

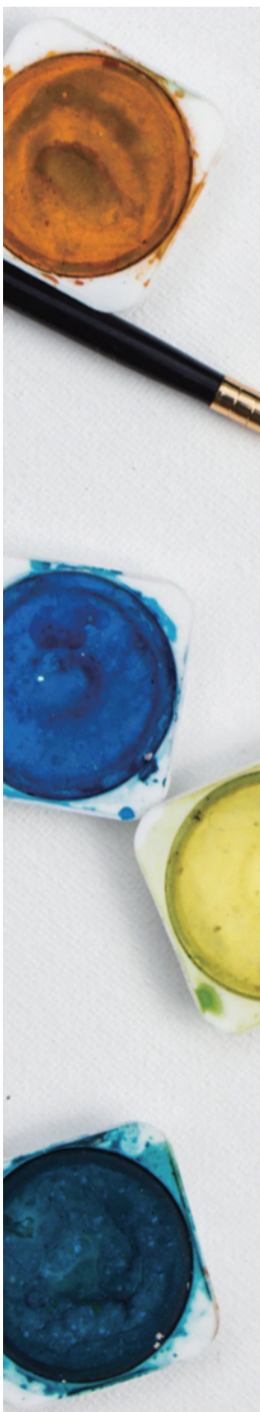
TINOX[®] Titanium Dioxide *for paints & coatings*

·R-2140 ·R-2160 ·CR-1120
·R-2180 ·A-2380 ·SUR-100

TINOX
make colors bright

Tinox TiO₂ for paints & coatings

"TINOX® pigment performance meet economics"



Introduction

This brochure is your guide to the correct selection of TINOX® titanium dioxide products for applications in paints and coatings.

Many years of experience in the production of titanium dioxide pigments is the basis for successful development and optimization of TINOX® titanium dioxide pigments for paint and coating applications. This has resulted in a clearly structured pigment portfolio from which a wide range of applications.

Starting product developments with a manageable number of different pigment grades and fewer production changes, and thus easier to achieve consistent product quality, are proven additional values for our customers.

This corporate strategy has resulted in the intelligent TINOX® pigment portfolio "The right choice" for paint & coating TiO₂ pigments.

Depending on the end application, this high level results in different demands on the TiO₂-pigment grades to be used.

Related products

TINOX® R-2180 The "balanced" choice

TINOX® R-2180 is a rutile universal pigment from the sulphate process for aqueous and solvent-based paint and coating systems. It produces excellent balanced properties between whiteness, undertone and hiding power. This pigment is suitable for interior and exterior applications. TINOX® R-2180 shows strong hiding-power with strong gloss and shows strong dispersing properties.

TINOX® R-2160 The "bright" choice

TINOX® R-2160 is a rutile universal pigment from the sulphate process for aqueous and solvent-based paint & coating systems. It generates excellent whiteness and excellent blue undertone on level of various CP-grades. This pigment is suitable for interior and exterior applications. TINOX® R-2160 generates good hiding-power with excellent gloss and shows excellent dispersing properties.

TINOX® R-2140 The "covering" choice

TINOX® R-2140 is a rutile TiO₂ universal pigment from the sulphate process for aqueous and solvent-based paint & coating systems. It generates strong whiteness at a very acceptable undertone. This pigment is suitable for indoor and outdoor applications. TINOX® R-2140 generates excellent hiding-power with strong gloss and shows strong dispersing properties.

TINOX® CR-1120 The "full" choice

TINOX® R-1120 is a universal pigment from the chloride process for aqueous and solvent-based paints & coatings systems. It generates excellent whiteness and excellent blue undertone. This pigment is suitable for interior and exterior applications. TINOX® CR-1120 generates excellent hiding-power, excellent gloss and shows excellent dispersing properties.

TINOX® A-2380

TINOX® A-2380 is a universal anatase pigment which is pure, dry-milled and untreated. This pigment is used in a wide range of applications in colors, paper and ceramics and special applications, especially where the excellent bluish undertone of anatase is desired. Due to the absence of post-treatment, A-2380 is exclusively suitable for indoor applications.

TINOX® SUR-100

TINOX® SUR-100 is a universal rutile pigment from the sulfate process which is pure and untreated. This pigment is used in a wide range of applications like in paints, paper and rubber and special applications especially where strong hiding power of rutile is desired.

Tinox TiO₂ for paints & coatings

“TINOX® in different grades meet all your needs.”



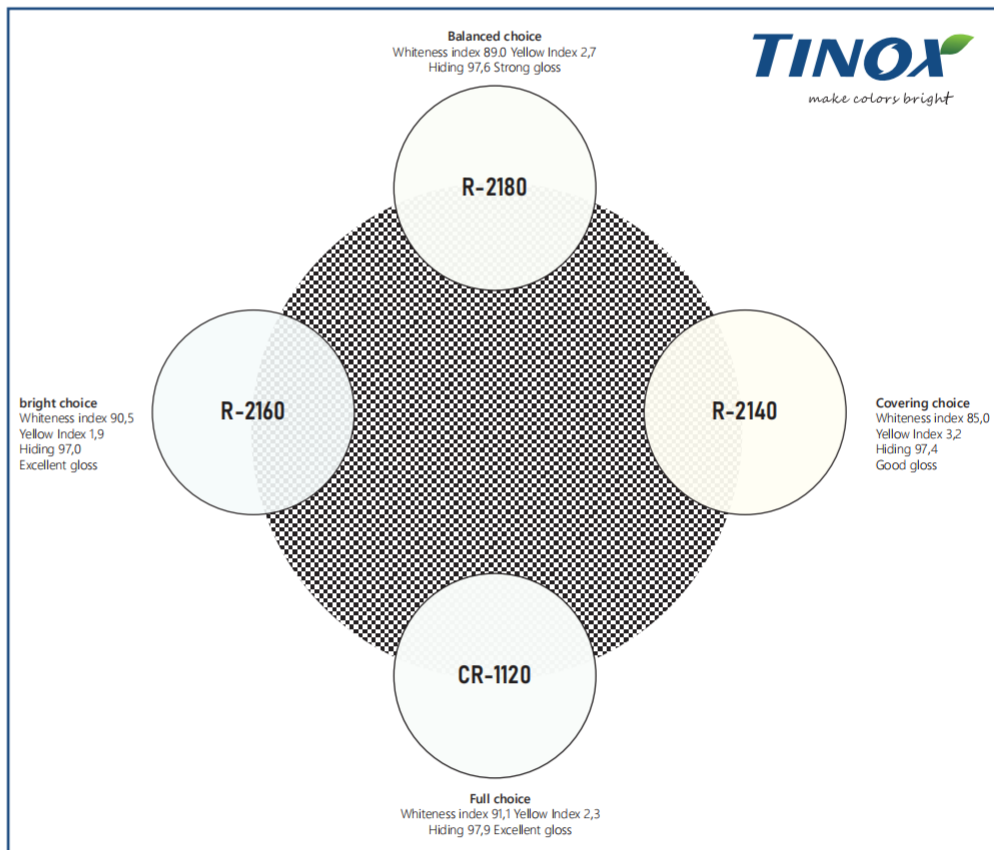
Introduction TINOX® TiO₂ the right choice

TINOX® product portfolio for paints & coatings is structured in a way that weighted basic requirements can be covered by selecting a specific TINOX® pigment grade.

While the sulfate rutile R-2160 generates an excellent blue undertone as mainly TiO₂-pigments produced from the chloride process, R-2140 shows its strengths in excellent hiding power with very acceptable undertone.

R-2180 generates a balanced ratio of undertone and hiding power and is thus suitable to reproduce these two excellent properties at a strong level. R-2180 thus combines the bluish undertone property of the "bright" choice R-2160 and the hiding power of the "covering" choice R-2140 in a well-balanced ratio. Chloride process grade CR-1120 combines all optical performance properties at the highest level. White Index, blue undertone, hiding power and gloss introduced into the pigmented system are outstanding.

Figure 1: Weighted basic requirements can be covered by selecting a specific TINOX® pigment grade.



Tinox TiO₂ for paints& coatings

“TINOX® adopt different combinations of treatments to ensure better results”



Overview and classification

Classification and overview of typical properties of TINOX® superfine milled TiO₂ types with different combinations of inorganic and organic surface treatments.

Tab 1.: Classification of basic data TINOX® pigment types for paints & coatings

Parameter	R-2180	R-2160	R-2140	CR-1120	A-2380
Process	sulphate	sulphate	sulphate	chloride	sulphate
Standard Classification ¹⁾	R2	R2	R2	R2	A1
Inorganic treatment	Al, Si	Al, Zr	Al, Zr	Al, Zr	N.A.
Organic treatment	Polyalcohole	Polyalcohole	Polyalcohole	Polyalcohole	N.A.
TiO ₂ content min. [%] ²⁾	≥93	≥93	≥94	≥93	≥98
Density [g/cm ^{3,3)}	4.2	4.2	4.2	4.2	3.9
Bulk density [kg/m ³]	780	790	810	960	580
Tinting Strenght ⁴⁾	≥1900	≥1880	≥1900	≥1900	
Oil absorption (ISO 787/5)	≤17	≤18	≤20	≤20	≤23
Particle size d50,m [µm] ⁵⁾	0.44	0.35	0.42	0.39	0.36
White Index Berger (powder) ⁶⁾	89.0	90.5	85.8	91.1	95.7
Yellow Index E-313 (powder) ⁶⁾	2.7	1.9	3.4	2.3	0.1
Weathering resistance ⁷⁾	B	B	B	B	A

1) The classification corresponds to DIN EN ISO 591, part 1.

2) Titanium dioxide content depends on the quantity of the inorganic post-treatment.

3) Density of crystal (rutile resp. anatase)

4) Determination of Tinting Strength according Reynolds against internal reference pigment.

5) Determination of D50,m according ISO 13320 by laserscattering method (wet dispersed).

6) Determination by colorimetric measurement of powder tablet with light source C2 and 2° observer.

7) According to internal classification. A= no weathering resistance, B=strong weathering resistance, C=excellent weathering resistance.



Tinox TiO₂ for paints & coatings

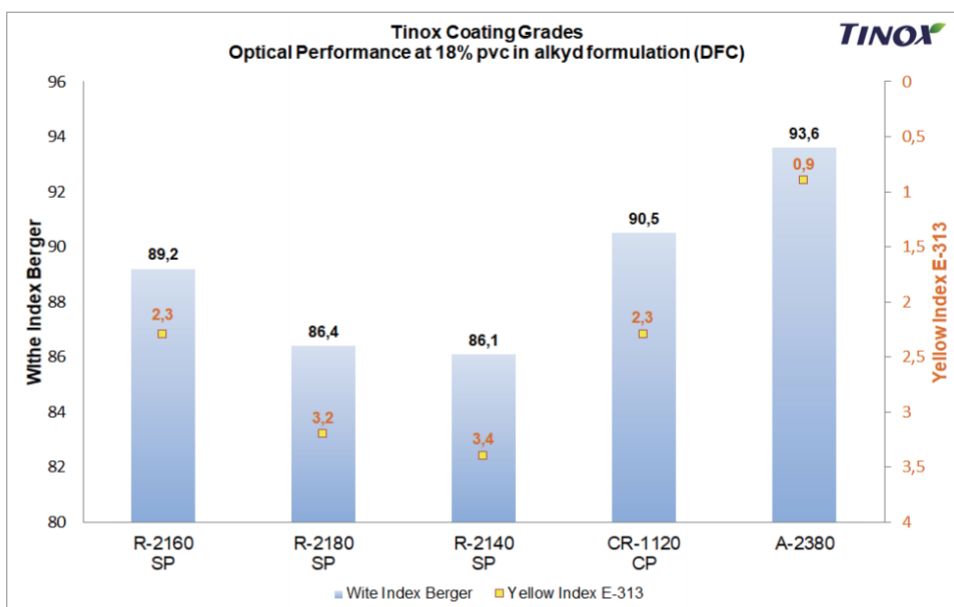
“TINOX® TiO₂ grades colors properties varies.”



TINOX® optical range of portfolio

TINOX® pigment portfolio for use in paints & coating consists of rutile and anatase grades which are manufactured by sulfate and chloride process. The products have different strengths in their pigment properties and complement each other.

Figure 2: Optical performance of TINOX® TiO₂ portfolio, determined in alkyd formulation.



Since the properties of pigmented systems cannot be calculated from the pure pigment properties due to various interactions between the components, the optical performance is tested in the dried alkyd film.

The TiO₂ pigment to be tested is dispersed into a medium oil alkyd resin paint using an automatic Pigment Muller. The reflectance values of the dried paint layers are determined with spectral colorimeter under light source C₂° and converted into Whiteness Index WI and Yellow Index YI.



“TINOX® was designed both for decorative and industrial purpose”



Decorative & Industrial application

The control of the manufacturing process and the associated direct influence on the quality of the manufactured goods has the top priority at TINOX®. Consulting and analytical support of TINOX® customers with state-of-the-art analytical and test methods as well as support of our customers with methods, specially developed for TiO₂-pigments testing, are an integral part of our business process. The physical and chemical properties of TiO₂ pigment grades from TINOX® are continuously compared with those of high-quality competitors. The data and information created in this way come specifically to our customers, e.g. within the scope of pigment consulting, and increase the opportunities for our pigment development.

Decorative paints & varnishes

The basic requirements of titanium dioxide to produce high-quality decorative paints are reliably met by TINOX® TiO₂ paint and varnish grades.

- * Universally applicable in water-based and solvent-based systems
- * Easily dispersible, e.g. also with dissolver equipment
- * Inorganic and organic surface post-treatment tailored to the application in paints & coatings is the key to producing excellent high-quality products

Tab. 2: Application fields of TINOX® TiO₂-Grades in architectural paints

Application	R-2180	R-2160	R-2140	CR-1120	A-2380
Emulsion paints, interior	X	X	X	X	X
Emulsion paints, exterior	X	X	X	X	
Gloss emulsion paints		X		X	
Semi-gloss emulsion paints		X	X	X	
Wood protecting coatings	X	X	X	X	
Silicone paints	X	X	X	X	
Silicate paints				X	
Plasters, emulsion-bound	X	X	X	X	

X highly recommended
 X advisable



“All the partners recognise TINOX® as a brand of reliability”

Industrial Coatings

The basic requirements of titanium dioxide to produce high-quality industrial coatings are reliably met by TINOX® TiO₂ paints and coatings.

- * Strong dispersing properties
- * Good wettability
- * Ultrafine particle
- * Resistance to challenging environments, e.g. high resistance to chalking and loss of gloss
- * Increased stability of the optical properties in the pigmented system

Tab. 3: Application fields of TINOX® TiO₂-Grades in industrial coatings

Application	R-2180	R-2160	R-2140	CR-1120	A-2380
Waterborne interior	X	X	X	X	X
Waterborne exterior	X	X	X	X	
Solvent based interior	X	X	X	X	
Solvent based exterior	X	X	X	X	
Powder coatings interior	X	X	X	X	
Powder coatings exterior	X	X	X	X	
Low-VOC systems		X	X	X	
Coil coatings				X	
Can coatings		X		X	
Marine Coatings & Automotive				X	
Road marking paints	X		X		
Printing Inks flexographic				X	
Printing Inks Screen		X		X	

X highly recommended
 X advisable



Tinox TiO₂ for paints & coatings

“TINOX® build labs in Germany and China to develop new products and provide with high level QC management.”



TINOX® TiO₂ Pigment Testing

TINOX® has established a variety of controls that ultimately benefit the consumer. These control measures are used to verify that a pigment grade always retains its proven suitability for a specific application without change.

Tests are necessary because the specific relationships between the TiO₂-pigments characterizations and the application properties must be carried out in the formulation system.

Figure 3: Verification of the crystal structure SP-rutile R-2140 by X-ray diffraction XRD. Pure rutile phase with process usual traces of anatase.

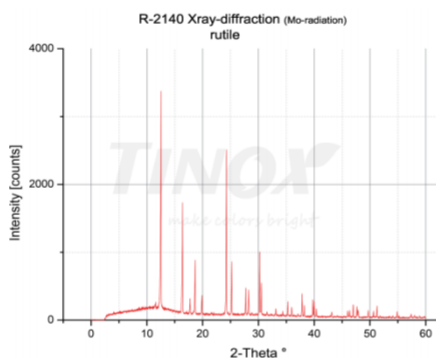


Figure 4: Verification of the crystal structure SP-rutile R-2160 by X-ray diffraction XRD. Pure rutile phase with process usual traces of anatase.

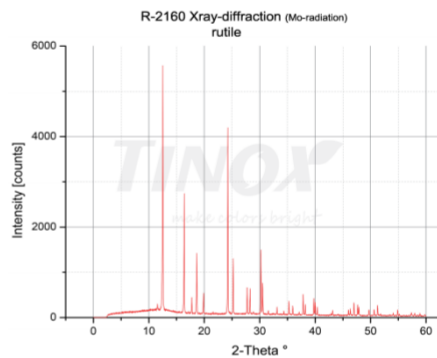


Figure 5: Verification of the crystal structure SP-rutile R-2180 by X-ray diffraction XRD. Pure rutile phase with process usual traces of anatase.

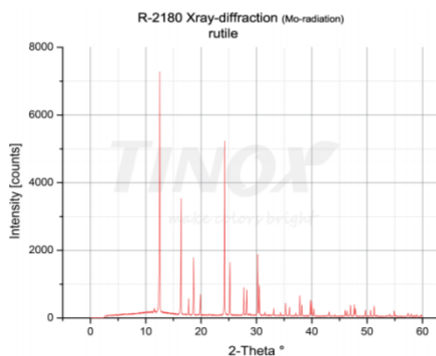
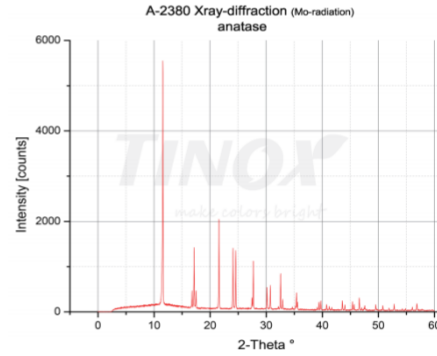


Figure 6: Verification of the crystal structure anatase A-2380 by X-ray diffraction XRD. Pure anatase phase.



“TINOX® are dedicated to provide services to all TiO₂ applications.”



TINOX® TiO₂ pigment slurry stability

TiO₂-pigments for applications in paint & coatings usually undergo inorganic and organic surface post-treatment during the manufacturing process. In the inorganic post-treatments, for example, aluminates, silicates, aluminosilicates or zirconium compounds are precipitated onto the pigment surface. The aim of this post-treatment is to improve the application properties of the TiO₂-pigments. Important properties such as whiteness, hiding power, weathering resistance and dispersion properties are thus improved. Depending on the pigment grade, the inorganic post-treatment is adapted to the respective application.

Surface characterization of TiO₂-pigments can help to clarify the relationship between surface treatment and application properties. For this reason, surface characterization of the post-treated TiO₂-pigments is an important tool for the development of new pigment grades or their optimization. However, knowledge of the surface chemistry of the TiO₂-pigments used is also of great importance for the end user in the manufacture of paints & coatings.

The inorganic surface treatment of a TiO₂-pigment for paints & coatings has an influence on the position of the isoelectric point in an aqueous TiO₂-dispersion, and thus on the dispersion stability within a formulation.

Monitoring of the quality and consistency of post-treatment is carried out closely at TINOX®. The measurement technology used for this purpose operates at high process concentrations and characterizes the technical dispersions in a condition as it is also present at the end customer where sedimentation processes are often suppressed and not detected by strong agitators in the large process vessels. These process conditions are included in the stability analysis performed at TINOX®. The measurement results of the highly concentrated TiO₂-pigments correlate directly with the electrokinetic properties of the dispersed product.

Figure 7: Exemplary determination of the isoelectric point of a 20 wt% aqueous R-2160 dispersion under process-like conditions. This grade has an aluminum and zirconium post-treatment. The applied surface chemistry determines the flocculation point at pH7.

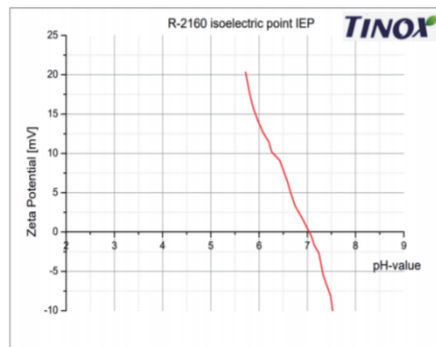
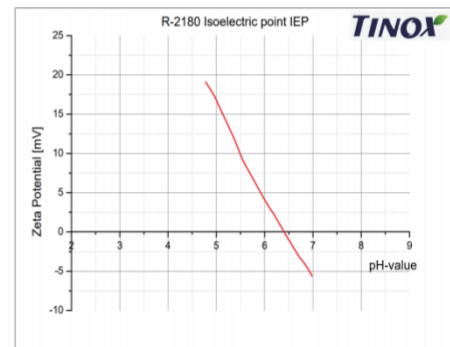


Figure 8: Exemplary determination of the isoelectric point of a 20 wt% aqueous R-2180 dispersion under process-like conditions. This grade has an inorganic aluminum and silicon post-treatment. The applied surface chemistry determines the flocculation point at pH 6.4.



Tinox TiO₂ for paints & coatings

“TINOX® adopt strict QC process to guarantee the stable and quality.”



TINOX® Quality Control

The quality of the manufactured products has top priority at TINOX®.

Consulting and analytical support for TINOX® customers with state-of-the-art analytical and testing methods as well as supporting our customers with methods specifically developed for TiO₂-pigment testing are an integral part of our business process.

Quality Demands

The requirements for titanium dioxide pigments vary widely in the numerous application areas. This results in a high demand for specific test methods in quality control. We meet this need by operating a comprehensive analytical and pigment testing department. The end result is a gapless monitored manufacturing process at TINOX® with close-meshed quality control of the end products.

Test Language

The high quality requirements for our products are assured by defined test and inspection methods. A common test language based on precisely defined methods and used parameters represents a clear communication platform between our quality control and the end customers. TINOX® has therefore established a set of well-defined controls to verify that a pigment grade always maintains its proven suitability for a particular application.

Test-values

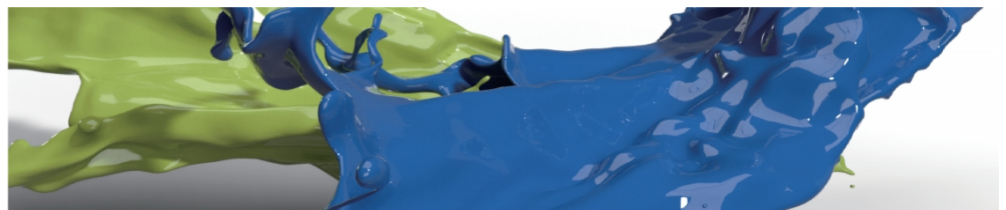
The test values characterizing certain application properties are seen as final results of complex interactions. They are composed of the input of all components used, such as test materials, instruments, environmental conditions and the influence of the operator. In our company performed method validations are a basis for reproducibility and accuracy of the generated test values.

Action

The chemical composition, as well as physical and application properties of our TiO₂-pigment products are compared with those of global competitors in a continual process.

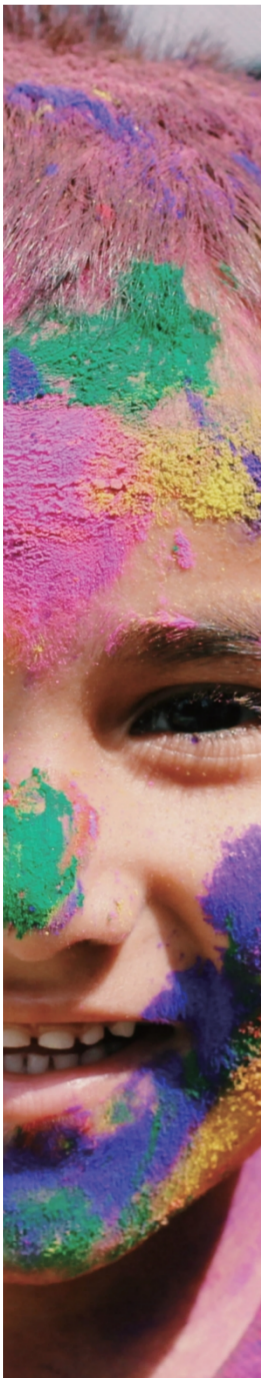
This results in a continuous improvement process that enables us to compare the quality of our products not only in absolute terms, but also always relative to the most successful worldwide competitor products. The data and information obtained continuously in this way provide a reliable basis for classifying the quality and performance of our products in the competitive environment.

As an integral part of our business process, this knowledge is certainly incorporated into the value of our TINOX® TiO₂ products in order to generate added value for our customers, e.g. in the context of pigment consulting.



Tinox TiO₂ for paints & coatings

“TINOX® fulfilled all the requirements of REACH-EC Regulation 1907/2006.”



TINOX® TiO₂ Safety, Quality and Packaging

Safety, health and the environment

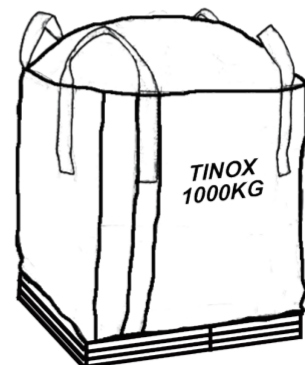
TINOX® Titanium Dioxide is stable under normal conditions and inert to most chemical substances. Titanium dioxide is generally not classified as hazardous to human health or the environment, and is also a non-hazardous substance for transportation. In dealing with TINOX® dust is possible. In the case of long-term exposure of TiO₂ dust suitable dust respiratory carrier should be used. All requirements of REACH-EC-Regulation 1907/2006 are fulfilled. There is a safety data sheet for TINOX®. Titanium dioxide from TINOX® meets the legal limits for use in materials that come into contact with food.

Quality

The production and distribution of TINOX® Titanium Dioxide takes place within the framework of the certified quality management system ISO 9001, as well as the ISO 14001-certified environmental management system and the OHSAS 18001.

Package

TINOX® TiO₂ pigments are packed as bagged goods with 25 kg net weight or in big bags for 1000 kg net. TINOX® is supplied on disposable wooden pallet (each pallet 1 ton), pallets are covered with polyethylene shrink film. Special packaging and labels can be arranged on request.



TINOX

make colors bright



SCAN FOR E-VERSION

For further information, please contact:

TINOX CHEMIE GMBH (Headquartered)

Add: Lütticher Straße132,Düsseldorf,Deutschland

Tel: +49 (0)211 52809600

Email: sale@tinnoxchem.de

TINOX (INDIA) CHEMICALS LLP (Branch company)

Add: Silver astra, office No.63 6TH floor, near J B nagar circle Andheri east, Mumbai 400 059 maharastra, India

Tel: +91 8137003079

Email: sale@tinnoxchem.com

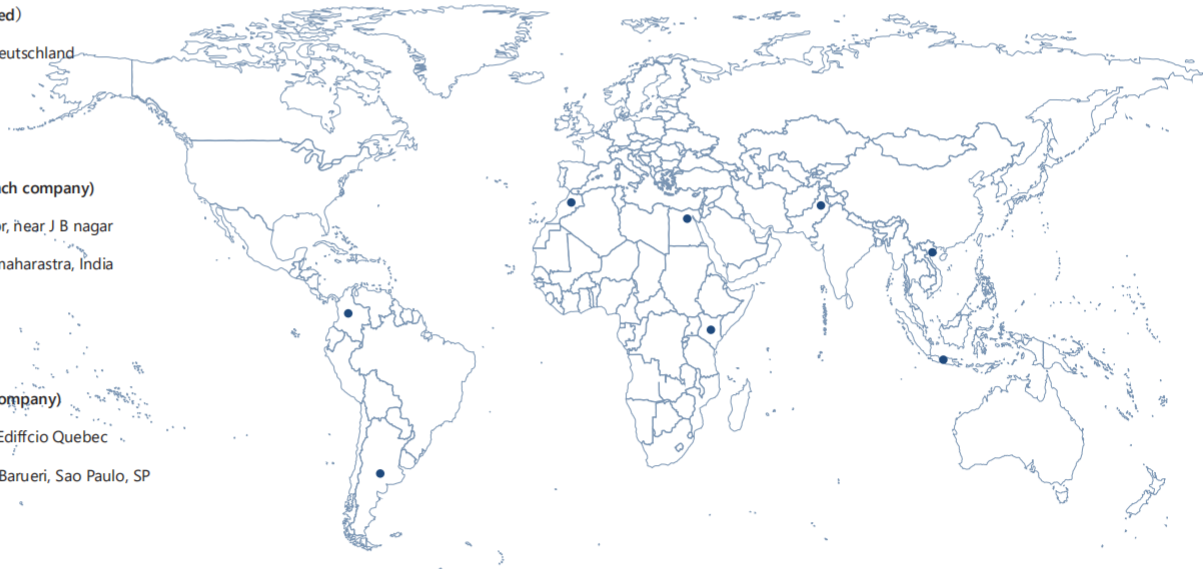
TINOX CHEMIE DO BRASIL (Branch company)

Add: Alameda Madeira, 162-Sala 308 Edificio Quebec

Business Center- Alphaville Industrial-Barueri, Sao Paulo, SP

Tel: +55-11 97073-3570

Email: sale@tinnoxchem.com



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TINOX
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Tinox Chemie Gmbh, www.tinnoxchem.com, +49 (0)211 52809600, sale@tinnoxchem.com, Düsseldorf, Deutschland