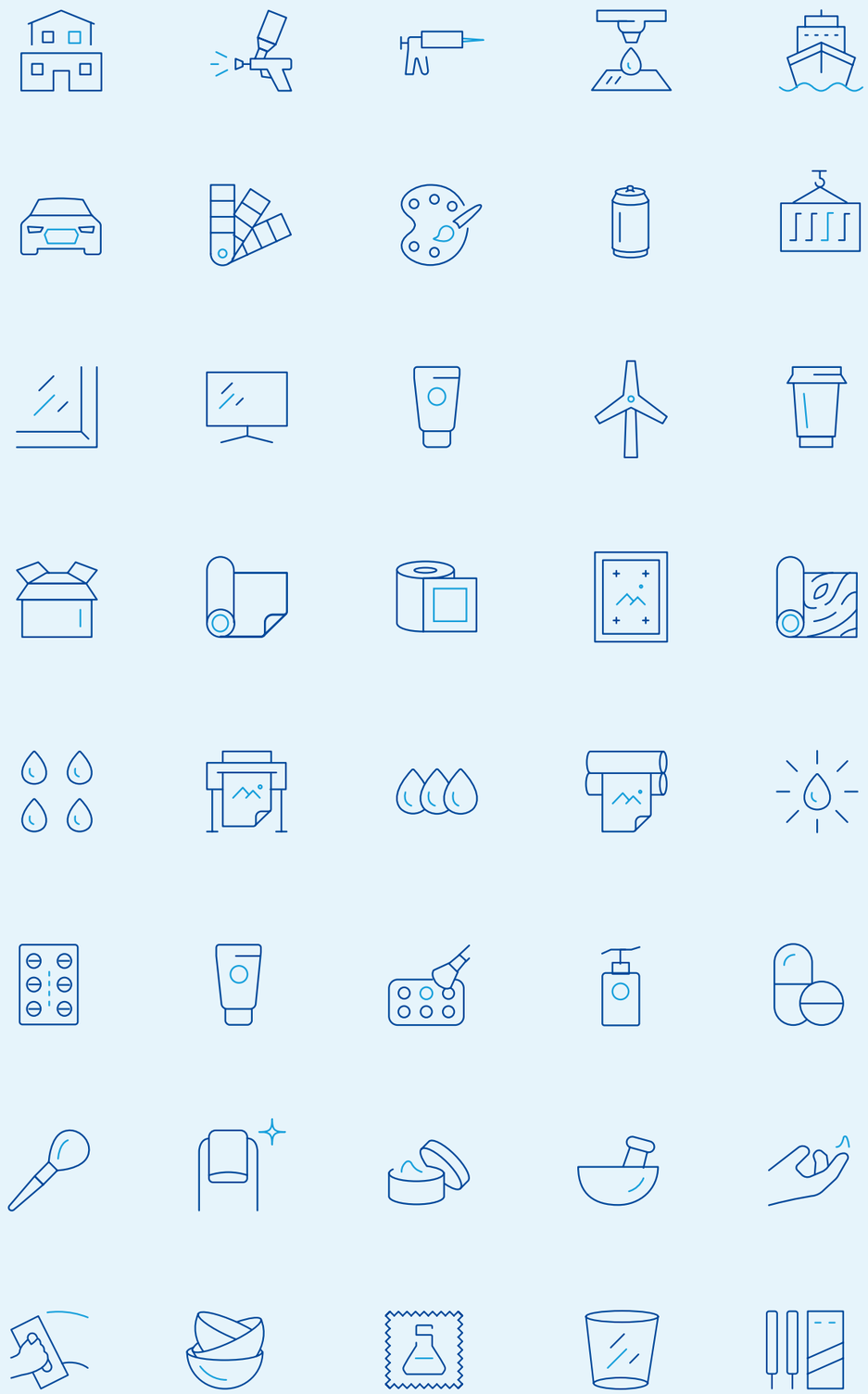
Brighter together

KRONOS™

List of Grades Worldwide

KRONOS Titanium Dioxide



TiO_2 is what we do

KRONOS IS A LEADING GLOBAL PRODUCER OF TITANIUM DIOXIDE PIGMENTS, A HIGHLY DEVELOPED PRODUCT USED IN A WIDE RANGE OF APPLICATIONS.

WE ARE IN FOR ...

Maximum brightness.
Highest opacity.
Neutral tone in white.
Weather resistance.
Brilliance. Clean tints.
Easy dispersion.
Color stability. Tinting strength. Glossy finish.
Whitest white.
Improved durability.
Interior and exterior.
Constant high quality.

Coatings

In it for
PERFECTiO$_2$N

PROVEN PRODUCTS FOR HIGH-PERFORMANCE COATINGS

INNOVATIVE TiO_2 PIGMENTS FREE OF TMP AND TME

The KRONOS product range is being gradually converted to products free of TMP and TME.

Following the successful introduction of KRONOS 2190, additional KRONOS products are being reinvented to deliver a modern organic post treatment solution, replacing TMP. These KRONOS TiO_2 pigments are free of TMP and TME and provide similar optical and physical performance in coating systems.*

Regulatory classification

KRONOS developed trimethylolpropane (TMP)-free alternative of its most successful pigment grades to address a recent regulatory classification of TMP. More Information is available at **www.tdma.info/news** (TDMA = Titanium Dioxide Manufacturers Association).

KRONOS 2190 (free of TMP and TME) is a universal sulfate grade with a very high tinting strength for a wide range of water-based, solvent-based, powder coating and ink applications.

KRONOS 2710 (= KRONOS 2310 free of TMP and TME) is a universal chloride grade for a wide range of coating and ink applications with very high opacity and tinting strength combined with a clean, neutral undertone and excellent weather resistance for water-based, solvent-based and powder coating applications.

KRONOS 2760 (= KRONOS 2360 free of TMP and TME) is a premium chloride grade with advanced dense-skin surface treatment. It provides exceptional weather resistance for the most demanding water-based and solvent-based coatings, as well as for exterior powder coating systems. KRONOS 2760 shows superior dispersing properties that support the production of high gloss and low-haze coatings.

KRONOS 2660 (= KRONOS 2160 free of TMP and TME) is a dense-skin surface treated chloride grade engineered to deliver excellent exterior weathering performance, even in the most demanding solvent-based, water-based, and powder coating systems. This TiO_2 grade displays very high brightness and a neutral tone in white finishes.

Further expanding our growing portfolio of products free of TMP and TME are our proven grades **KRONOS 2300** (Type 3721) for coatings, **KRONOS 2056** (Type 3856) for coatings and printing inks, the titanium dioxide pigment concentrate, **KRONOS 9900 Digital White** for digital inks, and the high post-treated rutile grade **KRONOS 2044**, designed for matte architectural paints and inks.

Complementing this range, the new laminate grade **KRONOS 2810**, manufactured via the sulfate process, further advances our product offering of grades free of TMP and TME.

* See page 8-9 for chemical and physical characteristics and page 10-11 for application related data

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

Fields of application

Coatings

Industrial coatings

KRONOS	2056	2064	2066	2160		2300	2310	2360
Free of TMP and TME	Type 3856			2660	2190	Type 3721	2710	2760
Industrial coatings, water-based, interior	●	●	●		●	●		
Industrial coatings, water-based, exterior				●			●	●
Industrial coatings, solvent-based, interior	●	●	●		●	●		
Industrial coatings, solvent-based, exterior				●			●	●
Powder coatings, interior		●	●			●		
Powder coatings, exterior				●			●	●
Low-VOC systems				●	●	●	●	●
Coil coatings, exterior				●			●	●
Can coatings		●	●			●		
Marine coatings, automotive finishes				●			●	●
UV coatings		●				●	●	

Architectural coatings

KRONOS	2047	2056		2300	2310	2360	4045 (EU)	4311 (NA)
Free of TMP and TME	2044		Type 3856	2190	Type 3721	2710	2760	
Emulsion paints, interior	●			●	●		●	
Emulsion paints, exterior					●	●		●
Semi-gloss paints, interior				●	●		●	●
Semi-gloss paints, exterior					●	●		●
Gloss emulsion paints				●	●	●	●	●
Wood protection coatings				●	●	●	●	●
Silicone paints	●					●	●	●
Silicate paints			●	●	●	●		
Plasters, emulsion-bound	●			●	●	●		

EU only available in Europe NA only available in the USA and Canada

Printing inks

KRONOS		2047	2056	2064	2066		2300	2310
Free of TMP and TME	2044		Type 3856			2190	Type 3721	2710
Gravure inks				●	●			
Flexographic inks, glossy			●	●	●		●	●
Flexographic inks, matte	●	●						
Screen-printing inks				●	●	●	●	●
Digital printing (waterbased, solvent-born, UV)				●	●			●

● strongly recommended

KRONOS grades not strongly recommended in these tables may nevertheless be highly efficient in specific cases. Ask our technical service staff.

Digital printing inks

KRONOS	
Free of TMP and TME	9900 (Digital White)
Water-based inkjet inks	●
Hybrid (water/UV) inkjet inks	●

Rutile pigments – chemical and physical characteristics

KRONOS		2047	2056	2064	2066	2160		2300	2310	2360
Free of TMP and TME	2044		Type 3856			2660	2190	Type 3721	2710	2760
Weather resistance[1]	B	B	B	C	C	A	B	B	A	A
TiO_2 content[2] min. [%]	85.5	91.0	94.8	96.6	97.0	92.0	95.7	94.7	93.9	92.8
Relative scattering power[3]	84	91	97	104	107	95	103	103	102	100
Oil absorption [g/100 g] (ISO 787/5)	43	28	21	17	18	20	20	18	20	19
Stabilised with compounds of these elements	Al, Si	Al, Si	Al, Si	Al	Al	Al, Si	Al, Zr	Al	Al, Si, Zr	Al, Si
Density[2] [g/cm³]	3.6	3.8	4.0	4.1	4.1	3.9	4.1	4.1	4.0	4.0
Bulking Value [l/kg]	0.27	0.26	0.25	0.24	0.24	0.26	0.24	0.24	0.25	0.25
Bulking Value [gal/lb]	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Bulk density[4] [kg/m³]	450	650	750	800	850	750	800	800	800	800
Apparent density [lb/ft³]	28	41	47	50	53	47	50	50	50	50
ASTM D476 Type	III	III	II, III	II, III	II, III	IV, V	II, III. Vi, VII	II, III. Vi, VII	II, III. Vi, VII	IV, V, VI, VII
Standard classification[5]	R3	R3	R2	R2	R2	R2	R2	R2	R2	R2
Production process (Sulfate SP, Chloride CP)	SP	SP	SP	SP	SP	CP	SP	CP	CP	CP

[1] A = Maximum weather resistance / B = Good weather resistance / C = Indoor use

[2] The titanium dioxide content and density of the pigments depend on the type and quantity of the treatment substances used to improve the application properties. Pure rutile has a density of 4.2 g/cm³, while pure anatase has a density of 3.8 g/cm³.

[3] The relative scattering power is the decisive parameter for the tinting strength and hiding power of titanium dioxide pigments. Determinationof the scattering power to DIN 53165 is part of quality control at all our plants. An internal standard is used as the reference pigment.

[4] The bulk densities of the pigments are approximate values and may vary, depending on the storage conditions.

[5] The classification R1, R2 corresponds to ISO 591, Part 1.

KRONOS TiO_2 pigment concentrate

KRONOS	
Free of TMP and TME	9900 (Digital White)
Solids content [%]	52 - 56
Viscosity [mPa*s]	< 300
pH as delivered	8.5 - 9.5
Density (ISO 787-10) [g/cm³]	1.60 - 1.70

KRONOS 9900 Digital White - a titanium dioxide pigment concentrate.

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

Application related data

Coatings

KRONOS TiO_2 slurries

KRONOS	4045 (EU)	4311 (NA)	KRP 11 (NA)
Solids content [%]	71.0	76.5	76.5
TiO_2 surface treatment	none	Al, Si, Zr	Al, Si, Zr
Weathering class	C	A	A
Production process	SP	CP	CP
Brookfield viscosity [mPas]	approx. 800	approx. 200	approx. 200
pH	8.0	8.5	7.9
Density [g/cm³]	2.1	2.2	2.2

Applications

KRONOS 4045 (EU)	KRONOS 4311 (NA)	KRP 11 (NA)
Paper pulp	Architectural coatings	Paper/cardboard coatings
Paper and cardboard coatings	Industrial coatings, water-based	Paper mass
Cost efficient primers, interior		

EU only available in Europe

NA only available in the USA and Canada

Brightness and tone in white

KRONOS	2056	2064	2066	2160		2300	2310	2360
Free of TMP and TME	Type 3856			2660	2190	Type 3721	2710	2760
Brightness (L*)	97.1	97.2	97.2	97.8	97.2	97.8	97.8	97.9
	97.1			97.7	97.2	97.8	97.8	97.9
Tone (b*)	2.5	1.9	2.1	1.7	2.1	1.7	1.6	1.6
	2.5			1.6	2.1	1.6	1.6	1.6

Test formulation: stoving solvent borne enamel based on an acrylic/melamine system (pigment volume concentration: 18%)

Relative tinting strength and tone in grey

KRONOS	2056	2064	2066	2160		2300	2310	2360
Free of TMP and TME	Type 3856			2660	2190	Type 3721	2710	2760
Relative tinting strength (TS)	96	101	103	96	101	103	104	100
	98			103	108	103	108	107
Tone (b*)	-4.9	-7.3	-5.9	-6.6	-6.5	-7.1	-6.9	-6.8
	-4.5			-6.3	-6.1	-7.0	-6.6	-6.4

Brightness and tone in white

KRONOS		2300	2310	2360
Free of TMP and TME	2190	Type 3721	2710	2760
Brightness (L*)	97.6	98.2	98.1	98.2
	97.6	98.1	98.1	98.2
Tone (b*)	1.8	1.2	1.2	1.1
	1.8	1.2	1.2	1.2

Relative tinting strength and tone in grey

KRONOS		2300	2310	2360
Free of TMP and TME	2190	Type 3721	2710	2760
Relative tinting strength (TS)	102	102	102	100
	101	102	101	99
Tone (b*)	-5.9	-6.1	-6.0	-5.9
	-5.9	-6.0	-5.9	-5.9

Test formulation: water-based, high-gloss emulsion paint based on acrylic resin (pigment volume concentration: 19%)

Brightness and tone in white

KRONOS	2044	2047	2056	2190	2300	2310	2360
Free of TMP and TME			Type 3856		Type 3721	2710	2760
Brightness (L*)	97.4	97.3	97.0	97.0	97.6	97.6	97.6
			97.0	96.9	97.7	97.6	97.6
Tone (b*)	2.1	2.1	2.4	2.0	1.7	1.7	1.4
			2.4	2.2	1.7	1.8	1.5

Relative tinting strength and tone in grey

KRONOS	2044	2047	2056	2190	2300	2310	2360
Free of TMP and TME			Type 3856		Type 3721	2710	2760
Relative tinting strength (TS)	140	125	121	104	102	103	112
			123	103	103	103	112
Tone (b*)	-1.7	-2.1	-1.0	-2.8	-2.7	-2.8	-2.5
			-1.0	-2.9	-2.8	-2.5	-2.5

Test formulation: water-based interior emulsion paint based on polyvinyl acetate (pigment volume concentration: 78%)

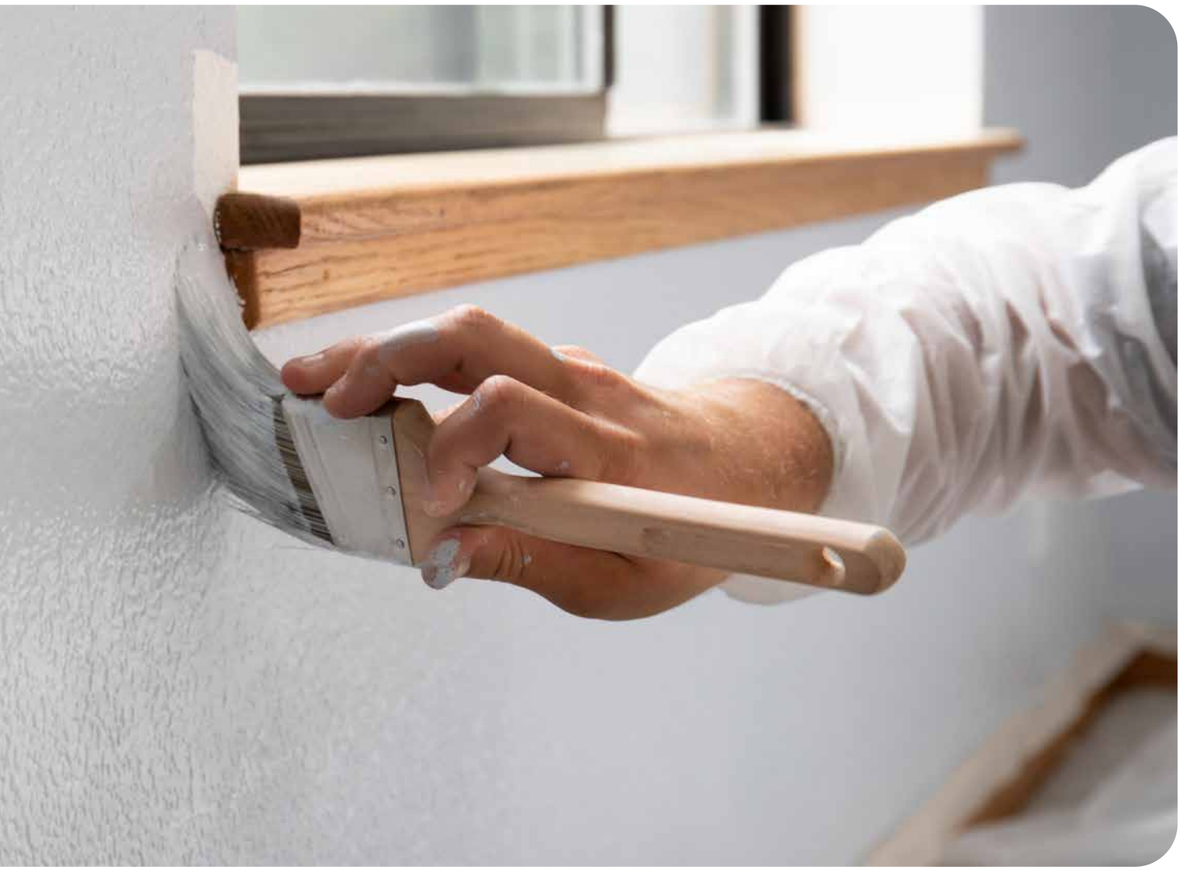
The colorimetric values L* and b* characterise the brightness and tone of the coating samples pigmented with titanium dioxide (DIN 55983). The higher the L* value found for a pigment in white coatings, the greater the brightness at equal pigment volume concentrations.

The higher the L* value found for a pigment in grey coatings, the greater is its relative tinting strength. The more negative the b* value found, the greater the blueness of the grey system. The figures given are mean values over extended production periods. The mill base composition and the dispersing machinery are essential parameters in paint manufacture. The stabilised KRONOS pigments are readily dispersed under a wide variety of formulating and manufacturing conditions.

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

KRONOS pigments for coatings

Coatings



KRONOS 2044 (free of TMP and TME) is a special, organic-free sulfate pigment with a voluminous, alumina-silica surface treatment for matte architectural paints, cardboard coatings and matte printing inks. It imparts high brightness, a neutral tone in white coatings and a clean, bluish undertone in tinted systems. As a result of its high specific surface area, it achieves maximum performance in terms of tinting strength and opacity in interior emulsion paints by promoting the dry hiding effect. Its special coating also prevents the pigment from penetrating cardboard surfaces, which enhances opacity and surface printability. In addition, KRONOS 2044 exhibits excellent non-setting properties in water-based systems.

KRONOS 2047 is a highly coated sulfate grade with superior brightness and a neutral tone for applications, such as paper and cardboard coatings, lightweight coated paper (LWC paper), matte emulsion paints and lamination printing inks. KRONOS 2047 significantly improves the wet and dry opacity of paper and cardboard.

KRONOS 2056 and Type 3856 (= KRONOS 2056 free of TMP and TME) are versatile sulfate pigments with a warm tone recommended for conventional air-drying paints, silicate paints and plasters. They display good opacity and dispersibility, and are suitable for outdoor paints. Moreover, KRONOS 2056 and Type 3856 (KRONOS 2056 free of TMP and TME) provide excellent bath stability in impregnating resins for paper laminates.

KRONOS 2064 is a narrow particle-size sulfate pigment with a neutral tone. KRONOS 2064 offers extremely low abrasion properties for high gloss gravure and flexographic inks, packaging and can coatings. Additionally, it is a multipurpose grade for a wide range of interior industrial and wood coatings. It is characterized by superior gloss, opacity, and tinting strength. It wets out rapidly and is readily dispersed in both water-based and solvent-based inks and coatings.

KRONOS 2066 is a superior sulfate pigment for high gloss gravure and flexographic inks. KRONOS 2066 displays a warmer tone compared to KRONOS 2064. It delivers outstanding opacity while maintaining very high gloss and is suitable for both solvent-based and water-based systems. KRONOS 2066 is highly recommended for glossy interior wood and stoving finishes.

KRONOS 2160 and KRONOS 2660 (= KRONOS 2160 free of TMP and TME) have a dense-skin surface treatment which provides superior exterior weathering performance for use in the most demanding solvent-based, water-based and powder coatings systems, as evidenced by their prolonged chalk-free periods, superior gloss retention and color stability. The chloride pigments display very high brightness and a neutral tone in white finishes.

KRONOS 2190 (free of TMP and TME) is a universal sulfate pigment for water-based and solvent-based coatings. The pigment exhibits key performance properties, such as superior dispersibility, excellent tinting strength in conjunction with high gloss and low haze properties. KRONOS 2190 displays good exterior durability due to its zirconia surface treatment.

KRONOS 2300 and Type 3721 (= KRONOS 2300 free of TMP and TME) is a chloride pigment for industrial, wood and packaging coating applications, as well as glossy indoor architectural paints. It displays superior brightness with a neutral tone in white coatings and produces brilliant, clean tints in colored systems. It is the economical choice because of its rapid wetting, easy dispersibility and exceptional opacity and tinting strength. KRONOS 2300 is recommended for interior use.

KRONOS 2310 and KRONOS 2710 (= KRONOS 2310 free of TMP and TME) are high-performance chloride pigments with outstanding weatherability and color stability. Both pigments display very high opacity and tinting strength combined with a clean, neutral undertone. KRONOS 2310 and KRONOS 2710 free of TMP and TME achieve very high reflectance and glossy white coatings with a neutral tone. Both can be used in water-based, solvent-based and powder coatings.

KRONOS 2360 and KRONOS 2760 (= KRONOS 2360 free of TMP and TME) are premium chloride grades with advanced dense-skin surface treatment. They provide very high weathering resistance for the most demanding water-based and solvent-based coatings as well as for exterior powder coating systems. It results in very bright white paints with a neutral tone and outstanding opacity and tinting strength. Both have superior dispersing properties that support the production of high-gloss, low-haze coatings. KRONOS 2360 and KRONOS 2760 are recommended for all high-performance exterior coatings.

KRONOS 4045[EU] is an aqueous rutile pigment suspension for use in paper pulp, paper coating and interior emulsion paints. It improves brightness and opacity. KRONOS 4045 gives paper very high wet and dry opacity as well as whiteness when added directly to the paper pulp at the wet end.

KRONOS 4311[NA] is a multipurpose, ready-to-use chloride pigment slurry for the full range of interior and exterior architectural paints. It displays superior brightness, a neutral tone and excellent opacity in white coatings. KRONOS 4311 delivers very high tinting strength and brilliant, clean tints with excellent color stability in colored systems.

KRONOS Rutile Paper 11[NA] is a ready-to-use chloride pigment slurry for universal use in paper applications. It displays high brightness with a neutral tone in paper and cardboard coatings. It imparts excellent wet and dry opacity as well as very high whiteness to paper. This rutile slurry exhibits superior flow characteristics.

KRONOS 9900 Digital White (free of TMP and TME) is an innovative, aqueous chloride pigment base concentrate tailored for a wide range of digital printing technologies. The novel grinding technology used to produce the pigment concentrate ensures a narrow particle size distribution with an extremely low content of coarse particles, which is critical for avoiding clogging of print heads during the jetting process. KRONOS 9900 displays very high brightness and opacity with a bluish undertone and meets the stability requirements of advanced inkjet applications, e.g. short filtration times, excellent anti-sedimentation performance in the container, print head and final print image.

[EU] only available in Europe

[NA] only available in the USA and Canada

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

Plastics

In it for OPTIMIZATIO$_2$N

EXCELLENT
UV PROTECTION
OF WHITE PVC

Application related data

Plastics

Fields of application

KRONOS	2056	2073(NA)	2075(NA)	2160				2225			2360	2450	
Free of TMP and TME	Type 3856			2660	2211	2220	2222		2230	2233	2760		2500
PVC, exterior		● *		● **		●	●				● **		
PVC, interior	●	●			●	●	●				●	●	
Polyolefins/MB, interior		●	●		●							●	●
Polyolefins/MB, exterior								●					
Polystyrene and copolymers		●	●		●	●	●					●	
Thermoplastic Polyurethane (TPU)						●	●						
Polylactic Acid (PLA)						●							
Polycarbonates									●	●			
Other engineering plastics						●	●			●		●	

● strongly recommended KRONOS grades. Not strongly recommended in these tables may nevertheless be highly efficient in specific cases. Ask our technical service staff.

* chalking grade for white tin-stabilised PVC, exterior

** non-chalking grade for tinted tin-stabilised PVC, exterior

Rutile pigments – chemical and physical characteristics

KRONOS	2056	2073(NA)	2075(NA)	2160				2225			2360	2450	
Free of TMP and TME	Type 3856			2660	2211	2220	2222		2230	2233	2760		2500
Weather resistance[1]	B	C	C	A	C	A	A	B	C	C	A	C	C
TiO_2 content[2] min. [%]	94.8	97.1	97.6	92.0	97.0	94.5	94.5	95.8	96.3	95.4	92.8	96.7	97.6
Relative scattering power[3]	89	107	107	95	107	100	104	105	104	104	100	107	108
Oil absorption [g/100 g] (ISO 787/5)	21	14	13	20	17	19	18	19	16	13	19	17	13
Stabilised with compounds of these elements	Al, Si	Al	Al	Al, Si	Al	Al, Si	Al, Si	Al, Si	Al	Al	Al, Si	Al	Al
Density[2] [g/cm³]	4.0	4.2	4.2	3.9	4.1	4.0	4.0	4.1	4.1	4.0	3.9	4.1	4.1
Bulking Value [l/kg]	0.25	0.24	0.24	0.26	0.24	0.25	0.25	0.24	0.24	0.25	0.26	0.24	0.24
Bulking Value [gal/lb]	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Bulk density[4] [kg/m³]	750	850	850	750	850	900	850	850	850	800	800	800	800
Apparent density [lb/ft³]	47	53	53	47	53	56	53	53	53	50	50	50	50
ASTM D476 Type	ii, III	II	II	IV, V	II	II, III, VI	II, III, VI	II, III	II	II	IV, V, VI, VII	II	II
Standard classification[5]	R2	R2	R1	R2	R2	R2	R2	R2	R2	R2	R2	R2	R1
Production process (Sulfate SP, Chloride CP)	SP	CP	CP	CP	CP	CP	CP	CP	CP	CP	CP	CP	CP

[1] A = Maximum weather resistance / B = Good weather resistance / C = Indoor use

[2] The titanium dioxide content and density of the pigments depend on the type and quantity of the treatment substances used to improve the application properties. Pure rutile has a density of 4.2 g/cm³, while pure anatase has a density of 3.8 g/cm³.

[3] The relative scattering power is the decisive parameter for the tinting strength and hiding power of titanium dioxide pigments. Determinationof the scattering power to DIN 53165 is part of quality control at all our plants. An internal standard is used as the reference pigment.

[4] The bulk densities of the pigments are approximate values and may vary, depending on the storage conditions.

[5] The classification R1, R2 corresponds to ISO 591, Part 1.

[NA] only available in the USA and Canada

Brightness and tone in white

KRONOS	2056	2073(NA)	2075(NA)	2160				2225			2360	2450	
Free of TMP and TME	Type 3856			2660	2211	2220	2222		2230	2233	2760		2500
Brightness (L*)	97.4	98.1	98.0	97.8	98.1	98.0	98.1	98.0	98.1	98.0	98.0	98.2	98.1
	97.4			97.8							98.0		
Tone (b*)	3.8	3.0	3.0	3.4	3.1	3.1	3.0	3.1	3.1	3.1	3.3	2.8	2.7
	3.8			3.4							3.2		

Test formulation: PVC-P films according to the KRONOS standard method, based on DIN 14469.

Relative tinting strength and tone in grey

KRONOS	2056	2073(NA)	2075(NA)	2160				2225			2360	2450	
Free of TMP and TME	Type 3856			2660	2211	2220	2222		2230	2233	2760		2500
Relative tinting strength (TS)	90	106	106	93	107	101	102	104	104	103	98	108	109
	90			93							98		
Tone (b*)	1.7	-0.1	-0.1	0.2	-0.9	-0.1	-1.0	-0.1	-0.1	-0.8	0.2	-1.1	-1.1
	1.7			0.2							0.2		

The colorimetric values L* and b* characterise the brightness and tone of the film samples pigmented with titanium dioxide (DIN 14469).

The higher the L* value found for a pigment in grey films, the greater is its relative tinting strength. The more negative the b* value found, the greater the blueness of the grey system. The figures given are mean values over extended production periods.
The stabilised KRONOS pigments are readily dispersed under a wide variety of formulating and manufacturing conditions.

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

KRONOS pigments for plastics

KRONOS 2056 and Type 3856 (= KRONOS 2056 free of TMP and TME) are sulfate pigments with good opacity and a warm undertone. They are recommended for flexible PVC, plastisols and plasticizer pastes and display good weathering performance in outdoor applications.

KRONOS 2073 is a chloride pigment for universal use in flexible and rigid PVC, linoleum and synthetic rubber. It displays high brightness with a neutral tone and good opacity in film, sheet and molded products. It is the recommended chalking grade for white tin-stabilized PVC profiles.

KRONOS 2075 is a bright chloride pigment with a neutral tone and high opacity, suitable for use in plastics that are processed at elevated temperatures. Due to the low level of surface treatment, KRONOS 2075 supports the production of lacing-free films. It is recommended for masterbatches, PE melt extrusion coatings and the production of thin polyolefin films.

KRONOS 2160 and KRONOS 2660 (= KRONOS 2160 free of TMP and TME) are dense-skin chloride pigments that meet the highest demands in weathering performance, especially for exterior PVC profiles and sidings. They display excellent tinting strength, a clean, neutral undertone and superior color stability in tinted plastic applications. In white products, they display high brightness and good opacity. Both are regarded as non-chalking grades for outdoor, tinted, tin-stabilized PVC applications.

KRONOS 2211 is a versatile, easily dispersible chloride pigment used primarily in PVC and linoleum, but also in plastisols and plasticizer pastes, masterbatches and compounds. It imparts high brightness with a neutral tone and displays good opacity in white plastics. In colored systems, it has high tinting strength with a bluish undertone. KRONOS 2211 is recommended mainly for interior applications.

KRONOS 2220 is a high-performance chloride pigment specifically optimized for PVC profiles and sidings in terms of processability, optical properties and weathering resistance. It has been the benchmark pigment in the PVC profile industry for many years. KRONOS 2220 is also used in a wide range of other plastics applications, such as polyolefins, polystyrene, co-polymers, plastisols, plasticizer pastes, liquid colors and selected engineering plastics. It displays excellent opacity, very high brightness with a neutral tone in white, and high tinting strength with a neutral undertone in tinted systems.

KRONOS 2222 is also a chloride pigment, but with a smaller mean particle size compared to KRONOS 2220. It is recommended for the same applications as KRONOS 2220, but is preferred when a pronounced bluish undertone is required in colored systems. In white applications, KRONOS 2222 displays very high brightness and opacity with a neutral tone. It has excellent processing properties and imparts very high weathering resistance to plastics used outdoors.

KRONOS 2225 is a chloride pigment used in plastic films for exterior applications, such as agricultural films, where very high weather resistance is required. It is very easily dispersible and supports production of highly concentrated polyolefin masterbatches. It displays very high brightness, a neutral tone and good opacity in white films.

KRONOS 2230 is a functionalized chloride pigment that promotes excellent thermal stability in pigmented products made of polycarbonate and polycarbonate blends, preventing surface flaws in injection moldings with a high TiO_2 content. It is readily wetted, easily dispersed and displays high brightness and a neutral tone in whites. Pure whites in translucent applications have a clean, neutral tone.

KRONOS 2233 is another functionalized chloride pigment, but with a smaller mean particle size compared to KRONOS 2230, resulting in products with a more bluish undertone and higher tinting strength in colored polycarbonate systems. Thanks to optimized organic surface treatment, excellent color properties are retained even at high processing temperatures, especially in whites.

KRONOS 2360 and KRONOS 2760 (= KRONOS 2360 free of TMP and TME) are advanced dense-skin chloride pigments that are highly recommended for exterior, colored plastic applications, particularly PVC profiles and sidings requiring excellent chalking resistance and color retention. They impart high brightness and opacity with a neutral tone in white systems. In colored applications, KRONOS 2360 and KRONOS 2760 display high tinting strength and a neutral undertone.

KRONOS 2450 is an efficient, versatile chloride pigment for plastics. It disperses readily and supports the production of highly loaded pigment concentrates. It is characterized by very high brightness and a neutral tone in white, as well as superior tinting strength and a bluish undertone in colored systems. KRONOS 2450 imparts excellent opacity to films and injection moldings. Applications range from polystyrene, copolymers and PVC films, to polyolefin masterbatches, compounds and selected engineering plastics. It is recommended for indoor applications only.

KRONOS 2500 is a high-end chloride pigment that was developed to meet the highest processability requirements imposed on masterbatch pigments. It disperses extremely well, enabling very high process throughput rates, and is particularly suited to producing highly loaded pigment concentrates. With its low volatiles content, KRONOS 2500 is ideal for high temperature PE melt extrusion coatings, thin co-extrusion and cast films, and the production of lacing-free blown films. It displays very high brightness, a neutral tone and superior opacity in white films. KRONOS 2500 is recommended primarily for indoor application.

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

UNIQUE PLANT-BASED ORGANICS FOR SENSITIVE APPLICATIONS

Special Applications

In it for SPECIALIZATIO$_2$N

KRONOS 1171 | KRONOS 2071 | KRONOS 2171

All three purified pigment grades are used as colorants for both decorative cosmetics and personal care. These high purity products boost the protection of the valuable active substance in your formulation from the decomposition by light and prolong the shelf life of your sensitive products. They meet major quality standards in Europe and the United States.

KRONOS 1171* is an anatase pigment approved for the coloring of cosmetics and as an excipient for pharmaceuticals. KRONOS 1171 meets EU and US pharmacopeia.

KRONOS 2071 is a purified rutile pigment with an outstanding tinting strength, designed for water-based cosmetics.

KRONOS 2171 adds a unique plant-based organic component to the surface of the purified pigment. This organic component makes the KRONOS 2171 suitable for oil-based or powder-based decorative cosmetics and personal care products.
INCI: Titanium Dioxide, Glycine Soya Oil.

Key Attributes

- Highly purified products for sensitive applications
- Superior tinting strength and opacity
- Readily dispersed for oil- or water-based products
- Meets the definition of ‘derived mineral ingredients’ according to ISO 16128-1:2016

* KRONOS 1171 meets the purity requirements for use in food, but is restricted for such use in some jurisdictions.

High purity TiO_2 pigments for decorative cosmetics and pharmaceuticals

Chemical and physical characteristics

KRONOS		1171	2071	2171
Production by sulphate process		Anatase	Rutile	Rutile
Weather resistance[1]		C	C	C
TiO_2 content[2] min. [%]		100	100	99.4
Relative scattering power[3]		69	93	92
Oil absorption [g/100 g] (ISO 787/5)		19	17	17
Stabilised with compounds of these elements		-	-	-
Density[2] [g/cm³]		3.8	4.2	4.2
Bulking Value [l/kg]		0.26	0.24	0.24
Bulking Value [gal/lb]		0.03	0.03	0.03
Bulk density[4] [kg/m³]		500	600	950
Apparent density [lb/ft³]		31	37	59
ASTM D476	Type	I	II	II
Standard classification[5]		A1	R1	R1
Food Safety System Certification FSSC 22000		●		
EU Regulations	1223/2009/EC (cosmetics – E 171)	●	●	●
	2009/35/EU (pharma)	●		
US Regulations	21 CFR 73.2575 (cosmetics)	●	●	●
	21 CFR 73.1575 (pharma)	●		

1 A = Maximum weather resistance
B = Good weather resistance
C = Indoor use

2 The titanium dioxide content and density of the pigments depend on the type and quantity of the treatment substances used to improve the application properties. Pure rutile has a density of 4.2 g/cm³, while pure anatase has a density of 3.8 g/cm³.

3 The relative scattering power is the decisive parameter for the tinting strength and hiding power of titanium dioxide pigments. Determination of the scattering power to DIN 53165 is part of quality control at all our plants. An internal standard is used as the reference pigment.

4 The bulk densities of the pigments are approximate values and may vary, depending on the storage conditions.

5 The classification A1, R1 corresponds to ISO 591, Part 1.

Cosmetics and pharma applications for TiO_2 grades

- Colour cosmetics
- Nail varnishes
- Foundations
- Makeup
- Creams
- Soaps
- Powders
- Blushers
- Lotions
- Tablets
- Capsules
- Nutraceuticals

Application related data

Paper

KRONOS	1071	2047	2056	2160	2800		4045(EU)	KRP 11(NA)
Free of TMP and TME			Type 3856	2660		2810		
Décor paper and foils					●	●		
Paper pulp	●						●	●
Paper & cardboard coatings	●	●					●	●
Impregnating baths for paper laminates			●	●	●	●		

EU only available in Europe

NA only available in the USA and Canada

Man-made fibres

KRONOS	1071
Polyacrylic	●
Rayon	●

Ceramics & glass

KRONOS	3025
Electroceramics	●
Vitreous enamels	●
Glass	●
Glazes	●
Welding rods	●

● strongly recommended KRONOS grade. Not strongly recommended in these tables may nevertheless be highly efficient in specific cases. Ask our technical service staff.

Chemical and physical characteristics

KRONOS		1071	2800		3025
Free of TMP and TME				2810	
Weather resistance[1]		C	A	A	-
TiO_2 content[2] min. [%]		97.4	90.1	91.0	100
Relative scattering power[3]		72	83	84	-
Oil absorption [g/100 g] (ISO 787/5)		22	19	22	20
Stabilised with compounds of these elements		Al, Si	Al	Al	-
Density[2] [g/cm³]		3.8	3.9	3.9	4.2
Bulking Value [l/kg]		0.26	0.26	0.26	0.24
Bulking Value [gal/lb]		0.03	0.03	0.03	0.03
Bulk density[4] [kg/m³]		700	600	700	850
Apparent density [lb/ft³]		44	37	43	53
ASTM D476	Type	I	IV	IV	-
Standard classification[5]		A2	R2	R2	-
Production process (Sulfate SP, Chloride CP)		SP	CP	CP	SP

1 A = Maximum weather resistance / B = Good weather resistance / C = Indoor use

2 The titanium dioxide content and density of the pigments depend on the type and quantity of the treatment substances used to improve the application properties. Pure rutile has a density of 4.2 g/cm³ , while pure anatase has a density of 3.8 g/cm³.

3 The relative scattering power is the decisive parameter for the tinting strength and hiding power of titanium dioxide pigments. Determination of the scattering power to DIN 53165 is part of quality control at all our plants. An internal standard is used as the reference.

4 The bulk densities of the pigments are approximate values and may vary, depending on the storage conditions.

5 The classification A1, A2, R1, R3 corresponds to ISO 591, Part 1

Type = Temporary product number | TMP = trimethylolpropane | TME = trimethylolethane

KRONOS grades for special applications

KRONOS 1071 is a surface-treated anatase pigment with very low abrasion properties for delustering rayon, polyacrylic and acetate fibers. It is also suitable for producing masterbatches for polyester fibers. KRONOS 1071 is highly recommended for UV-cured printing inks and leather finishes in combination with an optical brightener. It is readily dispersed in water and organic solvents. KRONOS 1071 exhibits higher lightfastness in pigmented materials compared to untreated anatase pigments due to its alumina and silica surface treatment. The pigment is very white with a bluish tone.

KRONOS 2800 is a chloride pigment designed for decor papers and foils. It disperses readily and displays excellent opacity and retention performance, making it very economical in use. KRONOS 2800 exhibits very high reflectance with a bluish tone in white paper laminates as well as superior UV-graying stability and excellent yellowing resistance at elevated temperatures, e.g. in HPL applications.

KRONOS 2810 (free of TMP and TME) is a sulfate pigment developed for use in white and colored décor papers and foils. It disperses easily and provides outstanding opacity and retention properties, making it highly economical. In white paper laminates, KRONOS 2810 offers very high scattering performance with a warm tone. It also delivers excellent UV graying stability and superior resistance to yellowing at elevated temperatures, e.g. in HPL applications.

KRONOS 3025 is an untreated, coarse rutile with no pigmentary properties. It is used in vitreous enamels and glass, electroceramics and welding rods. It is readily fused in vitreous enamels and glass. In electroceramics, it improves sintering properties and enhances thermal and acid resistance. In welding applications, KRONOS 3025 functions as a slag-making agent with an excellent deoxidization effect that ensures consumption of the welding rod without spattering and easy reignition of the electrode. It also improves control of slag fluidity during welding.

TMP = trimethylolpropane | TME = trimethylolethane

Get some INSPIRATiO$_2$N

KRONOS virtual showroom

Visit our virtual showroom and enjoy the whole KRONOS product experience. Explore our products and applications in three unique virtual worlds and find out more about a specific KRONOS product grade and its key benefits.

SCAN THE QR-CODE AND GET INSPIRED!

Product Regulations

KRONOS grades maintain authorization for multiple applications, including grades that can be used in various food contact applications.

Substance Registrations

KRONOS grades maintain registrations in most jurisdictions, including under EU REACH 1907/2006 EC as amended.

Detailed information can be obtained via productstewardship@kronosww.com

Standards

EINECS No.: 236-675-5
CAS No.: 13463-67-7
Color Index: 77891 Pigment White 6
International Standard: ISO 591-2001

The International Standard divides titanium dioxide pigments into two types, which are then classified in groups: Type A, anatase / Groups A 1, A 2 Type R, rutile / Groups R 1, R 2, R 3 ASTM D476 Type I anatase, Types II to VII rutile.

Packaging

Packaging of KRONOS TiO_2 dry products
- Standard paper bags
- Standard PE bags
- Flexible Intermediate Bulk Container (FIBC)
- Dry-bulk tankers

The packaging complies with the requirements of Directive 94/62/EC, as amended.

Datasheets

Technical datasheets and safety datasheets are available on our website www.kronosww.com under Products > Datasheets and Literature.

Datasheets & Literature

Environmental, Social and Governance

TOMORROW TOGETHER

Environmental, social, and governance topics have been a focus for KRONOS since long before they were in the public eye. 'Doing the right thing' is at the heart of our core values.

Environmental
Environmental stewardship is a critical part of our mission to reduce our footprint and comply with developing regulatory schemes.

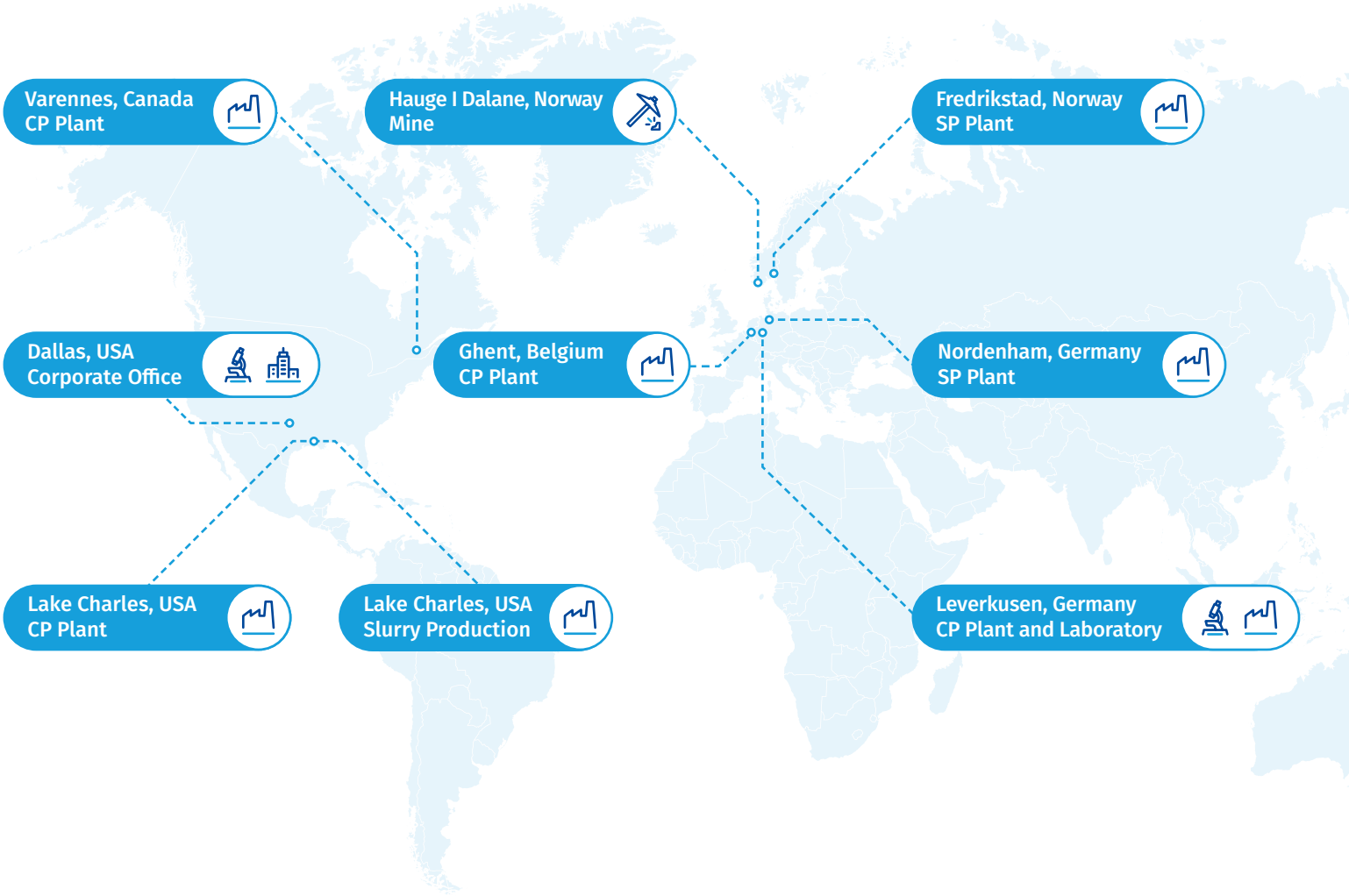
Social
Worker safety, product safety, employee wellbeing, human rights and community engagement are key focus areas.

Governance
Ethics and transparency are cornerstones of our business, and we strive for the highest level of integrity and strong corporate governance across our organization.

In January 2024 KRONOS was awarded the EcoVadis gold medal in recognition of our outstanding ESG programs

View ESG report

Brighter together
KRONOS™



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