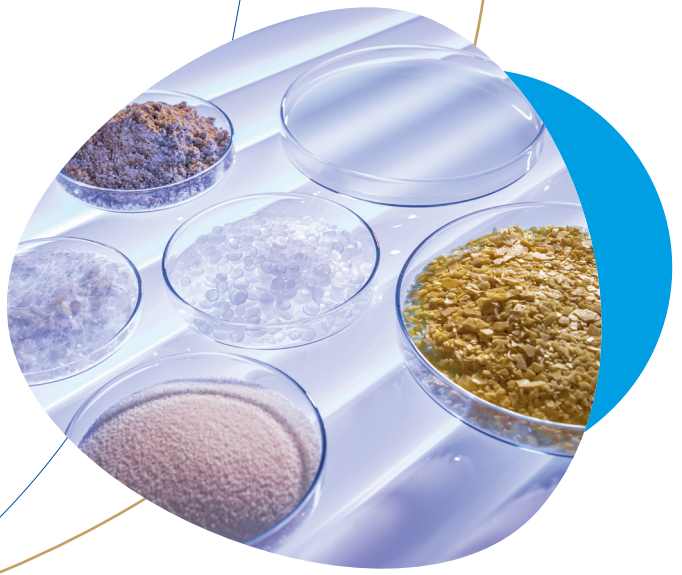
BYK

AQUACER

CERAFLOUR

PRODUCT GUIDE
WAX ADDITIVES



CERATIX

AQUAMAT

CERACOL

A member of ALTANA

Contents

Waxes – definition and classification

What is wax?

Waxes have been known since ancient times and in the beginning "wax" was often used as a synonym for "beeswax". Later on, other natural materials were discovered that also showed wax-like properties and in the 20th century synthetic waxes became available.

There is no generally accepted definition of waxes. A chemical description is not very meaningful, because the involved chemistries can be very diverse and not helpful in distinguishing waxes from non-wax materials. Wax is a broad term used to describe a general group of organic compounds. Physical and technical properties are more suitable as definitions. Among those properties are:

- Waxes are solids with a melting point above 40 °C (typically between 50 °C and 160 °C)
- They have a low melt viscosity (not more than 10 Pa·s at 10 °C above the melting point)
- They melt without decomposition
- They can be polished under slight pressure

The differentiation between waxes and organic polymers is not clear in all cases, e.g. polytetrafluoroethylene (PTFE) is often classified as a wax, but, by definition, it is not a wax, because it has no melting point.

Note

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Classification

Waxes come from a variety of sources. Besides natural waxes there are semi-synthetic waxes and synthetic waxes (G.01).

Natural waxes can be divided into fossil waxes and waxes from living organisms (non-fossil). Paraffin wax (from crude oil) and montan wax (from coal) are good examples of fossil waxes. In the group of non-fossil waxes, beeswax and carnauba wax are typical representatives of animal and plant waxes.

One drawback of natural waxes is that they are mixtures and their compositions can vary within a certain range. Additionally, they contain impurities which cause them normally to have a yellow or even brown color. Purification such as refining and bleaching are necessary before they can be used commercially in industry.

While natural waxes are still used, their significance continues to decline. Synthetic waxes can be tailored more readily for various areas of application, and their chemical composition is much more controlled.

Semi-synthetic waxes are created in the laboratory from natural raw materials. For example, amide waxes are produced by condensation of fatty acids and amines.

An industrially important amide wax is ethylene bis-stearamide (EBS).

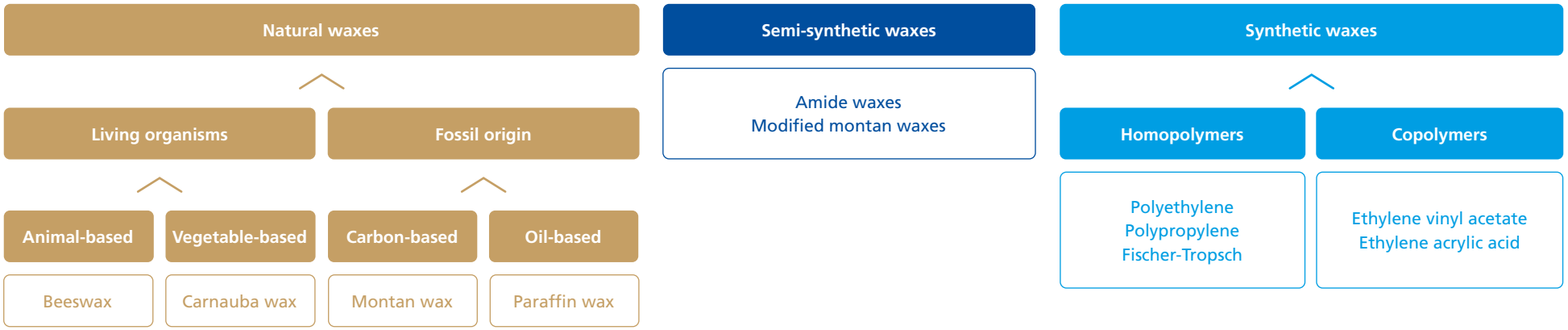
Synthetic waxes are the most important group today for a wide range of applications, and they can be subdivided into homopolymers and copolymers. The first synthetic waxes on the market were the Fischer-Tropsch waxes. Other homopolymer waxes such as polyethylene (LDPE, low density polyethylene and HDPE, high density polyethylene) and polypropylene waxes shortly followed. In addition to polymerization, depolymerization of high molecular weight polymers (especially in the case of polypropylene) can also be used for the production of such materials.

Copolymer waxes based on ethylene vinyl acetate (EVA) and ethylene acrylic acid (EAA) are well known in coating formulations, especially in metallic (basecoat) systems.

Biopolymers are a distinct group of polymers accumulated from various sustainable biomass sources.

Good biodegradability or compostability and potential reduction of carbon footprint make biopolymers attractive to achieve sustainability targets. Although biopolymers differ typical from waxes in molecular weight and state of matter under temperature, they provide unique properties. The particle shape as well as the chemical nature of the polymers creates surfaces with outstanding matting, transparency or haptics.

Origin of waxes



From waxes to wax additives

Waxes are solid materials and cannot be used directly in many applications. It is necessary to convert them into wax additives that are easy to handle and can be readily incorporated into all types of systems.

Wax additives can be finely dispersed waxes in a liquid carrier (water or organic solvents) or micronized waxes in powder form. Micronized wax additives are ideal for solvent-free applications but they also can be easily stirred into liquid systems.

Wax additives are formulations and may contain more than one type of wax. Wax combinations are often used to create wax additives with unique features.

Micronized wax additives

Micronized wax additives are products in powder form with an average particle size between 4 µm and 15 µm. Special types for creating textured surfaces can have particle sizes up to 90 µm. The micronized wax additives of BYK are offered under the trade name **CERAFLOUR.**

Typical production processes are milling and spraying, or a combination of both. BYK uses the jet milling process for its range of micronized wax additives. In this process, wax particles are accelerated to supersonic speed by an expanding air stream and the particles are reduced in size by impact.

One important quality aspect of micronized wax additives is their particle size distribution. For evaluation we use laser diffraction analysis and the data in this brochure and in our Technical Data Sheets are distributions by volume.

Aqueous wax additives

BYK offers three lines of wax additives with water as the liquid phase: the wax emulsions **AQUACER,** the wax dispersions **AQUAMAT,** and the primary dispersions **HORDAMER.** To produce an aqueous wax emulsion, the molten wax is mixed with hot water and an emulsifier. In the case of waxes with a melting point above 100 °C, this emulsification must be carried out under pressure. The particle size of **AQUACER** wax emulsions is below 1 µm and these products can therefore be used in high gloss systems without reducing gloss.

AQUAMAT wax dispersions are produced by forming larger particles in water in water. Particle size is generally above 1 µm which means that these additives will cause gloss reduction in many applications.

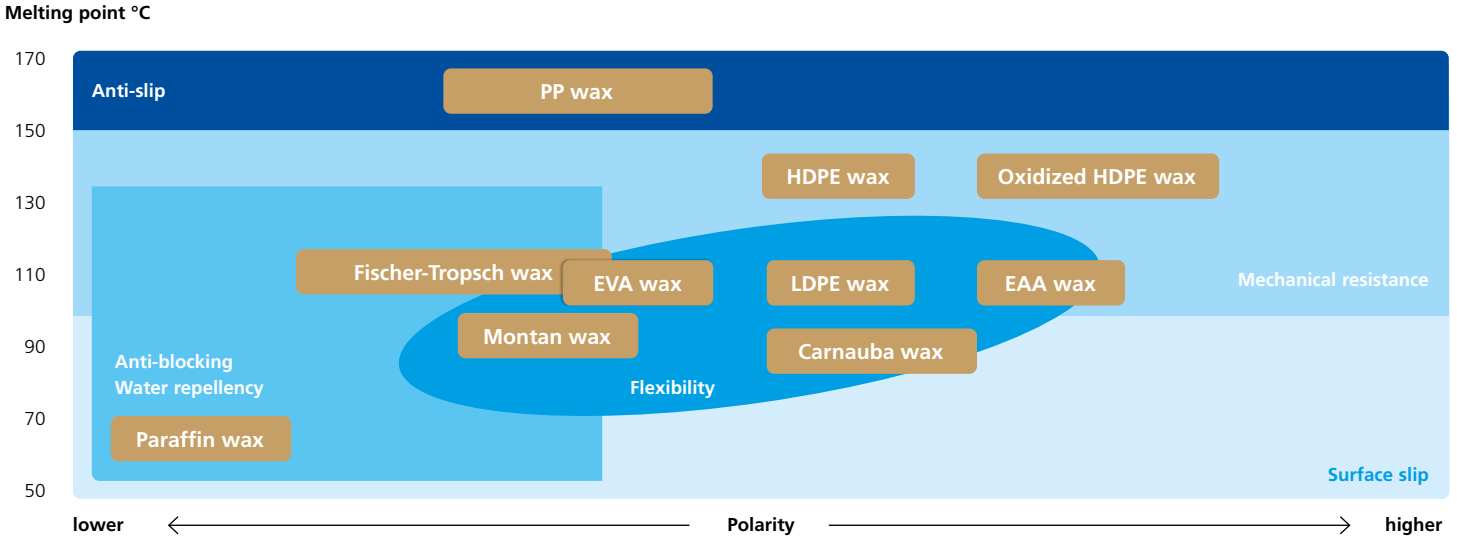
The **HORDAMER** types are primary polyethylene dispersions which are manufactured by direct polymerization of ethylene in water under high pressure in the presence of emulsifiers. This process yields stable aqueous dispersions of straight, non-modified polyethylene, while the emulsification always require polyethylene with polar modifications.

Wax additives based on organic solvents

The **CERAFAK** and **CERATIX** product lines are produced by a precipitation process. The waxes are dissolved at an elevated temperature in non-polar solvents such as xylene and butylacetate. On cooling, e.g., by admixing cold solvents, the wax crystallizes.

CERACOL and **CERAMAT** are produced by a wet grinding process. **CERACOL** products are ground in mainly polar solvents, and **CERAMAT** additives are ground in mainly non-polar solvents.

Wax properties



EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene LDPE = Low density polyethylene PP = Polypropylene G.02

Wax emulsions and dispersions in water (1/4)

Product	Wax base	Non-volatile matter (%)	Carrier	Emulsifier system	Melting point wax component (°C)	pH value (20 °C)
Paraffin wax						
AQUACER 494	Paraffin wax	55	Water	Non-ionic/anionic	65	9.0
AQUACER 497	Paraffin wax	50	Water	Non-ionic	60	5.5
AQUACER 533	Modified paraffin wax	40	Water	Anionic	95	9.5
AQUACER 535	Modified paraffin wax	30	Water	Non-ionic	105	10.0
AQUACER 537	Modified paraffin wax	30	Water	Anionic	110	9.5
AQUACER 539	Modified paraffin wax	35	Water	Non-ionic	90	9.5
AQUACER 1039*[1]	Modified paraffin wax	35	Water	Non-ionic	90	9.5
AQUACER 8330*[2]	Modified paraffin wax	30	Water	Anionic	60	10.0
AQUACER 8333*[2]	Modified paraffin wax	30	Water	Anionic	60	10.0
AQUACER 8335*[2]	Modified Paraffin wax	45	Water	Anionic	58	11.0
Carnauba wax						
AQUACER 565	Carnauba wax	30	Water	Non-ionic	85	6.5
AQUACER 570	Sunflower/carnauba wax blend	40	Water	Non-ionic	85	5.0
AQUACER 581	Carnauba wax	30	Water	Non-ionic	85	7.5
AQUACER 2650	Carnauba wax	30	Water	Non-ionic	85	4.5
AQUACER 8603*[2]	Carnauba wax	25	Water	Anionic	85	10.0
Rice bran wax						
AQUACER 571	Modified rice bran wax	25	Water	Non-ionic	80	9.75
Polyethylene wax						
AQUACER 501	Oxidized HDPE wax	35	Water	Non-ionic	130	9.0
AQUACER 505	Oxidized HDPE wax	35	Water	Non-ionic	130	9.0
AQUACER 506	Oxidized HDPE wax	35	Water	Non-ionic/anionic	120	9.0
AQUACER 507	Oxidized HDPE wax	35	Water	Anionic	130	9.7
AQUACER 513	Oxidized HDPE wax	35	Water	Non-ionic	135	9.2

*[1] Ecolabel version of AQUACER 539 *[2] Only available in North America

T. 01

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene PE = Polyethylene PP = Polypropylene

Wax emulsions and dispersions in water (2/4)

Product	Wax base	Non-volatile matter (%)	Carrier	Emulsifier system	Melting point wax component (°C)	pH value (20 °C)
AQUACER 517	Oxidized HDPE wax	35	Water	Non-ionic	120	9.0
AQUACER 519	Oxidized HDPE wax	35	Water	Non-ionic/anionic	125	9.5
AQUACER 530	Oxidized HDPE wax	32	Water	Non-ionic	130	8.0
AQUACER 531	Modified HDPE wax	45	Water	Non-ionic	130	3.5
AQUACER 532	Modified HDPE wax	40	Water	Non-ionic	130	3.5
AQUACER 552	Oxidized HDPE wax	35	Water	Non-ionic	130	9.0
AQUACER 582	Modified PE wax	40	Water	Non-ionic	125	9.0
AQUACER 840	Oxidized HDPE wax	30	Water	Cationic	135	5.0
AQUACER 1013*3	Oxidized HDPE wax	35	Water	Non-ionic	135	9.2
AQUACER 1031	Oxidized LDPE wax	40	Water	Non-ionic	105	7.0
AQUACER 1075	Oxidized HDPE wax	35	Water	Non-ionic	130	9.5
AQUACER 1096 N	Oxidized PE wax	30	Water	Anionic	125	10.0
AQUACER 1547	Oxidized HDPE wax	35	Water	Anionic	125	9.7
AQUACER 2500	Modified PE wax	40	Water	Non-ionic	125	9,0
AQUACER 8025*2	Oxidized HDPE wax	25	Water	Anionic	140	10.0
AQUACER 8026*2	Oxidized HDPE wax	25	Water	Anionic	140	10.0
AQUACER 8030*2	Oxidized HDPE wax	35	Water	Non-ionic	140	9.0
AQUACER 8035*2	Oxidized HDPE wax	35	Water	Anionic	140	9.0
AQUACER 8059*2	Oxidized HDPE wax	35	Water	Non-ionic	140	9.0
AQUACER 8075*2	Oxidized HDPE wax	35	Water	Non-ionic	136	9.5
AQUACER 8086*2	Modified oxidized PE wax	30	Water	Anionic	120	9.5
AQUACER 8500*2	Oxidized LDPE wax	30	Water	Anionic	110	9.0
AQUACER 8511*2	Modified PE wax	38	Water	Non-ionic	110	8.0
AQUACER 8517*2	Modified LDPE wax	40	Water	Non-ionic	110	8.5

*2 Only available in North America *3 Ecolabel version of AQUACER 513

T. 01

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene LDPE = Low density polyethylene PE = Polyethylene PP = Polypropylene

Wax emulsions and dispersions in water (3/4)

Product	Wax base	Non-volatile matter (%)	Carrier	Emulsifier system	Melting point wax component (°C)	pH value (20 °C)
AQUACER 8527*[2]	Modified LDPE wax	25	Water	Anionic	110	9.0
AQUAMAT 206	Oxidized HDPE wax	35	Water	–	135	10.0
AQUAMAT 208	Oxidized HDPE wax	35	Water	–	135	8.5
AQUAMAT 263	Oxidized HDPE wax	35	Water/propylene glycol n-butylether 12:1	–	130	9.5
AQUAMAT 272 N	Modified PE wax	55	Water	–	125	4.0
Polypropylene wax						
AQUACER 593	Modified PP wax	30	Water	Non-ionic	160	9.0
AQUACER 595	Modified PP wax	40	Water	Non-ionic	140	8.5
AQUACER 597	Modified PP wax	35	Water	Cationic	140	5.5
AQUACER 1041	Modified PP wax	40	Water	Cationic	140	7.5
AQUACER 1510	Modified PP wax	40	Water	Non-ionic	160	9.0
AQUACER 3500	Modified PP wax	41	Water	Cationic	160	7.0
AQUACER 8930*[2]	Modified PP wax	30	Water	Cationic	160	4.0
AQUACER 8940*[2]	Modified PP wax	40	Water	Non-ionic	160	9.0
AQUACER 8988*[2]	Modified PP wax	30	Water	Cationic	160	4.0
Polypropylene copolymer						
AQUACER 1822	PP-MAH grafted copolymer	35	Water	Non-ionic	165	9.0
AQUACER 1860	PP-MAH grafted copolymer	34	Water	Non-ionic/anionic	150	8.5
AQUACER 1870	PP-MAH grafted copolymer	35	Water	Non-ionic/anionic	150	9.0
EVA/EAA copolymer wax						
AQUACER 526	Modified EVA copolymer wax	30	Water	Anionic	105	9.7
AQUACER 527	Modified EVA copolymer wax	35	Water	Non-ionic	105	9.0
AQUACER 528	EAA copolymer wax	35	Water	Non-ionic	105	9.5
AQUACER 1061	EAA copolymer wax	30	Water	Anionic	110	7.5

*[2] Only available in North America

T. 01

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene PE = Polyethylene PP = Polypropylene

Wax emulsions and dispersions in water (4/4)

Product	Wax base	Non-volatile matter (%)	Carrier	Emulsifier system	Melting point wax component (°C)	pH value (v)
AQUACER 8227*2	Oxidized EVA copolymer wax	35	Water	Non-ionic	100	9.5
AQUACER 8835*2	EAA copolymer wax	35	Water	Non-ionic	108	9.0
AQUACER 8840*2	EAA copolymer wax	30	Water	Non-ionic	110	9.0
AQUACER 8841*2	EAA copolymer wax	40	Water	Non-ionic	110	9.0
AQUACER 8880*2	EAA copolymer wax	25	Water	Anionic	90	8.0
AQUATIX 8421	Modified EVA copolymer wax	20	Water	Non-ionic	105	5.5
Montanester wax						
AQUACER 541	Montanester wax	30	Water	Non-ionic	80	4.5
Bees wax						
AQUACER 561	Bees wax	25	Water	Non-ionic	65	5.5
Fischer-Tropsch wax						
AQUACER 2700	Fischer-Tropsch wax	40	Water	Non-ionic	110	9.5

*2 Only available in North America

T. 01

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene PP = Polypropylene

Primary polyethylene dispersions in water

Product	Polymer base	Non-volatile matter (%)	Carrier	Emulsifier system	Melting point (°C)	pH value (20 °C)
AQUACER 1040	Modified primary PE	38	Water	Non-ionic/anionic	95	9.0
AQUACER 1063	Primary PE	40	Water	Non-ionic/anionic	95	9.0
HORDAMER PE 02	Primary PE	40	Water	Anionic	95	8.0–11.0
HORDAMER PE 03	Primary PE	40	Water	Non-ionic/anionic	95	9.0
HORDAMER PE 34	Modified primary PE	38	Water	Non-ionic/anionic	95	9.0
HORDAMER PE 35	Primary PE	37.5	Water	Non-ionic/anionic	125	9.5

PE = Polyethylene

T. 02

Wax dispersions in organic solvents (1/2)

Product	Wax base	Non-volatile matter (%)	Carrier	Melting point wax component (°C)	Particle size Hegman (µm)	Particle size distribution (µm)	
						D50	D90
Carnauba wax							
CERAFAK 140 N	Carnauba wax	15	Isobutanol/aromatic hydrocarbons 13:4	85	10	–	–
CERACOL 79	Carnauba wax	20	Dipropylene glycol monomethyl ether	85	–	2	6
CERACOL 80	Carnauba wax	17.5	Methyl ethyl ketone	85	–	2	4.5
CERACOL 601	Carnauba wax	20	Dipropylene glycol monomethyl ether	85	–	2	6
CERACOL 604	Carnauba wax	11.5	Butylglycol	85	–	4	7
CERACOL 605	Carnauba wax	20	Butylglycol	85	–	2	3
CERACOL 609 N	Wax-modified lanolin	20	Aromatic hydrocarbons/isopropanol 1:1	85	–	3	6
Fischer-Tropsch wax							
CERAFAK 117	Modified Fischer-Tropsch wax	25	Aromatic-free white spirit	110	50	–	–
CERAFAK 127 N	Modified Fischer-Tropsch wax	15	Aromatic hydrocarbons	120	–	3	7
CERAMAT 250	Fischer-Tropsch wax	40	Butyl acetate	120	16	–	–
CERACOL 83	Fischer-Tropsch wax	20	Isopropanol	105	–	2.5	6
Polyethylene wax							
CERAFAK 111	PE wax	12.5	Butyl acetate	110	<12	–	–
CERAFAK 151	Oxidized HDPE wax	25	Xylene	135	30	–	–
CERAMAT 248	PE wax	20	Aromatic-free white spirit	110	20	–	–
CERAMAT 258	Oxidized HDPE wax	17.5	Butyl acetate	135	30	–	–
CERACOL 607 R	PTFE modified PE	35	Butyl diglycol acetate/butyldiglycol/ aromatic hydrocarbons 1/1/1	115	–	4	10
EVA/EAA copolymer wax							
CERAFAK 100	EVA copolymer wax	10	Xylene/butyl acetate 1:1	105	25	–	–
CERAFAK 103	EAA copolymer wax	6	Xylene/butyl acetate/butanol 7:8:1	110	15	–	–

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene PE = Polyethylene

T. 03

Wax dispersions in organic solvents (2/2)

Product	Wax base	Non-volatile matter (%)	Carrier	Melting point wax component (°C)	Particle size Hegman (µm)	Particle size distribution (µm)	
						D50	D90
CERAFAK 106	EVA copolymer wax	6	Xylene/butyl acetate/butanol 7:8:1	105	20	–	–
CERAFAK 110	EVA copolymer wax	6	Butyl acetate/butanol 15:1	100	20	–	–
CERATIX 8561	EVA copolymer wax	4.7	Xylene/butyl acetate/butanol 3:6:1	105	20	–	–
CERATIX 8563	EVA/EAA copolymer wax mixture	4.4	Xylene/butyl acetate/butanol 3:6:1	110	15	–	–
CERATIX 8566	EVA copolymer wax	4.7	Butyl acetate/butanol 9:1	100	20	–	–
Hydrocarbon wax							
CERACOL 600	Modified hydrocarbon wax	20	Methoxypropyl acetate	100	–	2	5
Microcrystalline wax							
CERACOL 610	Microcrystalline wax	15	Naphthalene-depleted, aromatic hydrocarbons	95	–	5	9
CERACOL 615	Microcrystalline wax	20	Dipropylene glycol monomethyl ether (DPM)	95	–	6	10

EAA = Ethylene acrylic acid EVA = Ethylene vinyl acetate HDPE = High density polyethylene PE = Polyethylene

T. 03

Micronized wax additives (1/2)

Product	Wax base	Melting point wax component (°C)	Density (g/ml)	Particle size distribution (µm)	
				D50	D90
Polyethylene wax					
CERAFLOUR 916	Modified HDPE wax/polymer mixture	135	0.99	46	82
CERAFLOUR 925 N	Modified PE wax	115	1.06	6	10
CERAFLOUR 927 N	Modified HDPE wax	125	1.05	9	15
CERAFLOUR 929 N	Modified PE wax	115	1.06	8	15
CERAFLOUR 950	Modified HDPE wax	135	0.95	9	15
CERAFLOUR 959	PTFE-modified PE wax	115	1.14	9	21
CERAFLOUR 961	Modified PE	140	0.95	5	11
CERAFLOUR 962	Modified PE	140	1.00	9	21
CERAFLOUR 968	PTFE-modified PE wax	115	1.00	6	11
CERAFLOUR 969	PTFE-modified PE wax	115	1.30	6	14
CERAFLOUR 988	Amide-modified PE	140	0.97	6	13
CERAFLOUR 991	PE wax	115	0.95	5	9
CERAFLOUR 996 R	PTFE-modified PE wax	115	0.96	6	11
CERAFLOUR 997 R	PTFE-modified PE wax	115	0.96	7	13
CERAFLOUR 998 R	PTFE-modified PE wax	115	0.96	5	8
CERAFLOUR 999	PTFE-modified PE wax	115	0.96	4	9
CERAFLOUR 1050	PTFE-free PE wax	125	0.97	5	10
CERAFLOUR 1051	PTFE-free modified PE wax	125	1.06	6	10
CERAFLOUR 1052	PTFE-free modified PE wax	125	0.98	6	10
Polypropylene wax					
CERAFLOUR 913	PP wax	160	0.90	18	31
CERAFLOUR 914	PP wax	160	0.90	24	36
CERAFLOUR 915	PP wax	160	0.90	34	57

HDPE = High density polyethylene PP = Polypropylene PE = Polyethylene PTFE = Polytetrafluoroethylene

T. 04

Micronized wax additives (2/2)

Product	Wax base	Melting point wax component (°C)	Density (g/ml)	Particle size distribution (µm)	
				D50	D90
CERAFLOUR 970	PP wax	160	0.90	9	14
Amide wax					
CERAFLOUR 960	Modified amide wax	145	1.00	4	11
CERAFLOUR 964	Amide wax	75	1.00	20	50
CERAFLOUR 993	Amide wax	145	1.00	13	31
CERAFLOUR 994	Amide wax	145	0.99	5	10
Polytetrafluoroethylene					
CERAFLOUR 965	PTFE	–	2.20	31	80
CERAFLOUR 966	PTFE	–	2.28	25	70
CERAFLOUR 981 R	PTFE	–	2.28	3	6
Rape seed wax					
CERAFLOUR 1010	Rape seed wax	70	0.91	6	16

HDPE = High density polyethylene PP = Polypropylene PE = Polyethylene PTFE = Polytetrafluoroethylene

T. 04

Micronized polymers

Product	Polymer base	Melting point (°C)	Density (g/ml)	Particle size distribution (µm)	
				D50	D90
CERAFLOUR 917	Organic polymer	135	0.93	42	64
CERAFLOUR 920	Organic polymer	–	1.47	5	16
CERAFLOUR 967	Synthetic polymer	–	1.11	–	–
CERAFLOUR 1000	Biopolymer	175	1.25	5	11
CERAFLOUR 1001	Biopolymer	175	1.25	3	7
CERAFLOUR 1002	Biopolymer	175	1.25	6	31
CERAFLOUR 1003	Biopolymer (corn starch)	–	1.50	13	19
CERAFLOUR 1004	Biopolymer (corn starch)	–	1.50	10	15

T. 05

B-G 1 02/2023

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