



FIRST CHOICE

FOR A BRIGHTER LIFE



KRONOS Titanium Dioxide

List of Grades Worldwide

Quality, Expertise
and Innovation



KRONOS Information
KI 2.1

KRONOS®

KRONOS - the experts company

The KRONOS group is one of the world's leading manufacturers of titanium dioxide (TiO₂) and has been operating as an international company for more than 100 years. The group owes its significant market position to the quality of its products, innovation, technical experience and reliable customer service around the world. The company's international representation is supported by an effective distribution system.

KRONOS manufacturing sites are located in five countries on two continents, with European sites at Leverkusen and Nordenham/Germany, Fredrikstad/Norway and Ghent/Belgium, and North American sites at Lake Charles, Louisiana/USA, and Varennes, Quebec/Canada. The current annual production capacity is approximately 550,000 metric tonnes TiO₂. The company has its own ilmenite mine in Hauge i Dalane/Norway, a key raw material in the sulphate process.

KRONOS is certified to DIN EN ISO 9001, DIN EN ISO 14001, DIN EN ISO 50001 and FSSC 22000. There are two processes for manufacturing TiO₂ pigments, one uses sulphuric acid for digestion (sulphate process), while the other uses chlorine (chloride process). KRONOS plants employ both methods.

As a result of the raw material used, both processes also produce iron salts, which are used in water treatment and purification, in the production of iron oxide pigments, chromate reduction in cement and in agriculture. The sulphuric acid occurring in the sulphate process at KRONOS is either concentrated and returned to the process or neutralised. The chlorine from the chloride process is recovered.

Experience, quality and innovation for the customer

From our earliest beginnings up till today, KRONOS continues to lead the industry in both process innovation and product quality. The continuous improvement of production processes, intensive research and development, constant dialogue as well as cooperation with our customers and raw material suppliers are the guarantees for sharing success in the future.

KRONOS is the first choice for a brighter life.

Throughout the years, KRONOS has made a commitment to its product quality and customers. Our team of technical service, marketing and sales representatives works together in close cooperation with our customers. A team of specialist staff offers solutions for customers or provides on-the-spot advice.

This list of grades is designed to help our customers select the most suitable KRONOS titanium dioxide pigments for their field of application. The information in this publication is, to the best of our knowledge, true and accurate however no warranty is given or to be implied in respect of such information.

The KRONOS staff, our sales agents worldwide and distributors will be pleased to answer any questions you may have about our products in order to enable their most effective use.



Coatings

Easy incorporation, optimum hiding power and tinting strength, as well as good gloss development, are just a few of the demands a TiO₂ pigment has to meet in the coatings field. KRONOS can support you in choosing the most cost-effective pigment for your intended application.



Fields of application
Industrial coatings

KRONOS	2056	2064	2066	2160	2190	2300	2310	2360
Industrial coatings, waterborne, interior	●	●	●		●	●		
Industrial coatings, waterborne, 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	2043	2044	2047	2056	2190	2300	2310	2360	4045	4311
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	●				●	●	●			

Printing inks

KRONOS	2044	2047	2056	2064	2066	2190	2300	2310	● = strongly recommended KRONOS grades not strongly recommended in these tables may nevertheless be highly efficient in specific cases. Ask our technical service staff.
Gravure inks				●	●				
Flexographic inks, glossy			●	●	●		●	●	
Flexographic inks, matt	●	●							
Screen-printing inks				●	●	●	●	●	

Rutile pigments primarily for coatings - chemical and physical characteristics

KRONOS	2064	2066	2043	2044	2047	2056	2190	2300	2160	2310	2360
Weather resistance ¹	C	C	B	B	B	B	B	B	A	A	A
TiO ₂ content ² min. [%]	95.0	95.0	84.0	82.0	88.0	94.0	94.0	94.0	90.5	92.5	92.0
Relative scattering power ³	104	106	80	84	92	97	103	103	96	103	100
Oil absorption [g/100 g] (ISO 787/5)	18	17	35	41	27	21	18	17	18	17	19
Stabilised with compounds of these elements	Al	Al	Al, Si	Al, Si	Al, Si	Al, Si	Al, Zr	Al	Al, Si	Al, Si, Zr	Al, Si
Density ² [g/cm ³]	4,1	4,1	3,7	3,6	3,8	4,1	4,1	4,1	3,9	4,0	3,9
Apparent density [lb/ft ³]	47	47	31	31	34	44	47	53	47	50	50
Bulk density ⁴ [kg/m ³]	750	750	500	500	550	700	750	850	750	800	800
ASTM D476 Type	II, III	II, III	III	III	IIII	II, III	II, III, VI, VII	II, III, VI, VII	IV, V	II, III, VI, VII	IV, V, VI, VII
Standard classification ⁵	R2	R2	R3	R3	R3	R2	R2	R2	R2	R2	R2
Production process (Sulfate SP, Chloride CP)	SP	SP	SP	SP	SP	SP	SP	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 determined in a plastisol formulation. 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.

Rutile slurry - chemical and physical characteristics

KRONOS	4045 ^(EU)
Solids content [%]	69 - 72
Viscosity [mPas]	≤1000
pH	7.5 - 8.8
Density of slurry [g/cm ³]	approx. 2.2

KRONOS	4311 ^(NA)
Solids content [%]	76.5 ± 0.5
Viscosity [cps@100 rpm]	approx. 200
pH	8.0 - 9.0
Dispersion weight [lb/gal]	approx. 19.5 ± 0.1

^{EU} only available in Europe
^{NA} only available in the USA and Canada

KRONOMatt

KRONOMatt	KRONOS 9000
Post treatment	Al ₂ O ₃ , SiO ₂ Dense skin
Density [g/m ²]	3.9
Oil absorption [g/100 g]	23
Mean particle size [µm] (Mastersizer 2000)	10

KRONOMatt	KRONOS 9100
Post treatment	Al ₂ O ₃ , SiO ₂ Dense skin
Density [g/m ²]	3.9
Oil absorption [g/100 g]	24
Mean particle size [µm] (Mastersizer 2000)	14

Optical properties

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

Brightness and tone in white

KRONOS	2056	2064	2066	2160	2190	2300	2310	2360
Brightness (L*)	97.1	97.5	97.2	97.9	97.4	98.0	97.8	97.9
Tone (b*)	2.5	2.1	2.2	1.8	2.4	2.0	1.8	1.5

Relative tinting strength and tone in grey

KRONOS	2056	2064	2066	2160	2190	2300	2310	2360
Relative tinting strength (TS)	96	104	105	96	102	103	102	100
Tone (b*)	-4.9	-7.5	-6.2	-6.8	-7.0	-6.9	-7.0	-7.0

Test formulation: waterborne, semi-gloss emulsion paint based on acrylic resin
(pigment volume concentration: 28%)

Brightness and tone in white

KRONOS	2190	2300	2310	2360
Brightness (L*)	96.6	97.4	97.3	97.2
Tone (b*)	2.1	1.5	1.5	1.5

Relative tinting strength and tone in grey

KRONOS	2190	2300	2310	2360
Relative tinting strength (TS)	103	102	103	103
Tone (b*)	-2.8	-2.8	-2.8	-3.0

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

Brightness and tone in white

KRONOS	2043	2044	2047	2056	2190	2300	2310	2360
Brightness (L*)	96.9	97.4	97.4	96.5	97.0	97.7	97.5	97.6
Tone (b*)	2.2	2.0	2.1	2.3	2.0	1.7	1.8	1.5

Relative tinting strength and tone in grey

KRONOS	2043	2044	2047	2056	2190	2300	2310	2360
Relative tinting strength (TS)	137	140	127	121	103	102	103	111
Tone (b*)	-0.5	-1.5	-1.9	-1.1	-2.8	-2.7	-2.6	-2.6

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.



KRONOS 2043 is designed for heavily filled systems, such as matt architectural paints and synthetic resin plasters. It imparts a warm tone, high brightness and shows excellent opacity in coating formulations above the critical pigment volume concentration, making it very economical in use.

KRONOS 2044 is a special pigment for matt emulsion paints, as well as matt flexographic inks. As a result of its high specific surface area, KRONOS 2044 leads to maximum hiding power in interior emulsion paints by promoting the dry-hiding effect. It is additionally characterised by excellent non-settling properties in waterborne systems.

KRONOS 2047 is a pigment developed for highly filled systems, such as paper and cardboard coatings, light-weight coated paper (LWC paper), matt emulsion paints and lamination printing inks. It improves the whiteness and also the wet and dry opacity of paper and cardboard.

KRONOS 2056 is a versatile pigment with a warm tone recommended for conventional air-drying paints, silicate paints, plasters and impregnating baths for paper laminates.

KRONOS 2064 is a narrow-particle sized pigment with a neutral tone and low abrasion values for high-gloss and flexographic inks. Additionally it is a universal grade for interior industrial and wood coatings. It is characterized by superior opacity and tinting strength. It wets out and disperses readily leading to high gloss coating surfaces with low haze.

KRONOS 2066 is an outstanding pigment for high-gloss gravure and flexographic inks. It is characterised by excellent opacity, maintaining the highest gloss, and is suitable for both solvent-based and waterborne systems. This grade can also be used for glossy interior wood and stoving finishes. It complies with FDA 21 CFR 178.3297 as a colourant for use in food packaging.

KRONOS 2160 provides superior weather resistance performance for the most demanding solvent-based and waterborne paints and powder coatings.

KRONOS 2190 is a universal pigment for waterborne and solvent-based paints. The outstanding properties of this pigment are its superior dispersibility and excellent tinting strength, together with high gloss and low haze.

KRONOS 2300 is a pigment for industrial, wood and packaging coating applications, as well as glossy architectural paints. It is readily dispersed and recommended predominantly for interior use.

KRONOS 2310 is a high-performing, all-round pigment with excellent tinting strength and hiding power. It shows outstanding weather resistance, as well as very good dispersing properties and colour stability. It can be used in waterborne and solvent-based systems and also for all outdoor applications.

KRONOS 2360 is a premium universal grade with a dense-skin type of surface treatment. It provides the highest weather resistance performance for the most demanding waterborne and solvent-based paints or powder coating systems. It gives very bright white paints with a neutral tone and outstanding opacity and tinting strength. It also has superior dispersing properties that enable the production of high-gloss, low-haze coatings.

KRONOS 4045 is an aqueous rutile pigment suspension for universal use in waterborne coatings and in the paper industry. It improves the brightness and opacity of interior emulsion paints and paper coatings and gives paper very high wet and dry opacity when added directly to the pulp in the wet end. Furthermore, it is also approved as a colourant for food packaging with indirect food contact.

KRONOS 4311 is a multipurpose rutile titanium dioxide slurry for use in waterborne systems, such as in the full range of interior and exterior architectural paints.

KRONOMatt

KRONOS 9000 is a matte titanium dioxide grade and recommended for interior and exterior wood and industrial coatings. It shows a significantly reduction of gloss in binder rich coatings. KRONOS 9000 provides a good opacity, a high brightness and a neutral tone in white. It also exhibits highest weather resistance performance as well as excellent stain resistance and develops good dispersibility.

KRONOMatt

KRONOS 9100 is a matte titanium dioxide grade with good opacity, a high brightness and a neutral tone in white. It shows a significantly reduction of gloss in binder rich coatings. In comparison to KRONOS 9000, KRONOS 9100 is somewhat coarser on particle size and is therefore recommended for architectural coatings. It exhibits also highest weather resistance performance, excellent stain resistance and develops good dispersibility.



Plastics

The plastics laboratory at KRONOS is equipped with an impressive array of machines for incorporating the titanium dioxide pigments into a wide variety of polymer matrices. The pigmented plastic specimens can be tested not only for pigmentary properties, but also for polymer-related characteristics.



Fields of application

KRONOS	2056	2073 ^(NA)	2075 ^(NA)	2076 ^(EU)	2160	2211	2220	2222	2225	2230	2233	2360	2450	2500
PVC, exterior		● *			● **		●	●				●		
PVC, interior	●	●				●	●	●				●	●	
Polyolefins/MB, interior		●	●	●		●							●	●
Polyolefins/MB, exterior									●					
Polystyrene and copolymers		●	●	●		●	●	●					●	
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.

* KRONOS 2073 chalking grade for white tin-stabilised PVC, exterior
** KRONOS 2160 non-chalking grade for tinted tin-stabilised PVC, exterior

Rutile pigments for plastics - chemical and physical characteristics

KRONOS	2073 ^(NA)	2075 ^(NA)	2076 ^(EU)	2211	2230	2233	2450	2500	2056	2225	2160	2220	2222	2360
Weather resistance ¹	C	C	C	C	C	C	C	C	B	B	A	A	A	A
TiO ₂ content ² min. [%]	96.5	97.0	97.0	95.5	96.0	96.0	96.0	97.5	94.0	94.5	90.5	92.5	92.5	92.0
Relative scattering power ³	107	107	107	107	105	105	107	108	89	104	97	100	104	100
Oil absorption [g/100 g] (ISO 787/5)	15	13	12	17	15	15	14	13	21	16	18	15	17	19
Stabilised with compounds of these elements	Al	Al	Al	Al	Al	Al	Al	Al	Al, Si	Al, Si	Al, Si	Al, Si	Al, Si	Al, Si
Density ² [g/cm ³]	4.1	4.2	4.2	4.1	4.2	4.2	4.1	4.2	4.1	4.0	3.9	4.0	4.0	3.9
Apparent density [lb/ft ³]	56	50	55	56	56	44	56	50	44	47	47	56	56	50
Bulk density ⁴ [kg/m ³]	900	800	900	900	900	700	900	800	700	750	750	900	900	800
ASTM D476 Type	II	II	II	II	II	II	II	II	II, III	II, III	IV, V	II, III, VI	II, III, VI	IV, V, VI, VII
Standard classification ⁵	R2	R1	R1	R2	R2	R2	R2	R1	R2	R2	R2	R2	R2	R2
Production process (Sulfate SP, Chloride CP)	CP	CP	CP	CP	CP	CP	CP	CP	SP	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 determined in a plastisol formulation. 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.

^{EU} only available in Europe
^{NA} only available in the USA and Canada

Optical properties

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

Brightness and tone in white

KRONOS	2056	2073	2075	2076	2160	2211	2220	2222	2225	2230	2233	2360	2450	2500
Brightness (L*)	97.3	98.1	98.1	98.0	97.8	98.1	98.0	98.1	98.0	98.1	98.1	98.0	98.1	98.1
Tone (b*)	4.0	3.0	3.0	3.2	3.4	3.0	3.1	3.0	3.1	3.1	3.0	3.3	2.9	2.8

Relative tinting strength and tone in grey

KRONOS	2056	2073	2075	2076	2160	2211	2220	2222	2225	2230	2233	2360	2450	2500
Relative tinting strength (TS)	90	105	106	104	93	107	101	102	103	103	103	100	108	108
Tone (b*)	1.7	0.0	0.1	0.3	0.2	-0.9	0.0	-0.9	0.0	0.1	-0.7	0.2	-1.0	-1.0

The colorimetric values L* and b* characterise the brightness and tone of the films 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.

KRONOS 2056 is a versatile pigment with a warm tone recommended for plasticisers and various types of plastics. It confers good exterior durability.

KRONOS 2073 is a versatile rutile pigment recommended for masterbatches and compounds. It is the chalking grade for white tin-stabilised PVC profiles.

KRONOS 2075 and **KRONOS 2076** are recommended for masterbatches, PE melt extrusion coatings and the production of thin films. They are suitable for use in plastics that are processed at elevated temperatures. These grades confer high brightness, approaches a neutral tone in whites and imparts high opacity to films.

KRONOS 2160 provides the highest weather resistance performance for the most demanding plastic applications, especially for PVC compounds. It is regarded as a non-chalking grade for tinted tin-stabilised PVC profiles and sidings used outdoors.

KRONOS 2211 is an easy-to-disperse rutile pigment for use in indoor applications. It is mainly used in PVC and linoleum, but also in masterbatches and compounds. It is readily wetted and dispersed in various polymers. It imparts high tinting strength and gives clean tints.

KRONOS 2220 is the leading KRONOS rutile pigment for the plastics industry. It meets the highest demands on material handling, dispersibility, optical properties and weather resistance. It has been the market leader for many years, particularly in the PVC profile industry.

KRONOS 2222 is a further development of the time-proven KRONOS 2220. It confers maximum brightness and a neutral tone in white PVC applications. It is characterised by high tinting strength and a pronounced bluish tone in pastel shades. It shows very high weather resistance, comparable to KRONOS 2220.

KRONOS 2225 is a rutile 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 permits production of highly concentrated polyolefin masterbatches. It also possesses high tinting strength and shows good opacity in films.

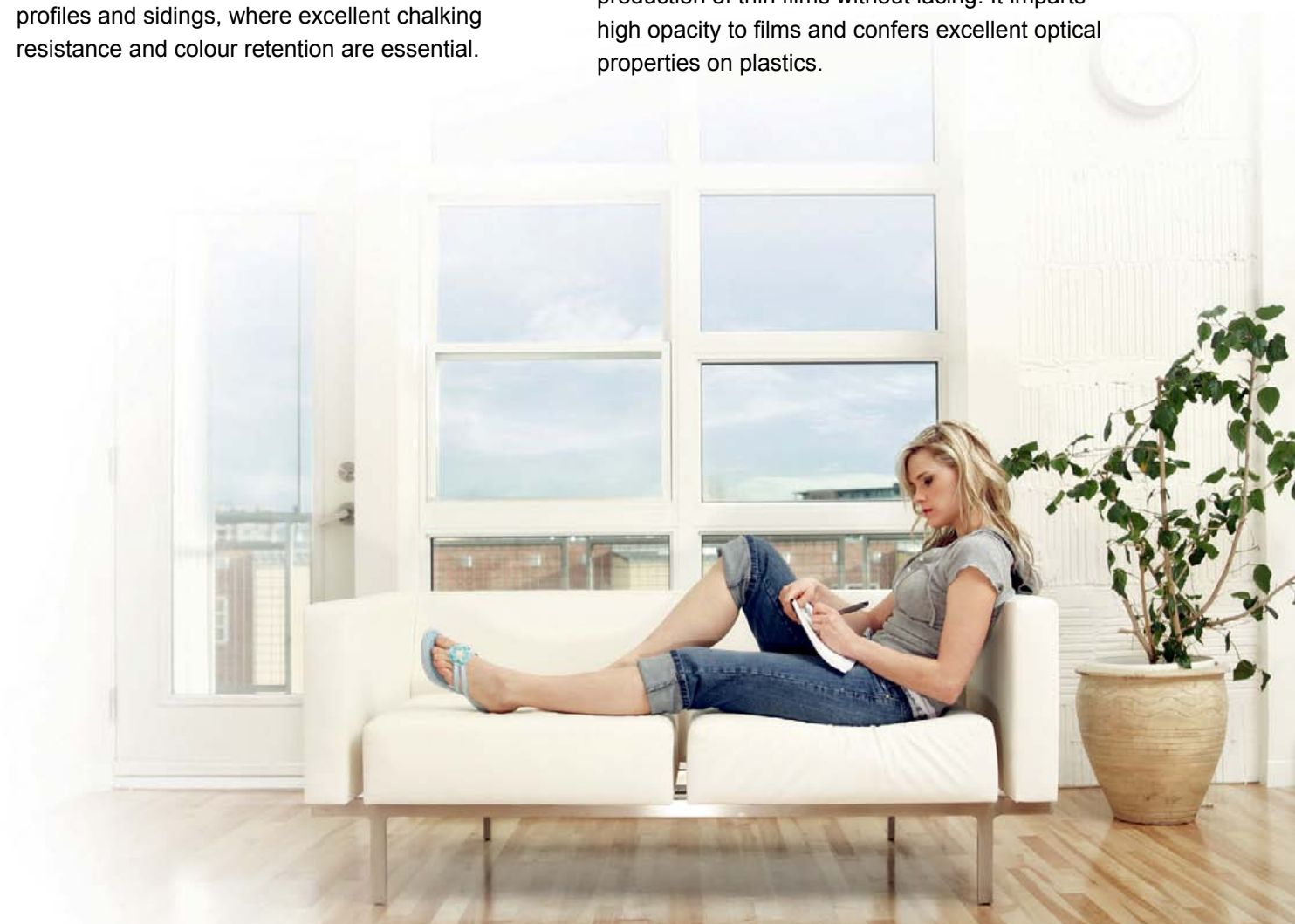
KRONOS 2230 is a rutile pigment specifically developed for pigmenting polycarbonate. Due to its special surface treatment, the degradation of polycarbonate is kept down to a minimum. It is readily wetted, easily dispersed and guarantees high brightness and a neutral tone in whites. Surface flaws in injection mouldings with a high TiO₂ content are prevented. Pure whites in translucent applications show a clean bluish tone.

KRONOS 2233 is a further development of the time-proven KRONOS 2230 for pigmenting polycarbonate and polycarbonate blends. It possesses very high tinting strength with a bluish tone. Due to optimisation of the organic surface treatment, excellent colour properties are retained even at high processing temperatures, especially in whites.

KRONOS 2360 is highly recommended for exterior, coloured plastic applications, especially for PVC profiles and sidings, where excellent chalking resistance and colour retention are essential.

KRONOS 2450 is an efficient, universal pigment for plastics. It disperses readily and enables the production of highly loaded pigment concentrates. It is characterised by very high brightness and a neutral tone in whites, as well as superior tinting strength and a bluish tone in coloured systems. It imparts excellent opacity to films and injection mouldings. Applications range from polystyrene, copolymers and PVC films to polyolefin masterbatches and compounds. It is recommended for indoor applications only.

KRONOS 2500 was developed to meet the highest demands on processability placed on a masterbatch pigment. It is characterised by its high process throughput and is particularly suited to highly pigmented concentrates. Its low volatiles content makes this grade very suitable for high-temperature PE melt extrusion coatings and the production of thin films without lacing. It imparts high opacity to films and confers excellent optical properties on plastics.



Grades for each and every purpose

The state-of-the-art equipment of the KRONOS paper laboratory allows testing of titanium dioxide in a wide variety of paper applications, with a focus on décor paper and decorative foils. KRONOS grades are offered for electroceramics, glass, glazes and welding rods, meeting special product requirements. Further grades are designed for pharmaceuticals, foodstuffs and cosmetics in compliance with global safety regulations.

Fields of application

Paper

KRONOS	1000 ^(NA)	1002	2047	2056	2160	2800	4045 ^(EU)
Décor paper and foils						•	
Paper mass	•	•					•
Paper & cardboard coatings		•	•				•
Impregnating baths for paper laminates				•	•	•	

Man-made fibres

KRONOS	1071
Polyacrylic	•
Polyester	•
Rayon	•

^{NA} KRONOS 1000 is only available in the USA and Canada
^{EU} KRONOS 4045 Slurry is only available in Europe

Health, food & beauty

KRONOS	1171*	2971*
Cosmetics	•	•
Foodstuffs	•	•
Pharmaceuticals	•	•

KRONOS 1171* and KRONOS 2971* are approved as food colourant E 171.

* For distributors of these products please check our KRONOS website: www.kronostio2.com

Ceramics & glass

KRONOS	1000 ^(NA)	1002	3025
Electroceramics	•	•	•
Vitreous enamels			•
Glass			•
Glazes	•	•	•
Welding rods		•	•

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

Chemical and physical characteristics

KRONOS	1000 ^(NA)	1002	1071	1171	2971	2800	3025
ASTM D476 Type	I	I	I	I	II	IV	-
Standard classification ¹	A1	A1	A2	A1	R1	R3	-
Stabilised with compounds of these elements	-	-	Al, Si	-	-	Al	-
TiO ₂ content ² min [%]	99.0	99.0	96.0	99.0	99.0	89.0	99.0
Density ² [g/cm ³]	3.8	3.8	3.7	3.8	4.2	3.8	4.2
Apparent density [lb/ft ³]	37	37	44	37	34	41	53
Bulk density ³ [kg/m ³]	600	600	700	600	550	650	850
Relative scattering power ⁴	71	74	72	72	90	90	-
Oil absorption [g/100 g] (ISO 787/5)	20.0	19.0	18.0	19.0	18.0	18.0	-

¹ The classification A1, A2, R1, R3 corresponds to ISO 591, Part 1
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 bulk densities of the pigments are approximate values and may vary, depending on the storage conditions.
⁴ 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.

KRONOS 1000 is an anatase pigment for use in paper mass, rubber and glazes. It is very bright with a neutral tone, which can be further improved by the presence of optical brighteners. It provides high wet and dry opacity in paper applications.

KRONOS 1002 is an anatase pigment for use in paper mass, rubber thread, as well as electroceramics, glass and welding rods. Piezoelectric ceramics are a noteworthy special application. It is readily dispersed and is characterised by high brightness with a neutral tone. It also confers excellent opacity in paper applications.

KRONOS 1071 is an anatase pigment for delustering rayon, polyacrylic and acetate fibres. It is also suitable for polyester and polyamide fibres. It is readily dispersed. Due to the inorganic surface treatment with aluminium and silicon compounds, it shows better lightfastness in pigmented materials than untreated anatase pigments.

KRONOS 1171 is an anatase pigment approved for colouring foodstuffs, cosmetics, pharmaceuticals and tobacco products.

KRONOS 2971 is a rutile pigment approved for colouring foodstuffs and cosmetics. Both comply with the following product safety regulations:

European Union:

- 1223/2009/EC (cosmetics)
- 1333/2008/EC (foodstuff additives)
- 231/2012/EU (food colour)

- 2009/35/EC (pharmaceuticals)
- European Pharmacopoeia
- FSSC 22000

USA:

- FDA Regulation 21 CFR 73.575 (foodstuffs)
- FDA Regulation 21 CFR 73.1575 (pharmaceuticals)
- FDA Regulation 21 CFR 73.2575 (cosmetics)
- US Pharmacopeia

KRONOS 2800 is designed for décor papers and décor foils. It is characterised by excellent opacity and retention, making it very economical in use. KRONOS 2800 provides high brightness and a neutral tone in white paper laminates. It also displays superior UV greying resistance and non-yellowing temperature stability.

KRONOS 3025 is a coarse rutile without pigmentary properties for use in ceramics, electroceramics, vitreous enamels, glass and welding rods. It improves the sintering properties when used in ceramics and enhances mechanical, thermal and acid resistance. Excellent ionisation and re-ignition of the electrode is achieved in electric arc welding applications.

KRONOS 4045* is an aqueous rutile pigment slurry for universal use in the paper industry. It improves the brightness and opacity of paper coatings. It gives paper very high wet and dry opacity when added to the paper mass.

* See page 7 for data

Innovations - Specialties

KRONOS is constantly striving for innovation and quality and thus to be the first choice of the customer. To offer our customers solutions to their questions and needs is what we are aiming at, any time. KRONOS is permanently thinking ahead and is seizing the challenges of the future for the customers' utmost benefit.

Be it to improve our reliable and well established grades or to find new and game-changing ones, KRONOS has been the leading company in research and development for more than a century.

KRONOClean[®] *inside*

KRONOClean is a photocatalyst based on titanium dioxide. It catalyses, i.e. promotes and accelerates, the degradation of organic molecules and the mineralisation of nitrogen oxides (NOX), etc. when irradiated with visible light or exposed to ultraviolet (UV) radiation (sunlight). Pollutants are converted into harmless substances, such as water and carbon dioxide, or nitrate that acts as a fertilizer for nearby plants.

KRONOMatt

KRONOMatt (KRONOS 9000 and KRONOS 9100) is the first matte titanium dioxide for coatings below cPVC. It offers numerous key features that all result in a lean, easy and highly efficient manufacturing process. By using **KRONOMatt** a matting agent is no longer required to formulate your product.

Health and Safety

Composition

Titanium dioxide is chemically inert and insoluble in aqueous and organic solvents. Hot, concentrated sulphuric acid or hydrofluoric acid, or acidic or alkaline melts, are needed for the digestion process, e.g. for analysis.

The majority of KRONOS TiO₂ pigments are surface-treated with aluminium compounds, but also with silicon and zirconium compounds, with the goal of improving specific pigment properties.

Organic substances are also added to almost all KRONOS pigments in order to improve their wettability. None of the substances used constitutes a health hazard under the given conditions.

Refer to the respective Product Stewardship information for further details on the individual grades.



Health and safety information

KRONOS titanium dioxide pigments have been produced and processed for 100 years and no acute or chronic harmful effects attributable to titanium dioxide have become known ¹⁾.

A study by the World Health Organization (WHO) determined that inhaled titanium dioxide behaves in a biologically inert manner ²⁾. Studies carried out by the US National Cancer Institute reveal that titanium dioxide is not carcinogenic ³⁾.

This finding is confirmed by epidemiological studies in Europe and the USA, which demonstrate that the risk of cancer does not increase as a result of handling titanium dioxide ⁴⁾. The IARC (International Agency for Research on Cancer) was nevertheless obliged to classify titanium dioxide in IARC Group 2b due to the assessment criteria applicable there.

¹⁾ H. Valentin, K. H. Schaller: Human biological monitoring of industrial chemicals, 3. Titanium. Commission of the European Communities, EUR 6609, 1980.

²⁾ Environmental Health Criteria 24, Titanium. World Health Organization, Geneva 1982.

³⁾ Bioassay of Titanium Dioxide for Possible Carcinogenicity: National Cancer Institute, Carcinogenesis Technical Report Series No. 97, 1979. U.S. Department of Health, Education and Welfare.

⁴⁾ P. Bofetta et al.: Mortality among workers employed in the titanium dioxide production industry in Europe. Cancer Causes and Control 15: 679-706, 2004.

Registrations and standards

EINECS No.: 236-675-5 titanium dioxide

CAS No.: 13463-67-7

Colour 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.

REACH

All requirements of REACH Regulation 1907/2006/EC are met. The Registration No. can be taken from the current Safety Data Sheet for TiO₂. These declarations are valid for all KRONOS locations in Europe.

For OR (Only Representative) services please refer to the KRONOS website under Sustainability/REACH.

Product safety regulations for TiO₂ pigments (excerpt)*

Colourants for use in packaging material for foodstuffs and in other articles of daily use

European Union

10/2011/EU**	on plastic materials and articles intended to come into contact with food
2009/48/EC**	on the safety of toys
EN 71-3**	Safety of toys (Part 3: Migration of certain elements)

USA

Not all titanium dioxide grades are suitable for use in inks and coatings in indirect contact with food. The amount of organic treatment on the pigment is often the limiting factor. These restrictions already apply in the USA (FDA Regulations), China and some other countries. The Product Stewardship shows the compliance list for the various countries worldwide. Detailed information can be obtained via productstewardship@kronosww.com.

* Refer to the respective Product Stewardship information for further details on the individual grades.

** in the currently valid version (07/2019)

Packaging

Packaging of KRONOS TiO₂ solid products

- Standard 25 kg bags
- Flexible Intermediate Bulk Container (FIBC, "Big Bag", KRONOBAG)
- Dry-bulk tankers

The packaging complies with the requirements of Directive 94/62/EC on packaging and packaging waste.**

Transport of TiO₂ suspensions

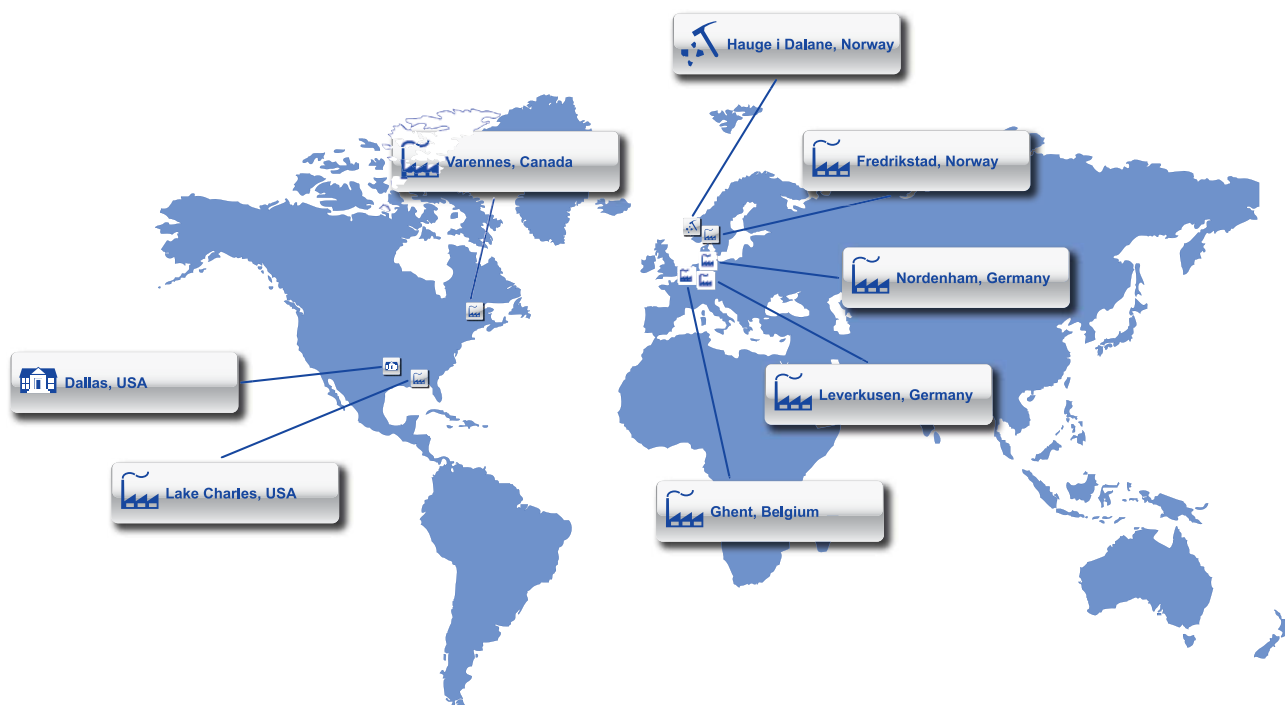
- Rail tankers
- Tank containers





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