

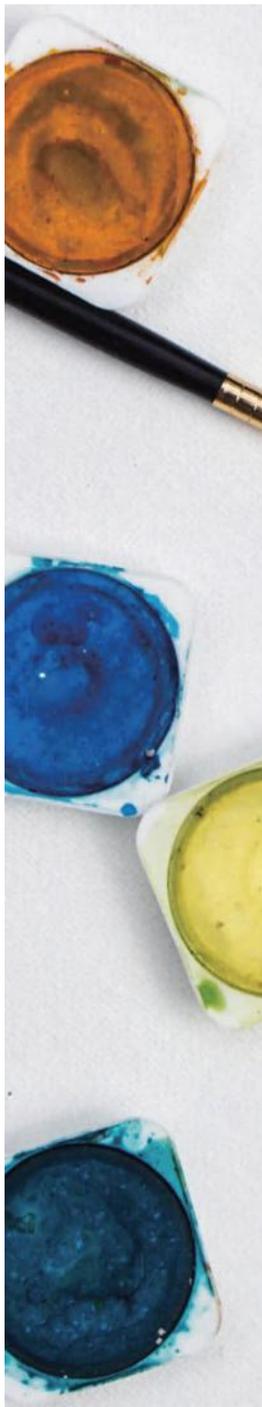
# **TINOX<sup>®</sup> Titanium Dioxide** *for paints & coatings*

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

**TINOX**  
*make colors bright*

# Tinox TiO<sub>2</sub> for paints & coatings

“TINOX® pigment performance meet economics”



## Introduction

This booklet is your guide to the right selection of suitable titanium dioxide products for applications in paints & varnishes. The TINOX® Guide contains a classification of TINOX® TiO<sub>2</sub> types, depending on the property and the usage.

Many years of experience in the production of TINOX® titanium dioxide has been used to develop different qualities which lead to a number of advantages in the application in paints & varnishes. High consistent standard and rigorous requirements for your specific application are achieved. The availability of TINOX® titanium dioxide pigments in some classes allows the use in decorative and industrial colors in a wide variety.

TINOX® titanium dioxide types for paints and varnishes have an optimal average particle size and very narrow particle size distribution.

TINOX® Titanium Dioxide pigments produce a high color strength, neutral or slightly blue undertone in the color matrix. The high reflectivity in the wavelength range of the visible light and their high scattering capacity in the lacquer formulations are other important features. Effective surface treatment leads to high electrostatic stability in different dispersed phases at high technical concentrations, which leads to good handling properties in the process as well as the finished product. TINOX® micronized rutile qualities with higher inorganic surface treatment suppressed by UV radiation decomposition processes of the binder and thus increase the durability of the lacquer & color products in the outdoor area with respect to chalking resistance and glossy posture.

## 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 White-Index, Yellow-Index and hiding power. This pigment is suitable for interior and exterior applications. TINOX® R-2180 shows strong hiding-power with strong gloss and 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 and coating systems. It produces excellent White-Index and low Yellow-Index on level of various CP-grades. This pigment is suitable for interior and exterior applications. TINOX® R-2160 shows good hiding-power with excellent gloss and excellent dispersing properties.

### TINOX® R-2140

#### The “covering” choice

TINOX® R-2140 is a rutile TiO<sub>2</sub> universal pigment from the sulphate process for aqueous and solvent-based paint and coating systems. It produces good optical properties in the pigmented system. This pigment is suitable for indoor and outdoor applications. This TiO<sub>2</sub> pigment type produces excellent hiding power, good gloss properties with strong dispersibility.

### TINOX® CR-1120

#### The “full” choice

TINOX® R-1120 is chloride process rutile TiO<sub>2</sub> pigment, which is coated with inorganic Al<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub> and special organic surface treatment. R-1120 has excellent glossiness, excellent dispersibility, excellent weather resistance and strong hiding power.

### TINOX® A-2380

TINOX® A-2380 is a pure, dry-milled anatase-universal pigment from the sulphate process. This pigment is used in a wide range of applications in colors, paper and ceramics, especially where the high whiteness of anatase is desired. TINOX® A-2380 gives the pigmented system an excellent brightness and shows strong dispersing properties with a neutral undertone.

### TINOX® SUR-100

TINOX® SUR-100 is an uncoated pure rutile universal pigment from the sulfate process. This type of pigment is used in a wide range of applications, among others, in paints, paper and rubber, especially where high tinting strength and high hiding power of rutile is desired. TINOX SUR-100 performs with strong hiding power, strong tinting strength and excellent dispersibility.

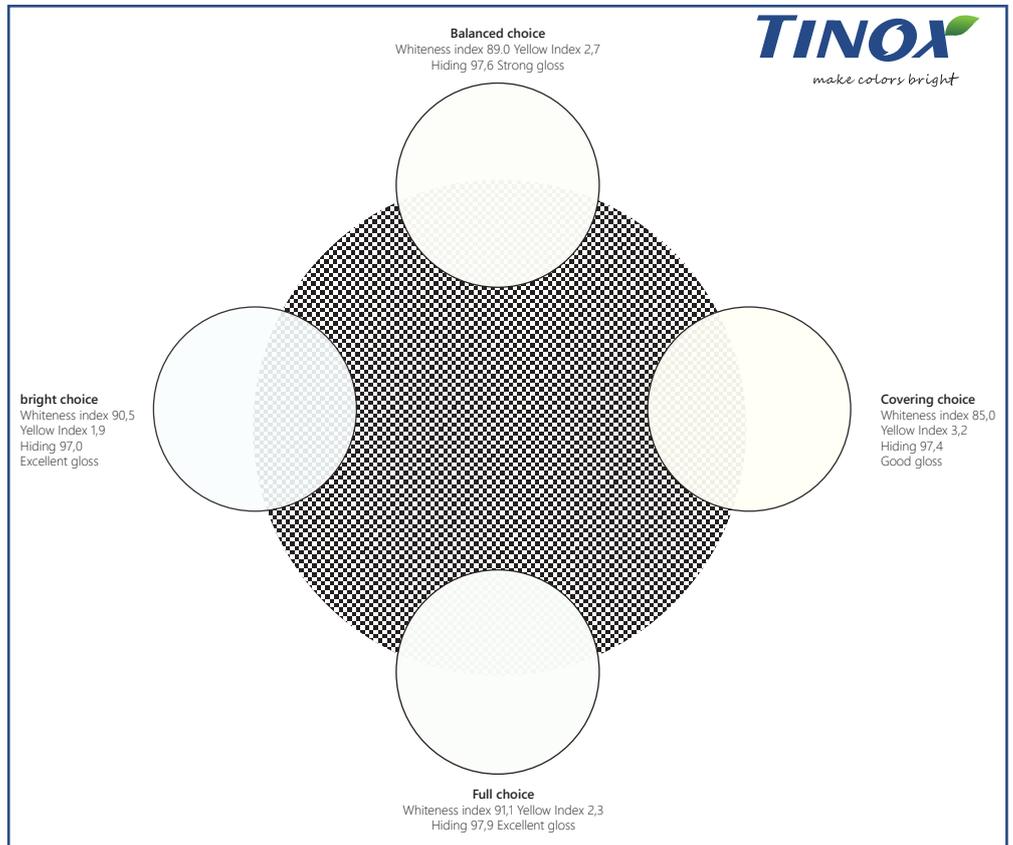
# Tinox TiO<sub>2</sub> for paints & coatings

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

## Introduction TINOX® TiO<sub>2</sub> the right choice

TINOX® product portfolio is structured in such a way that weighted basic requirements can be covered by suitable selection of a TINOX® pigment grade. While R-2160 produces such an excellent white index and yellow index that is mainly covered by CP grades, R-2140 produces excellent opacity with a still acceptable yellow undertone. In between, grade R-2180 can be selected as a pigment with balanced optical properties which combines the strengths of R-2160 and R-2140 in a balanced way. Thus, R-2180 creates a strong brightness with a neutral undertone while maintaining strong hiding power. TINOX® CP grade CR-1120 combines all optical performance properties on highest level. White-Index, blue undertone, hiding-power and gloss brought into the pigmented system is excellent.

Figure 2: Graphical illustration of TINOX® TiO<sub>2</sub> grades with its respective performance.



# Tinox TiO<sub>2</sub> 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 TiO<sub>2</sub> 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	sulfate	sulfate	sulfate	chloride	sulfate
Standard Classification <sup>1)</sup>	R2	R2	R2	R2	A1
Stabilization (Elements)	Al,Zr	Al,Zr	Al,Zr	Al, Zr	No
Organic treatment	TMP	TMP	TMP	TMP	none
TiO <sub>2</sub> - content min. [%] <sup>2)</sup>	≥93	≥93	≥94	≥93	>98,0
Density [g/cm <sup>3</sup> ] <sup>2)</sup>	4,2	4,2	4,2	4,2	3,9
Bulk density [kg/m <sup>3</sup> ]	780	790	810	960	580
Tinting Strenght <sup>4)</sup>	≥1900	≥1880	≥1900	≥1900	
Oil absorption (ISO 787/5)	≤17	≤18	≤20	≤20	≤23
Particle size d50,m [µm] <sup>5)</sup>	0,44	0,35	0,42	0,39	0,36
Powder Flowability <sup>3)</sup>	1,6	1,6	1,4	1,8	1,4
White Index Berger powder <sup>6)</sup>	89,0	90,5	85,8	91,1	95,7
Yellow Index E-313 powder <sup>6)</sup>	2,7	1,9	3,4	2,3	0,1
pH value <sup>7)</sup>	7,0	6,8	6,3	6,4	7,6
Isoelectric point IEP <sup>7)</sup>	7,5	7,5	7,2	7,3	none

1) The classification A1, A2, R1, R2, R3 corresponds to DIN EN ISO 591, part 1.

2) 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 and pure anatase has a density of 3,8

3) Bulk densities of pigments may vary depending on storage conditions. Bulk density and flowability values determined by Ringscher Method

4) Determination of Tinting Strenght according to Reynolds and is part of quality control at plants. An internal standard is used as a reference pigment.

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

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

7) Isoelectric point and pH value of 10 wt% TiO<sub>2</sub> suspension, stirred in H<sub>2</sub>O, determined by electroacoustic method.



# Tinox TiO<sub>2</sub> for paints & coatings

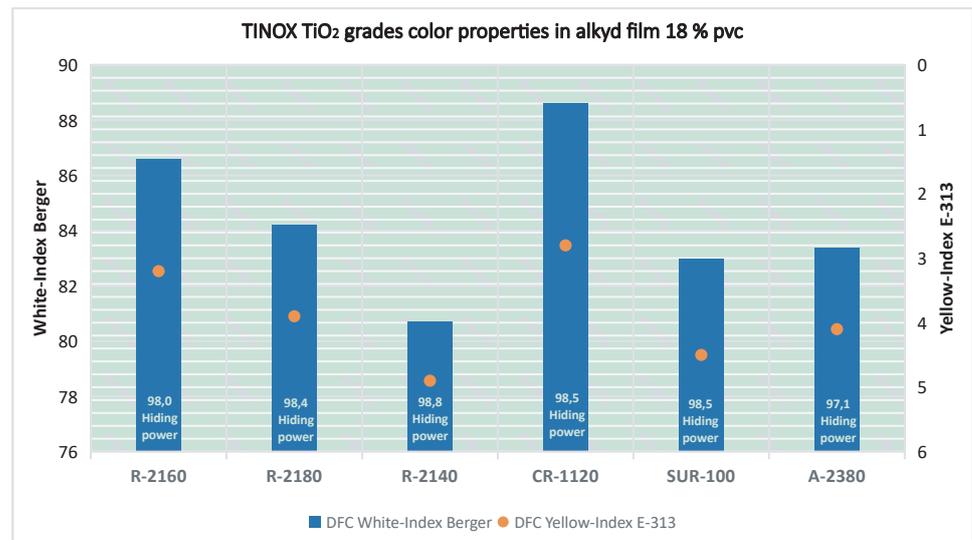
“TINOX® TiO<sub>2</sub> grades colors properties varies.”



## 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® TiO<sub>2</sub> portfolio, determined in alkyd formulation.



Because properties of pigmented systems are not calculable from the pure pigment properties due to various interactions between the components, the performance was measured at dried alkyd formulation with pigment volume concentration in height of 18 % on 120µm layer for hiding power and 450 micron layer for Brightness and b-value determination. Rutile grades R-2160, R-2140 complement each other in their optical performance while chloride grade CR-1120 is covering the largest performance range of all.



# Tinox TiO<sub>2</sub> for paints& coatings

“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 TiO<sub>2</sub> pigment testing, are an integral part of our business process.

The physical and chemical properties of TiO<sub>2</sub> 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 for titanium dioxide, for the production of high-quality decorative paints, are reliably fulfilled by TINOX® TiO<sub>2</sub> paint and varnish types.

\* Universally applicable in water-based and solvent-based systems

\* Easily dispersible, e.g. also using dissolver equipment

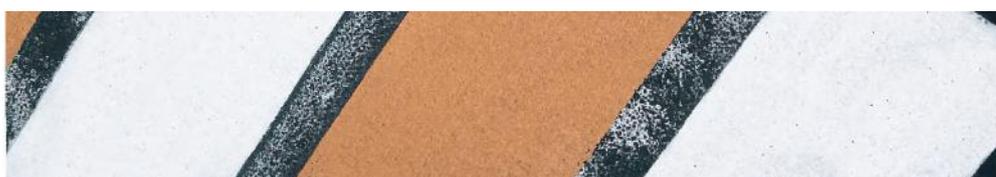
\* In highly concentrated technical dispersions they show a high electrostatic stability already by stir without dispersing

Tab. 2: Application fields of TINOX® TiO<sub>2</sub>-Grades in architectural paints

	R-2180	R-2160	R-2140	CR-1120	SUR-100	A-2380
Emulsion paints interior	●	●	●	●	●	●
Emulsion paints exterior	●	●	●	●		
Semi-gloss paints Interior	●	●	○	●		
Semi-gloss paints exterior	●	●	○			
Gloss emulsion paints	○	●		●		
Wood protecting coatings	●	●	●	●		
Silicone paints	○	●		●		
Silicate paints				●		
Plaster emulsion bond	●	●	●	●		

● Strongly Recommended

○ Advisable



# Tinox TiO<sub>2</sub> for paints& coatings

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

## Industrial Coatings

The basic requirements for titanium dioxide, for the production of high-quality industrial coatings, are met reliably by TINOX® TiO<sub>2</sub> paint and varnish types.

- \* Strong dispersing properties
- \* Good wettability
- \* 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® TiO<sub>2</sub>-Grades in industrial coatings

	R-2180	R-2160	R-2140	CR-1120	SUR-100	A-2380
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				●		
Can coatings	●	●		●		
Road marking paints					●	●
Printing Inks Flexographic				●		
Printing Inks Screen		●		●		

● Strongly Recommended

○ Advisable



# Tinox TiO<sub>2</sub> for paints& coatings

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



## TINOX® TiO<sub>2</sub> Pigment Testing

In the production of paints and varnishes, it is very important to avoid coagulation or agglomeration of a TiO<sub>2</sub> dispersion.

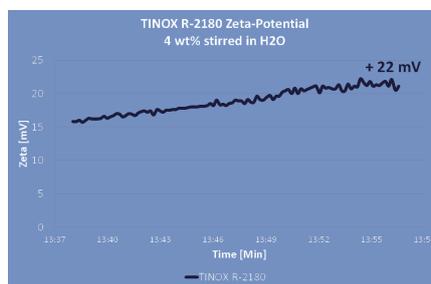
The zeta potential of the dispersion is a measure of the effective surface charge and the interaction of the TiO<sub>2</sub> pigment particles with each other.

The data of the samples analyzed in highly concentrated form directly relate to the electro kinetic properties of the dispersed particles in the raw material or in the finished product.

TINOX® R-2140 in a concentration of 4% by weight stirred in pure H<sub>2</sub>O.



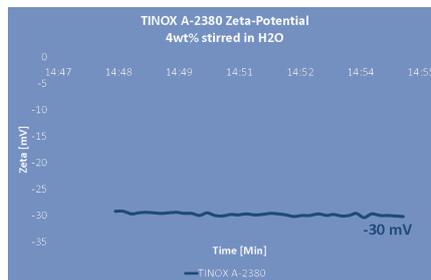
TINOX® R-2180 in a concentration of 4% by weight stirred in pure H<sub>2</sub>O.



TINOX® R-2160 in a concentration of 4% by weight stirred in pure H<sub>2</sub>O.



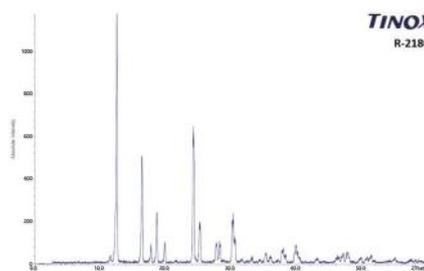
TINOX A-2380 in a concentration of 4% by weight stirred in pure H<sub>2</sub>O



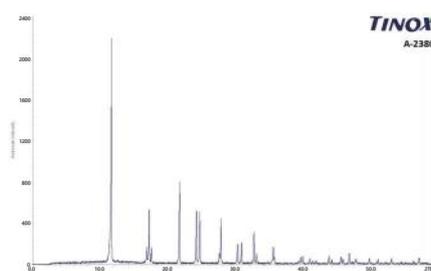
The powder diffractogram of the TINOX® TiO<sub>2</sub> pigment grades shows that the rutile crystal structure is in pure form. The traces of anatase modifications are common for TiO<sub>2</sub> pigments produced via the sulfate route, and are closely controlled by this method. The wider full width at half maximum FWHM of rutile main reflex R-298 is according to smaller crystallite size and leads to stronger blue undertone against

TINOX® R-2160 and TINOX® R-2140.

TINOX® R-2180 powder diffractogram (Mo radiation)



TINOX® A-2380 powder diffractogram (Mo radiation)



# Tinox TiO<sub>2</sub> for paints& coatings

“TINOX® are dedicated to provide services to all TiO<sub>2</sub> applications.”

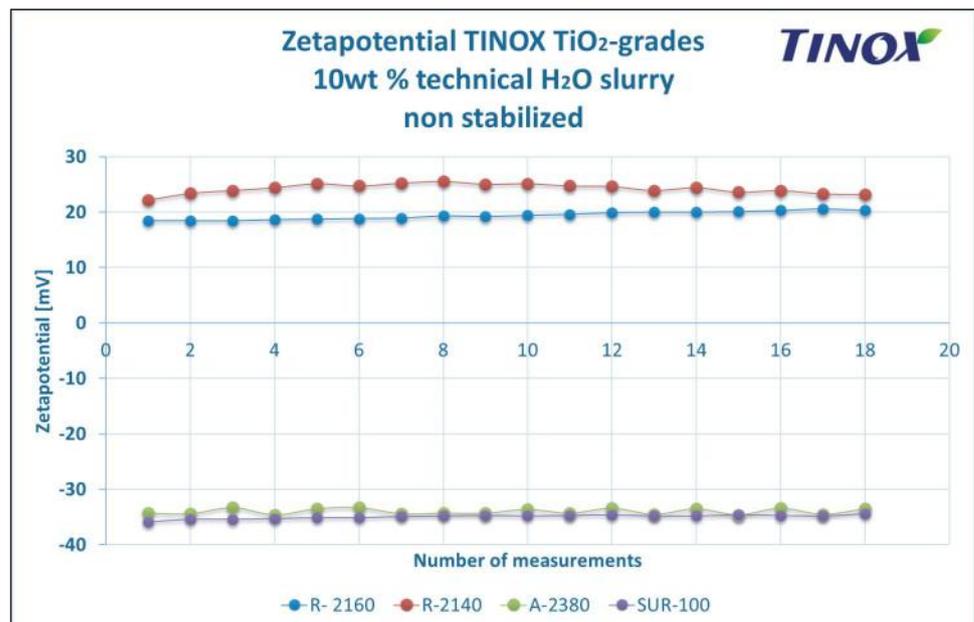


## TINOX® TiO<sub>2</sub>-pigment slurry stability

During the manufacturing process of paints, coatings and composite materials, avoiding the coagulation and agglomeration of the TiO<sub>2</sub> dispersion is important. Surface chemistry of TINOX® TiO<sub>2</sub>-pigments in highly concentrated aqueous technical slurries shows strong electrostatic stability, also close to neutral pH-value and without any stabilization additives in pure H<sub>2</sub>O matrix. Measuring the absolute surface charge of the TiO<sub>2</sub>-pigment gives a decisive parameter for an ultimate application of the product. Sedimentation is often inhibited by powerful agitators in the large-scale treatment containers. These process conditions are involved in the stability analysis carried out at TINOX®. Measurement results of the highly concentrated TiO<sub>2</sub>-pigments correlate directly with the electro kinetic properties of the dispersed product.

TINOX® R-2160 and R-2140 are electrostatically positively charged due to their inorganic post-treatment of the pigment surface in a pure aqueous environment, even in high technical concentrations.

Figure 3: In-line electrostatic stability screening of TINOX® grades in technical slurry.



Both untreated rutile and anatase grades SUR-100 and A-2380 are also electrostatically very stable in a purely aqueous environment. Both products are excellently suited for the production of highly concentrated TiO<sub>2</sub> slurries, as pre-production or as an end product.



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



## TINOX® Quality Control

### Quality Demands

The demands placed on titanium dioxide pigments in the numerous fields of application are very different. As a result, the development of special pigment grades leads to an extensive need for specific test methods in quality control that meet the respective application. For this reason, we are able to characterize the application-specific performance characteristics of TiO<sub>2</sub> pigments for lacquer and paint applications, plastics applications, fiber and paper applications and ultimately also for special types in niche applications.

### Test Language

The increasing use of titanium dioxide pigments and the ever increasing quality demands prompt us to develop numerous test and investigation methods. These methods are an important common test language between us and our customers, but also as a common test language within our own plant. TINOX® has therefore set up a number of controls that ultimately benefit the consumer. These control measures are used to check whether a pigment type always retains its proven suitability for a specific application.

### TiO<sub>2</sub>-Pigment Tests

Such suitability tests are necessary because the relationships between the pigment properties of a TiO<sub>2</sub> pigment and the properties of the finished pigmented system are not so clear that they can be calculated from the pigment properties. For example, from the refractive indices of the TiO<sub>2</sub> pigment, the amounts and the particle size distribution do not easily calculate the lightening power of the white pigment for the corresponding system. This fact is immediately understandable when one realizes that there are interactions between the components of a pigmented system that are temporarily beyond calculation.

### Test-values

The test values that are intended to characterize certain usage properties are complex in nature. They are composed of the properties of all components, all processing equipment and the influences of all processing, application and test methods. Accordingly, all test values are affected by the sum of all individual fluctuations and all individual errors. Binding statements about certain properties or conclusions about the cause of certain properties are therefore only possible if a test is repeated enough times and evaluated according to statistical principles. A single statement is of little value.

### Action

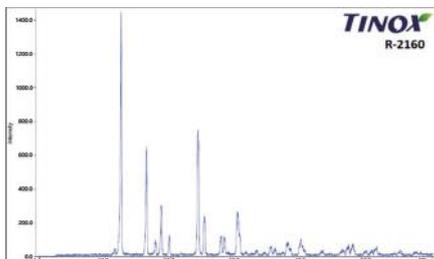
The control of the manufacturing process and the associated direct influence on the quality of the manufactured goods has the top priority at TINOX®. Consulting and analytical support of TINOX® customers with state-of-the-art analytical and test methods are an integral part of our business process. The physical and chemical properties of TiO<sub>2</sub> 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.

# Tinox TiO<sub>2</sub> for paints& coatings

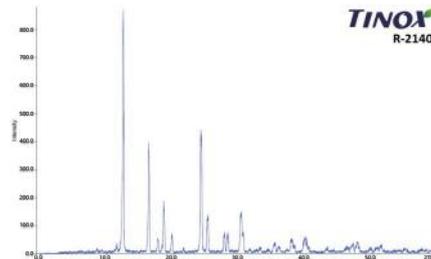
“TINOX® fulfilled all the requirements of REACH-EC Regulation 1907/2006.”



TINOX® R-2140 in a concentration of 4% by weight stirred in pure H<sub>2</sub>O.



TINOX® R-2140 powder diffractogram (Mo radiation)



## TINOX® TiO<sub>2</sub> Safety, Quality and Packaging

### Safety, health and the environment

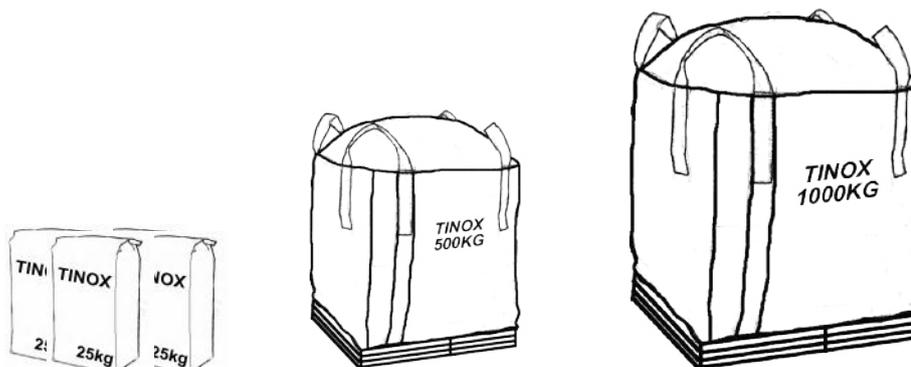
TINOX® Titanium Dioxide is stable under normal conditions and inert to most chemical substances. Titanium dioxide is generally not classified as hazardous to human health or the environment, and is also a non-hazardous substance for transportation. In dealing with TINOX® dust is possible. In the case of long-term exposure of TiO<sub>2</sub> 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® TiO<sub>2</sub> 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

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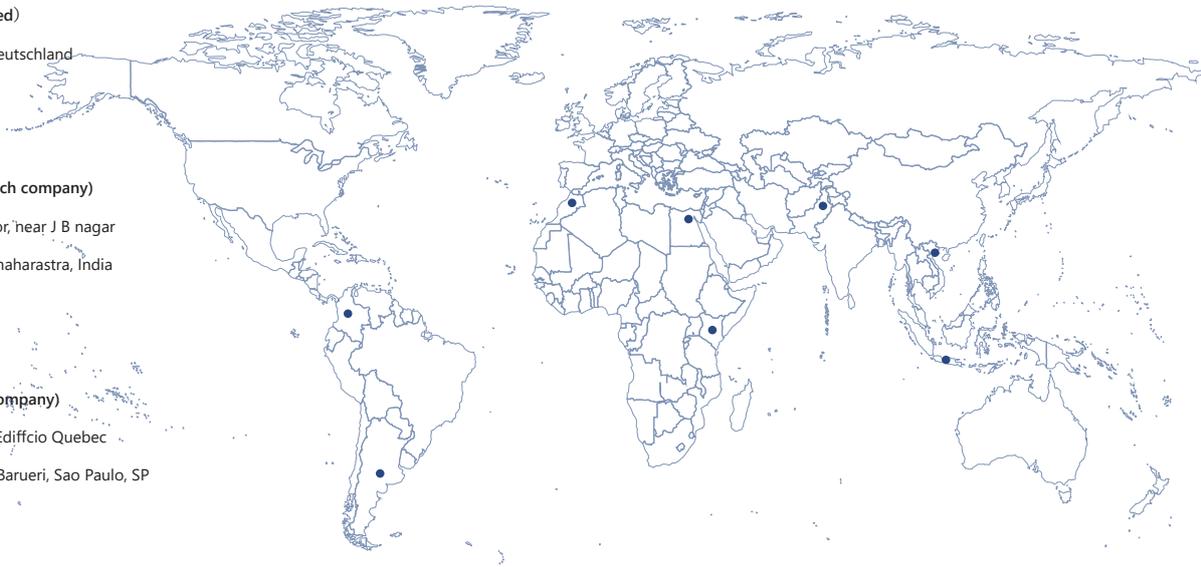
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