surfaces UV resistant coatings
<b>Emulsifier</b>	<b>EXObit E-K3B</b>	<b>EXObit E-S9</b> <b>EXObit E-D7</b>	<b>EXObit E-K3B</b> <b>EXObit E-K40</b>	<b>EXObit E-K3B</b> <b>ROKAmid KAD</b> <b>ROKAmid MR24</b>
<b>Co-emulsifier/stabilizer</b>	<b>EXObit E-D7</b> <b>EXObit E-S9</b>		<b>ROKAmid MR24</b>	





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The suggestions for product applications are based on our best knowledge.

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