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KRONOS Titanium Dioxide Grades for Ink Applications



KRONOS[®]



KRONOS ink grades for your applications

KRONOS	2044	2047	2064	2066	2190	2310	9900
Gravure inks	💧	💧	💧	💧			
Flexographic inks, glossy			💧	💧		💧	
Flexographic inks, matte	💧	💧					
Screen-printing inks		💧	💧		💧	💧	
Digital printing			💧	💧		💧	💧

💧 = Strongly recommended

KRONOS grades not strongly recommended in this table may nevertheless be highly efficient in specific cases. Ask our technical service staff for more information.

For FDA regulations: Detailed information can be obtained from: productstewardship@kronosww.com.



KRONOS pigment ink grades - Chemical and physical characteristics

KRONOS	2044	2047	2064	2066	2190	2310
Weather resistance ¹	B	B	C	C	B	A
TiO ₂ content min. [%] ²	82.0	88.0	95.0	95.0	94.0	92.5
Relative scattering power ³	84	92	104	106	103	103
Oil absorption [g/100 g] (ISO 787/5)	41	27	18	17	18	17
BET [m ² /g]	65	32	14	13	18	19
Stabilised with compounds of these elements	Al, Si	Al, Si	Al	Al	Al, Zr	Al, Si, Zr
Bulk density [kg/m ³] ⁴	500	550	750	750	750	800
ASTM D476 type	III	IIII	II, III	II, III	II, III, VI, VII	II, III, VI, VII
Production process (Sulfate SP, Chloride CP)	SP	SP	SP	SP	SP	CP

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

2 The titanium dioxide content depends on the type and quantity of the treatment substances used to improve the application properties.

3 The relative scattering power is the decisive parameter for the tinting strength and hiding power of titanium dioxide pigments. Determining 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 storage conditions.

KRONOS 9900 - aqueous pigment concentrate - Chemical and physical characteristics

KRONOS Digital White	9900
Solids content [%]	52 - 56
Viscosity [mPa*s]	< 300
pH as delivered	8.5 - 9.5
Stable within pH range of	5 - 10
Density (ISO 787-10) [g/cm ³]	1.60 - 1.70



**Grades for glossy applications -
KRONOS 2064 and KRONOS 2066**



Grades for glossy applications - KRONOS 2064 and KRONOS 2066

Applications

- ◆ High gloss solvent-based and waterborne gravure, flexographic and digital inks
- ◆ Monosolvent and bi-solvent based gravure inks (NC, PVB, PVC and PU based)
- ◆ UV-curing printing inks

Key attributes

- ◆ Maximum opacity
- ◆ Exceptionally high gloss
- ◆ Rapid wetting
- ◆ Readily dispersed allowing a faster through-put in production
- ◆ Low ink viscosity
- ◆ Very low abrasion

KRONOS 2064 and KRONOS 2066 were specially developed for use in high gloss gravure and flexographic ink applications. Both are rutile grades produced by the sulfate process. They are surface treated with alumina with an optimized amount of polyalcohol for use in printing inks which have indirect food contact.

KRONOS 2064 and KRONOS 2066 are fully equivalent grades in terms of the amount and type of surface treatment. The difference between them is the mean particle size of the TiO₂-core (base material) used.

KRONOS 2064 has a somewhat finer mean particle size which consequently leads to ink prints with a more bluish tone. This becomes evident when printing on dark or metalized surfaces.

KRONOS 2066, on the other hand, has been optimized in terms of opacity and has a higher portion of particles in the optimal size range. The mean particle size is intentionally shifted to a slightly higher value with a lower content of optically inefficient fine particles. In addition, elimination of the fine fraction results in a lower ink viscosity which is preferred. KRONOS 2066 also has a very low fraction of coarse particles which results in excellent gloss performance.

It is the exceptionally high gloss that makes these two grades so unique. It is achieved by optimized, very intensive milling procedures that guarantee the elimination of coarse pigment agglomerates. Intensive milling also ensures superior dispersing properties which in turn lead to shorter dispersing times, lower dispersing energies and higher production through-puts. Optimal dispersion performance is readily achieved by using standard high-speed dissolver or rotor-stator dispersion technologies. Both pigments show very low abrasion which is paramount for gravure inks. This is due to the fact that the pigments are sulfate grades, very intensively milled and have only alumina and no silica surface treatment.

Apart from high gloss surface printing, KRONOS 2064 and KRONOS 2066 are highly recommended for reverse and lamination printing, usually in combination with the semi-matte pigments KRONOS 2044 or KRONOS 2047.

Performance properties (typical values)

Test formulation: Nitrocellulose-based gravure ink

	Standard pigment	KRONOS 2064	KRONOS 2066
Brightness (L*)	94.6	94.7	94.7
Tone (b*)	0.08	0.04	0.10
Opacity as contrast ratio [%]	60.2	60.8	61.7
60° Gloss [U]	83	86	87
Cup viscosity [s/4 mm] mill base	53	51	48
Abrasion* [µm]	0.66	0.52	0.48

* Measured with the abrasion tester AT II (a value ≤ 0,80µm indicates excellent abrasion performance)

Particle size distribution analysis - CPS disc centrifuge

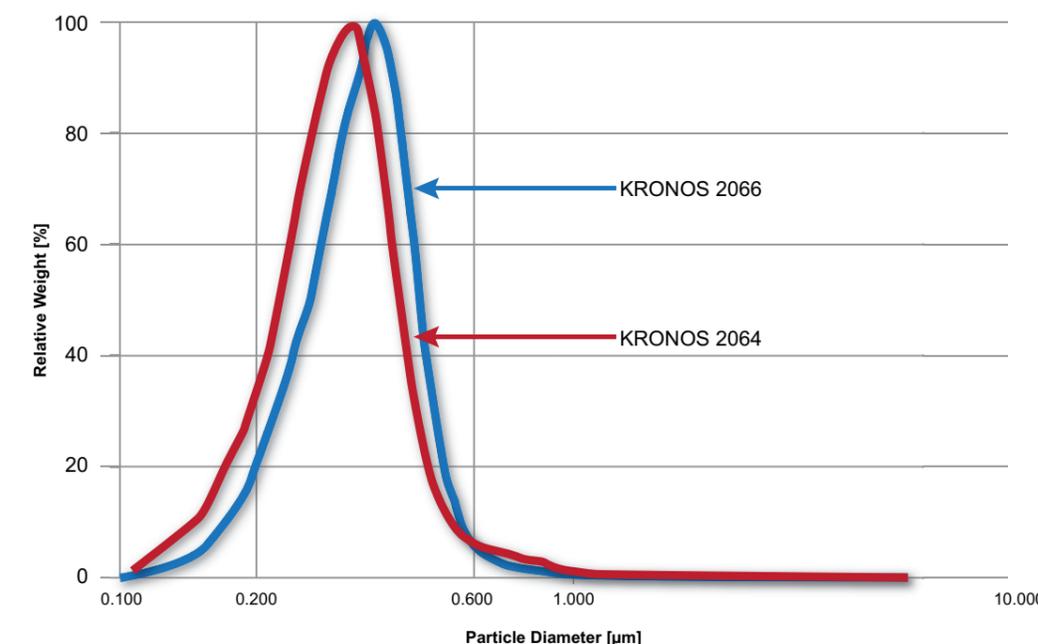


Fig. 1: KRONOS 2066 compared to KRONOS 2064 shows a narrower particle size distribution and accordingly higher opacity in gravure inks



Pigment abrasion evaluation



Pigment abrasion was evaluated using the abrasion tester AT II from Karl Schroeder KG, Germany. The abrasion value is important in gravure printing because TiO₂ grades showing high abrasion (see figure 2) cause a rapid wear of the engraved

chrome-plated copper cylinders. It is crucial for these "expensive" printing cylinders to last through large production runs without the image degrading.

Abrasion test

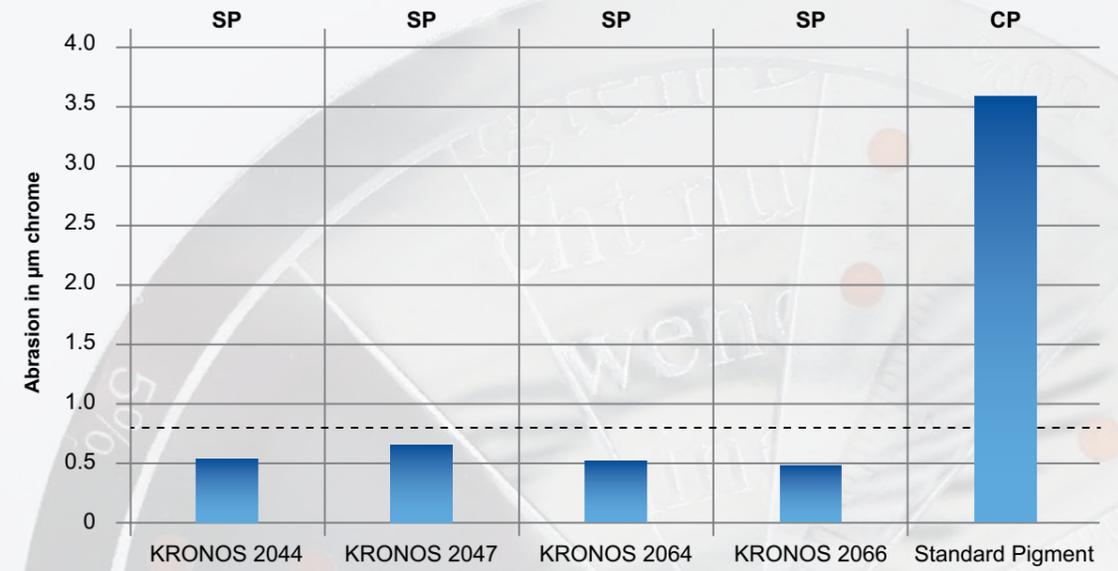


Fig. 2: Production process: SP = Sulfate, CP = Chloride Sulfate



A close-up photograph of industrial machinery, likely a pigment mill or roller. The image shows several large, polished metal rollers. A roll of red pigment is being processed between the rollers. The red pigment has a fine, granular texture. The machinery is dark, and the lighting highlights the metallic surfaces and the vibrant red of the pigment.

Grades for matte and special applications - KRONOS 2044 and KRONOS 2047



Grades for matte and special applications - KRONOS 2044 and KRONOS 2047

Applications

- ◆ Matte waterborne and solvent-based flexographic and gravure inks
- ◆ Lamination inks
- ◆ Reverse inks

Key attributes

- ◆ Superior opacity
- ◆ Rapid pigment dispersion
- ◆ Low abrasion
- ◆ Minimal penetration into the print substrate (décor paper)

KRONOS 2044 and **KRONOS 2047** are special, highly surface-treated rutile pigments produced by the sulfate process. They can be used very efficiently in surface printing inks to achieve a matte appearance or in lamination and reverse inks to achieve highest opacity.

KRONOS 2044 has a voluminous alumina/silica surface treatment which is highly recommended for matte flexographic inks. It imparts high whiteness with a clean, bluish tone and it performs extremely well in water-based gravure inks for printing décor papers and films. KRONOS 2044 can be used alone or in combination with glossy printing grades such as KRONOS 2064 to produce high opacity lamination inks. The combination of the two grades enables the ink formulators to optimize opacity and ink viscosity to achieve the best overall performance.

KRONOS 2047 is highly recommended for lamination and matte flexographic inks. This bluish grade shows advantages in inks used on absorptive surfaces like cardboard because it prevents the ink from penetrating the substrate. It has a lower level of alumina/silica surface treatment compared to KRONOS 2044 resulting in a lower BET surface and oil absorption value, which consequently allows inks to be produced with a lower ink viscosity.



Performance properties (typical values) -

Test formulation: waterborne acrylic emulsion flexographic ink

	Standard pigment	KRONOS 2044	KRONOS 2047
Brightness (L*)	94.0	94.0	94.0
Tone (b*)	0.27	0.03	0.14
Opacity as contrast ratio [%]	62.4	63.6	63.1
60° gloss [U]	27	5	18
85°gloss [U]	73	24	66

Particle size distribution analysis - CPS disc centrifuge

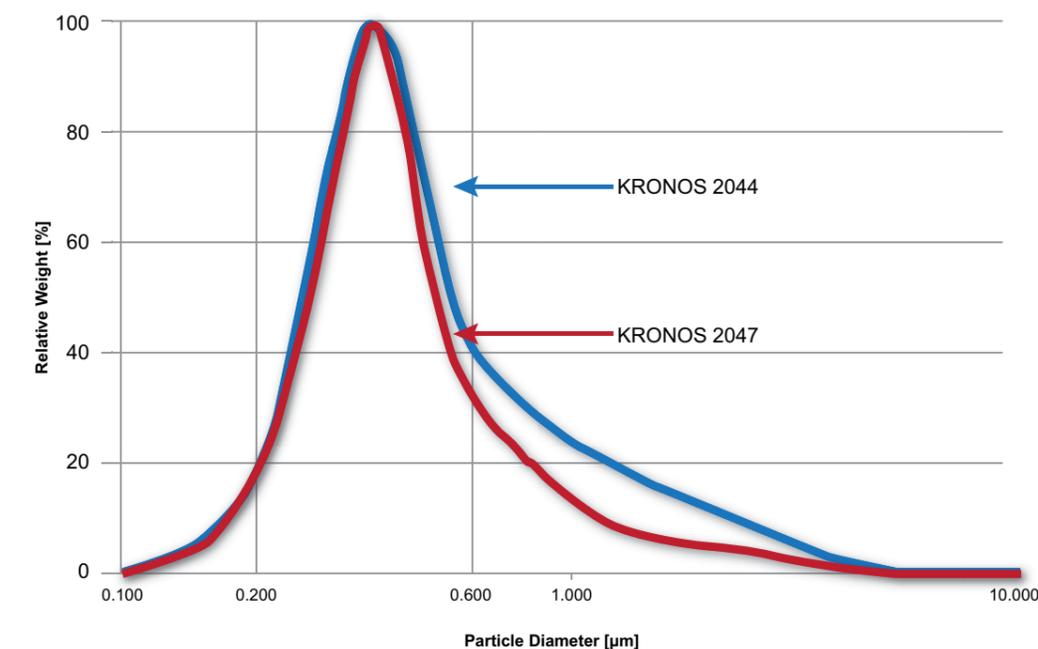
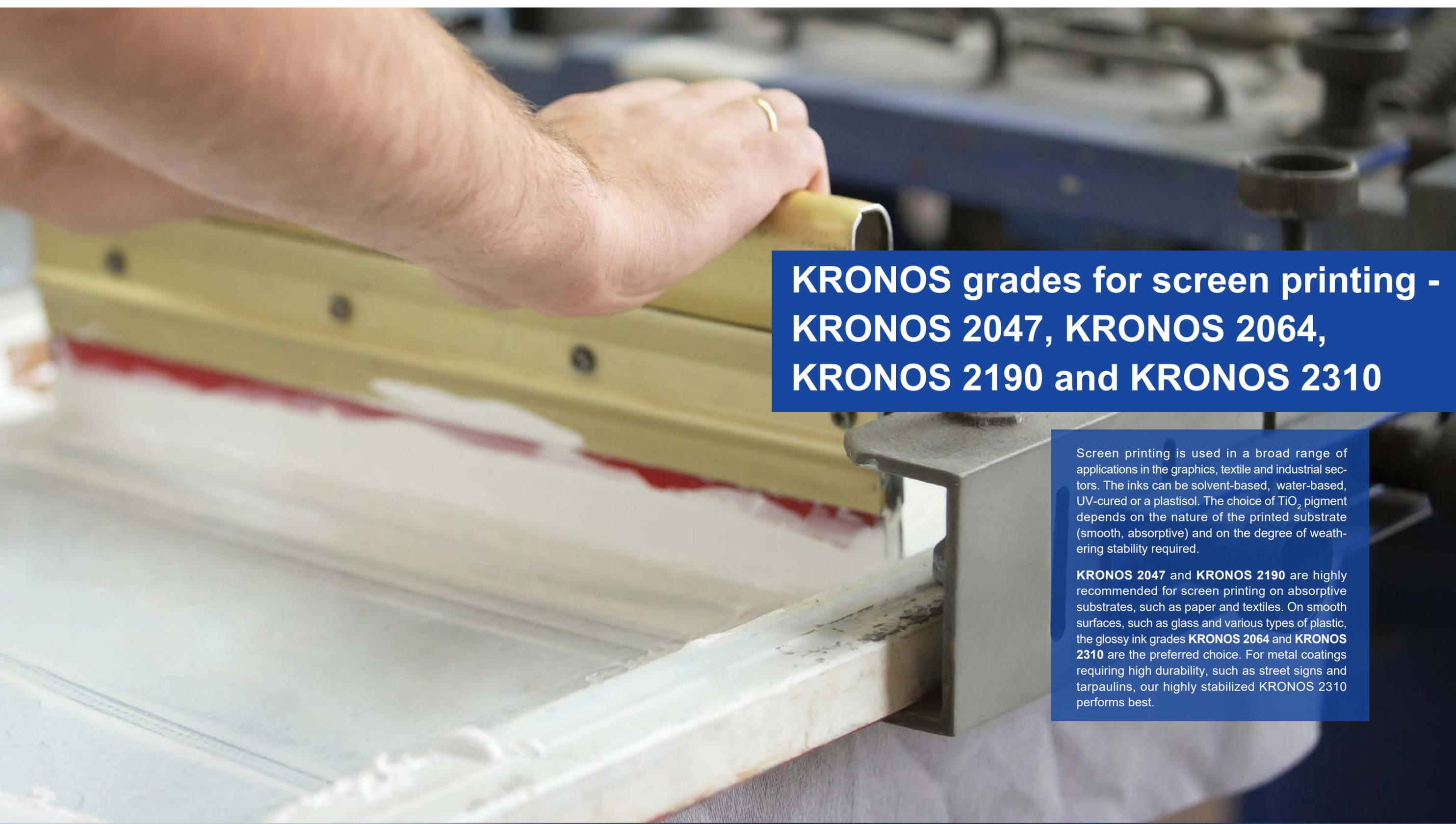


Fig. 3: KRONOS 2044 and 2047 are produced using the same TiO₂ base material. However KRONOS 2047 shows a narrower particle size distribution due to the significantly lower amount of silica surface treatment on the pigment. For the same reason, the BET surface area and the oil absorption of KRONOS 2047 are lower, which accordingly is reflected in a lower overall ink viscosity.



KRONOS grades for screen printing - KRONOS 2047, KRONOS 2064, KRONOS 2190 and KRONOS 2310

Screen printing is used in a broad range of applications in the graphics, textile and industrial sectors. The inks can be solvent-based, water-based, UV-cured or a plastisol. The choice of TiO₂ pigment depends on the nature of the printed substrate (smooth, absorptive) and on the degree of weathering stability required.

KRONOS 2047 and **KRONOS 2190** are highly recommended for screen printing on absorptive substrates, such as paper and textiles. On smooth surfaces, such as glass and various types of plastic, the glossy ink grades **KRONOS 2064** and **KRONOS 2310** are the preferred choice. For metal coatings requiring high durability, such as street signs and tarpaulins, our highly stabilized KRONOS 2310 performs best.

A large, dynamic splash of white ink or pigment against a black background, showing intricate, swirling patterns and textures.

**KRONOS 9900 Digital White -
the new aqueous grade for
inkjet applications**

KRONOS[®]
Digital White



KRONOS 9900 Digital White is the newly developed KRONOS aqueous grade for inkjet applications.

Applications

- ◆ Water based inkjet inks
- ◆ Hybrid (water/UV) inkjet inks
- ◆ Any other aqueous applications, in which a low coarse particle content and high stability are beneficial key attributes
- ◆ Chloride pigment base providing highest whiteness and bluish tone
- ◆ Dust-free ready-to-use pigment concentrate
- ◆ Supports the required rheological performance in inkjet inks
- ◆ Wide compatibility with various types of ink binders (e.g. PU and acrylic) and additives
- ◆ Good weather resistance
- ◆ Compliant with Swiss Ordinance and Nestlé guidance regulatory

Key attributes

- ◆ Exhibits excellent anti-sedimentation properties and storage stability
- ◆ Superior opacity in prints
- ◆ Ensures short filtration times of inkjet inks

For FDA regulations: Detailed information can be obtained from productstewardship@kronosww.com.

KRONOS 9900 Digital White is an innovative aqueous titanium dioxide pigment concentrate (solids content: approx. 54%) tailored for a wide range of inkjet technologies. It addresses the need in inkjet applications for maximum stability in bottle, drum, printhead, in flight and on substrate.

Thanks to the KRONOS proprietary process technology developed for this grade, the pigment concentrate displays excellent anti-sedimentation properties and longterm storage stability.

Particle size distribution analysis - CPS disc centrifuge

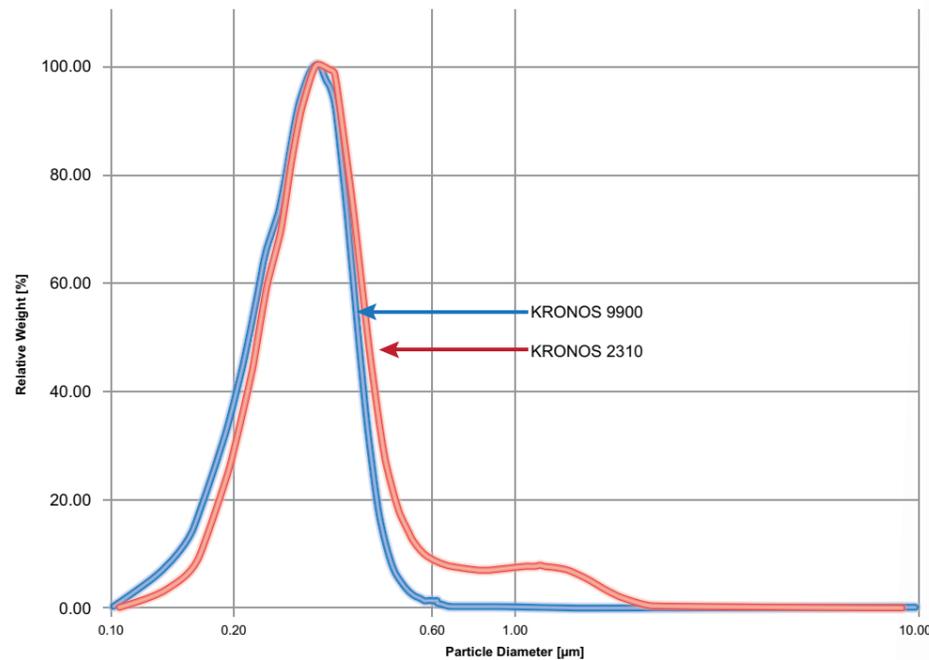


Fig. 4: KRONOS 9900 shows a very narrow particle size and an extremely low content of coarse particles above 0.6µm which is reflected in the excellent filtration behaviour of with KRONOS 9900 formulated inkjet inks

Performance properties (typical values)

KRONOS 9900	Directly after preparation	After 3 weeks 23°C	After 3 weeks 50 °C	After 1 year 23 °C
pH	9.2	9.2	9.2	9.2
Viscosity [mPa*s] ¹	< 300	< 300	< 300	< 300
Particle size distribution				
D 50 [nm] ²	~300	~300	~300	~300
D 90 [nm] ²	~400	~400	~400	~400
Sedimentation ³	none	none	none	none

¹ Measured by rotational Rheometer, 25°C, 100 1/s
² Measured by disc centrifuge

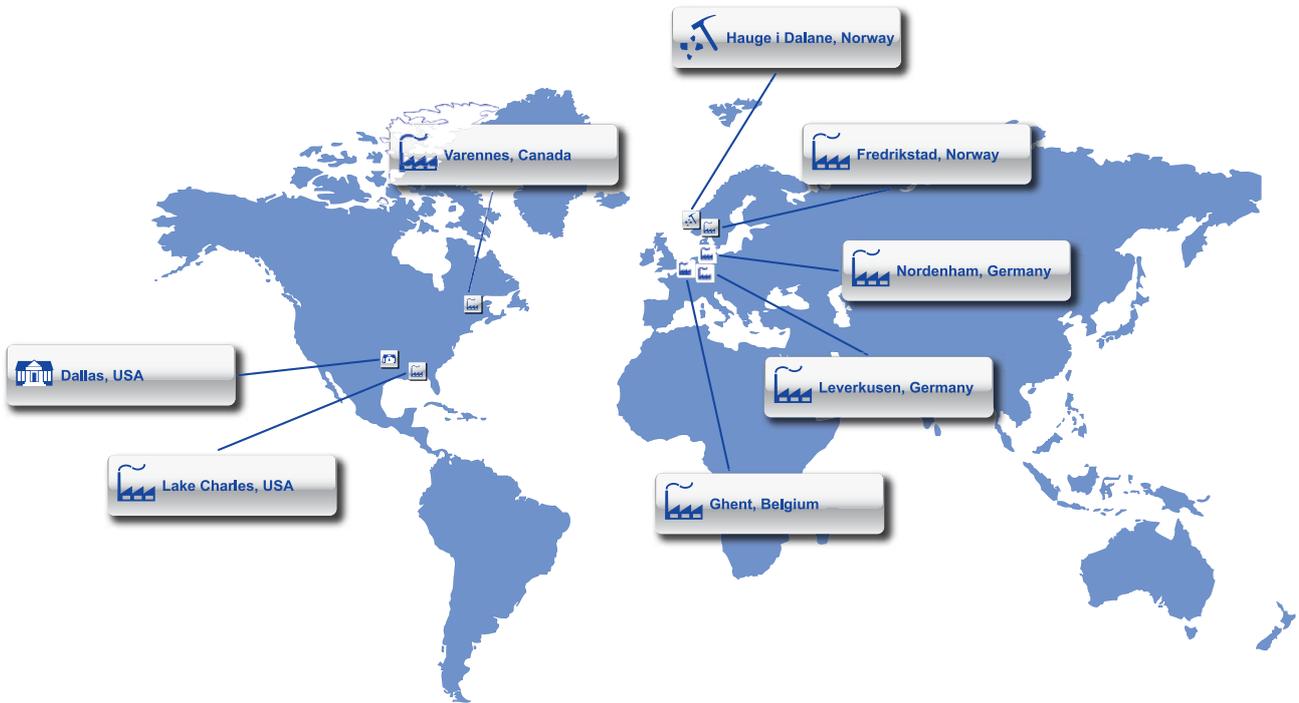
³ No sediment at the bottom of bottle, drum or IBC (→ excellent storage stability results). The pigment concentrate can easily be homogenized by stirring.

Fig. 5: KRONOS 9900 shows excellent storage stability results



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