NANOFLEX® DURA & SAPPHIRE

nano enzo
Duurzame preventieve protectie

GERMAN INNOVATION AWARD '19 WINNER

Outperforming Ceramic Coatings
Technical Data and Analysis

SOLUTIONS TO MAINTAIN THE VALUE OF YOUR SURFACE: KEY FEATURES

- **Non-Stick:** water and dirt repellence offers long-term protection and facilitates cleaning
- **Graffiti and stain protection:** barrier properties of ultra-dense ceramic and quartz structures protect from dirt and contamination ingress.
- **Scratch protection:** surfaces are more resistant to wear and tear
- **Corrosion prevention:** ultra-density halts rust at source
- **UV-protection:** anti-aging preserves valuable surfaces
- **High temperature resistance:** No change in characteristics under intensive heat (up to 1000 degrees)
- **The perfect finish:** Color enhancement and gloss bring outstanding aesthetics to surfaces.
- **Easy-to-apply:** Perfect finish is achieved without the need for special training

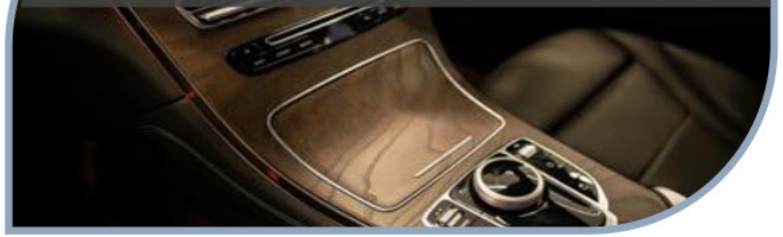
APPLICATIONS

Automotive

Using vehicles always carries risks – damage occurs regularly.
Our Nanoflex® Dura and Sapphire technology provides a remedy.

Protection of car bodywork from scratches, dirt and aging

Improved durability of decorative plastics and headlights



Universal protection from corrosion

Prevention of brake dust permanently bonding to wheel rims

Long-term protection in the automotive sector:

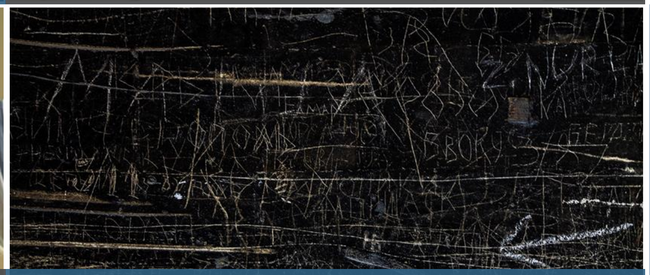
- **Exterior**: *Up to 100,000 km* or *100 washing cycles* in the car washing sector
- **Interior:** Matches durability of the surface

APPLICATIONS

Protection of the airplane fuselage from dirt and aging

Facilitates de-icing

Improved durability of decorative and strongly stressed plastics and synthetic materials

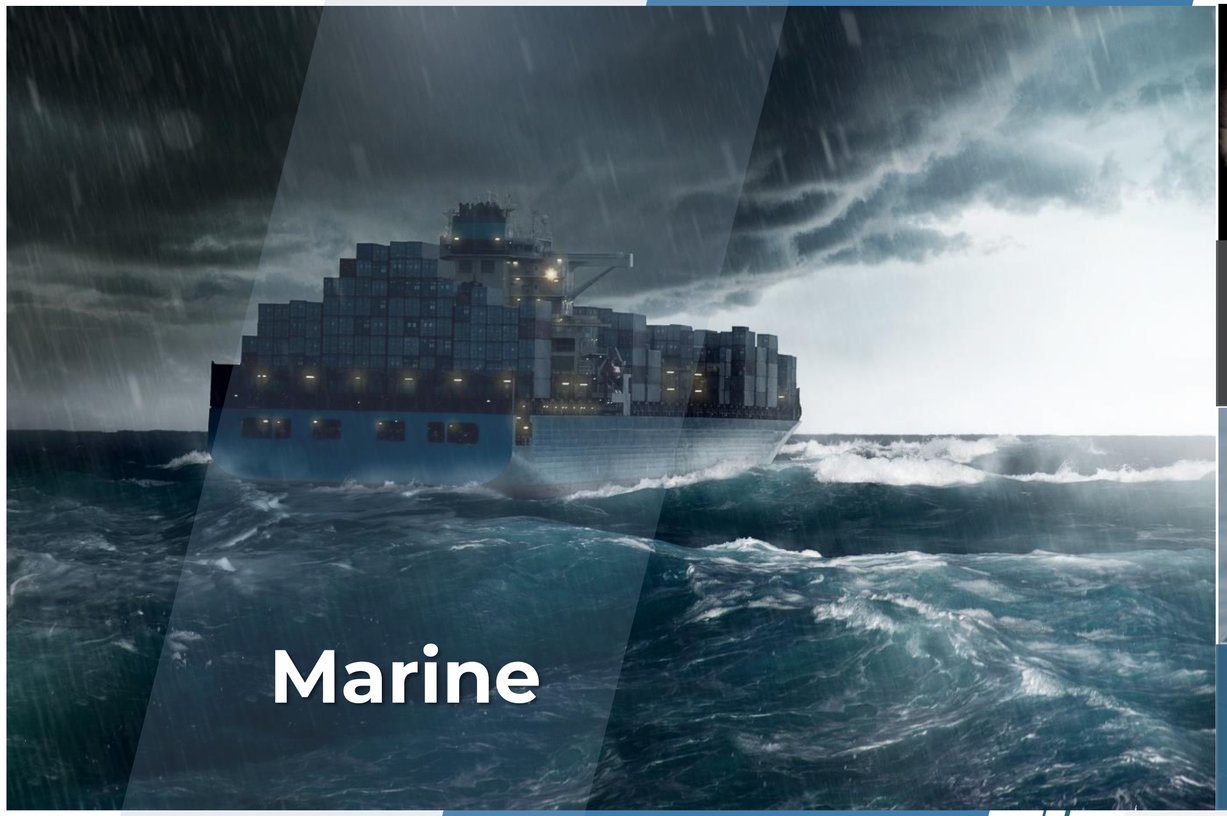


Protects surfaces from vandalism

Long-term protection in the aviation sector:

- **Exterior:** *Up to 10 years*
- **Interior:** Matches durability of the surface

APPLICATIONS

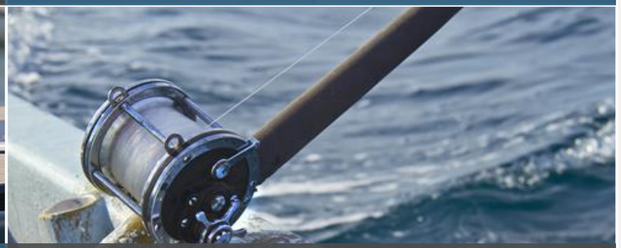


Marine

Protects hulls from aging, corrosion and provides anti-fouling protection

Corrosion protection for precious metals on deck

Delays wear and tear of decorative elements on deck



Facilitates easy cleaning of salt water residues

Long-term protection in the marine sector:

- **Exterior:** *Up to 10 years*
- **Interior**: Matches durability of the surface

APPLICATIONS

Architecture and building construction
(Exterior and interior surfaces)

Depending on their location, buildings are heavily exposed to heat, regular rainfall, humidity and snow. Interior surfaces are exposed to wear and tear and dirt.

Long-term protection for construction and architecture:

- **Exterior:** *Up to 10 years*
- **Interior:** Matches durability of the surface

APPLICATIONS

Industry (machinery, construction parts, mechanical equipment)

When companies make significant investments in industrial plant and equipment – they seek efficient and protected performance over the long-term. Ceramic coatings Nanoflex® Dura and Nanoflex® Sapphire provide a robust protection against corrosion, calcification, wear-and-tear and dirt. Moreover they show very strong chemical stability.

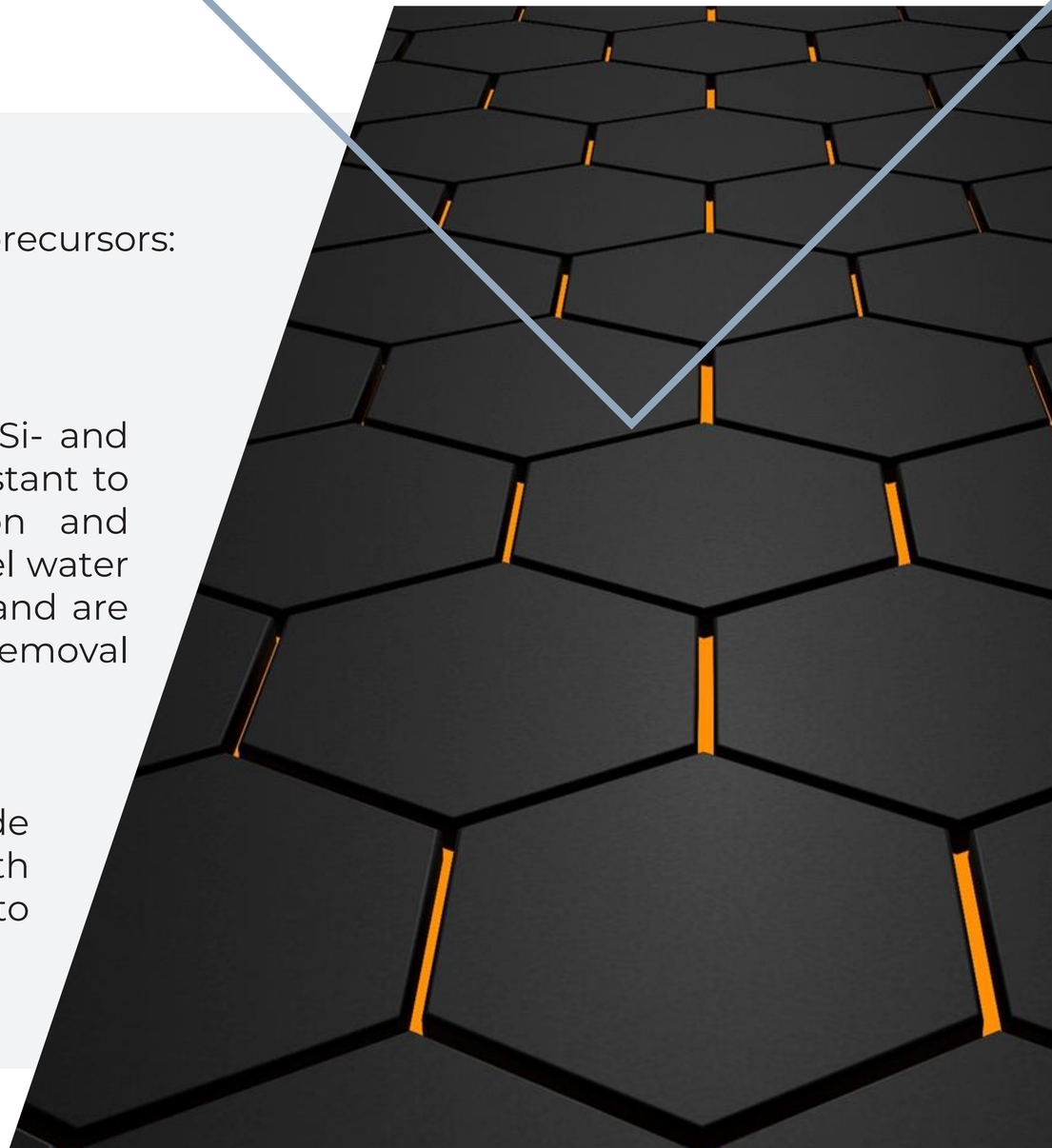
- Easy-clean performance in food production (production lines, tanks, reactors)
- Non-stick coating for pipelines, reactors used in the chemical industry, machines and utility vehicles
- Easy displacement of bio films

TECHNOLOGY OVERVIEW

Our ceramic coatings are composed of two different kinds of precursors: organic pre-ceramics and inorganic quartz.

Organic ceramics generate dense ceramic layers with Si-N-Si- and Si-O-Si structures. Consequently coatings are extremely resistant to heat and provide excellent protection against corrosion and weathering. In addition their strong non-stick properties repel water and dirt. Paints are distorted on hitting the coated surface and are hardly able to bond, thus demotivating graffiti artists. Graffiti removal is easily facilitated.

Inorganic quartz generates a film composed of silicon dioxide (similar to quartz or glass) and provides many substrates with anti-scratch properties as well as excellent stability to chemicals and heat.



EFFECTS IN DETAIL: EASY-CLEAN COATINGS FOR PERFECT SURFACES

Make life easier for industrial customers as well as consumers with ceramic coatings. They will save a lot of time and effort when cleaning cars, kitchens, boats and buildings.

EFFECTS IN DETAIL: EASY-CLEAN COATINGS FOR PERFECT SURFACES

Easy To Apply, Easy To Clean

The appearance of even the most well-maintained environments can easily be compromised:

- Sweaty hands leave permanent traces on stainless steel surfaces
- Mud splashes on cars
- Vandals leave graffiti on trains
- Their cleaning requires a lot of time and aggressive chemicals

Ceramic protection prepares the material for constant cleaning and contributes significantly to reduce contamination, thus saving not only time, but in the long run also reducing material costs.

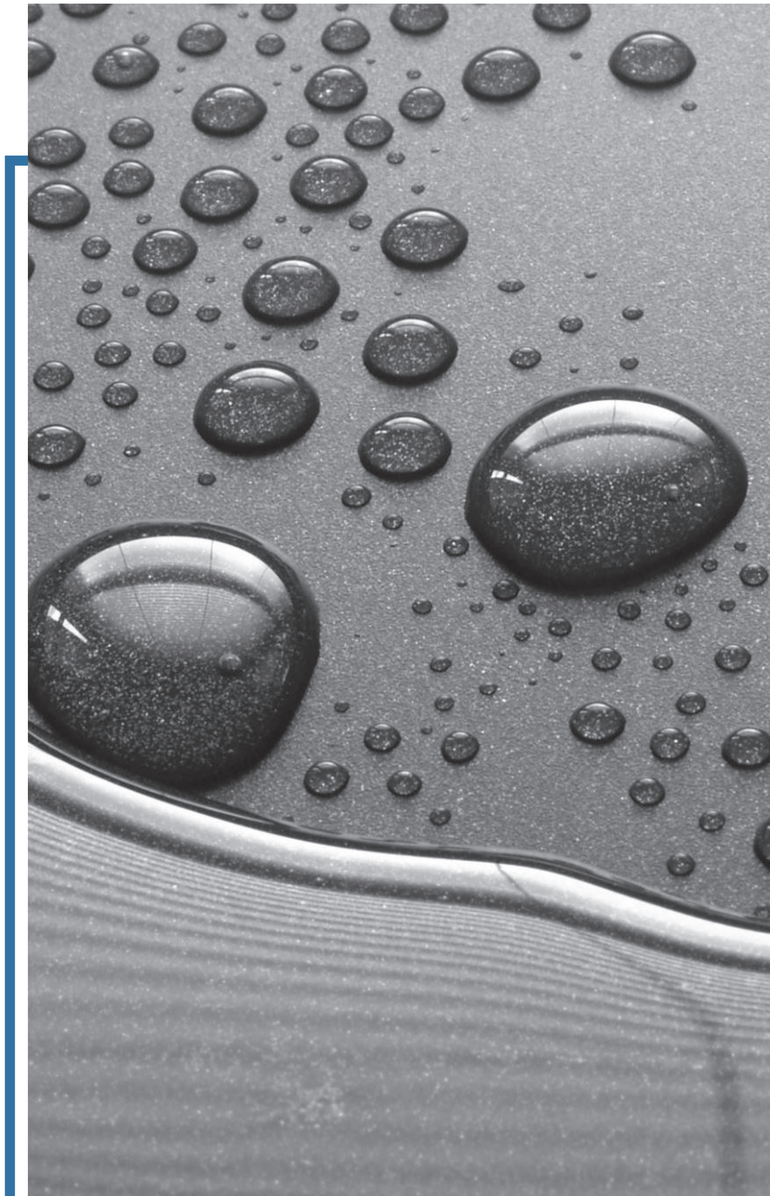
EFFECTS IN DETAIL: EASY-CLEAN COATINGS FOR PERFECT SURFACES

How Does This Effect Work?

Hydrophobicity is the magic word – it describes the capability of Nanoflex® Dura, Dura VF and Dura HD to repel water and to keep surfaces in good condition.

Cleaning only needs a small amount of water and cleaning liquid – no abrasion or aggressive cleaning methods.

Unwanted graffiti can be removed easily and quickly. Coatings also prevent damage caused by chemicals from paints.



EFFECTS IN DETAIL: EASY-CLEAN COATINGS FOR PERFECT SURFACES

Easy-clean-coatings such as Nanoflex® Dura, Nanoflex® Dura VF and Nanoflex® Dura HD are used in the following sectors:

Transport:

- Automotive
- Marine
- Public transport e.g. trams and trains

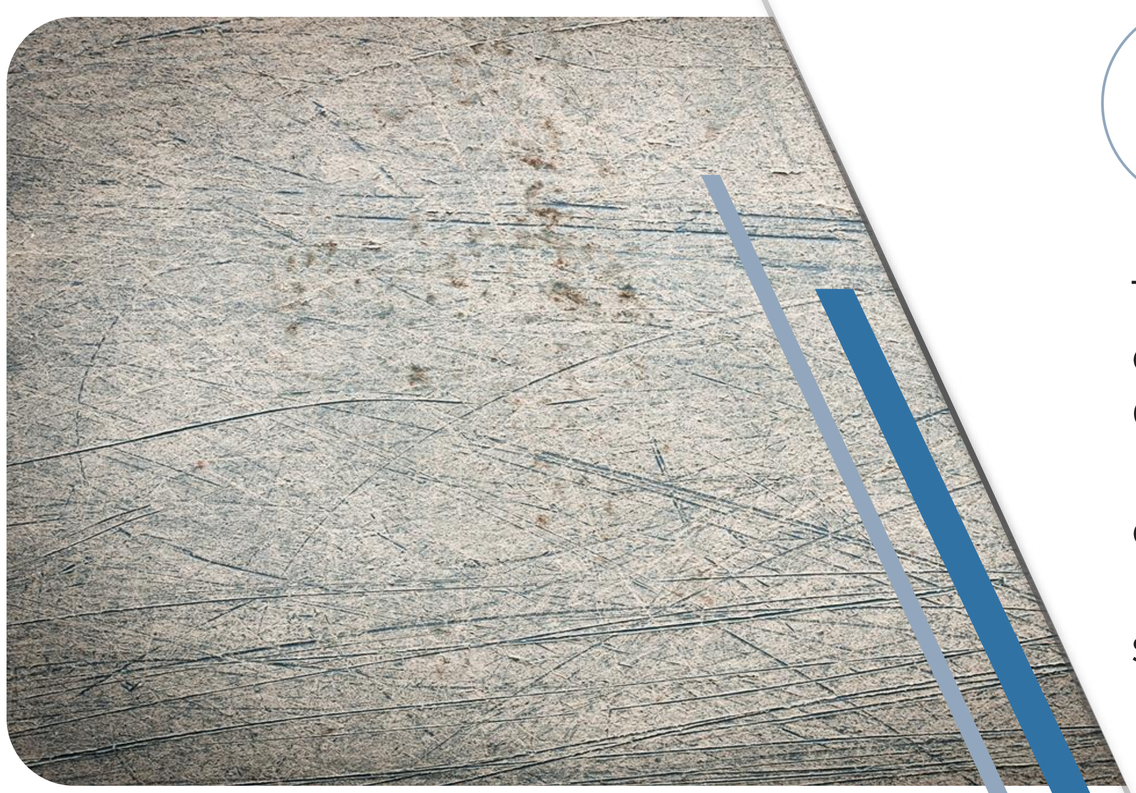
Architecture And Building Construction:

- Building facades
- Manufacturing plants
- Industry
- Interior fixtures and fittings, e. g. stainless steel sinks

Our products are able to protect the following materials:

- *Metal, e. g. steel*
- *Aluminium*
- *Polymers (plastics)*
- *Glass and ceramics, e.g. bus stops*

EFFECTS IN DETAIL: SCRATCH PROTECTION AGAINST WEAR & TEAR



The slightest damage to a surface is a curse, especially on high-gloss surfaces. Our solution for an enhanced scratch resistance provides the automotive, construction and marine industries, and many other sectors with optimum surface protection.

EFFECTS IN DETAIL: SCRATCH PROTECTION AGAINST WEAR & TEAR

- For scratch-resistant surfaces
- With the slightest of accidental movements when getting into a new car, in a second the perfect surface can be damaged by a small scratch – by a ring, a handbag or a zip.
- Besides Nanoflex® Dura, Dura VF and Dura HD Nanoflex® Sapphire provides all interior and exterior surfaces with a particularly enhanced scratch resistance.

EFFECTS IN DETAIL: SCRATCH PROTECTION AGAINST WEAR & TEAR

Use the products for a scratch-resistant finish on surfaces in the following areas:

Transport:

- Automotive
- Marine
- Public transportation, e. g. trams and trains

Architecture And Building Construction:

- Building facades
- Interior fixtures & fittings, e. g. stainless steel sinks
- Industry
- Production plants

Our solutions are able to be used to protect the following materials

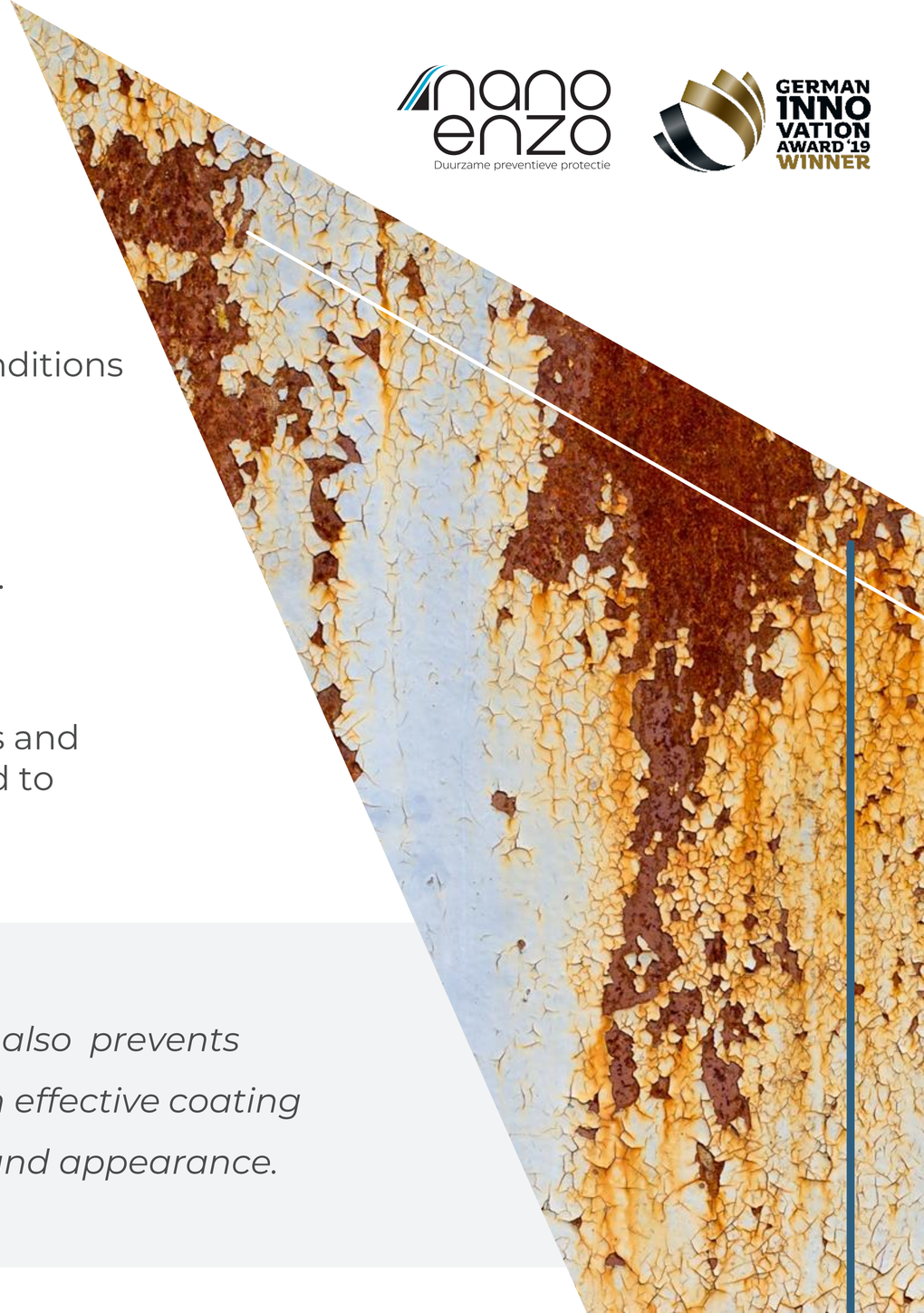
- Metal, e. g. steel
- Aluminium
- Plastics

EFFECTS IN DETAIL:
CORROSION PROTECTION

Weathering, high air humidity and other tough environmental conditions may damage materials through corrosion and surface rust.

Even aluminium-based material and equipment is at risk of being corroded. Any surface damage will create a negative visual impact.

For boats, building facades, vehicles or facilities such as wind parks and industrial facilities corrosion may pose a huge problem with regard to maintenance and safety requirements.



Corrosion protection does not only retain the appearance of a surface, but also prevents future surface damage to steel and other metals. Surfaces protected by an effective coating against corrosion repel the damaging elements - and retain their quality and appearance.

EFFECTS IN DETAIL:
CORROSION PROTECTION

Our coating solutions are used across a large number of sectors:

Transport:

- Automotive industry
- Marine
- Aviation
- Public transportation, e. g. trains and tramways

Architecture and building construction:

- Building facades
- Decorative interior fittings, e. g. stainless steel sinks
- Industry
- Windparks
- Production plants
- Pipelines

FORMULATIONS IN DETAIL:
PRODUCT CHARACTERISTICS

	Dura → organic	Sapphire → inorganic
Polymer	Si-N-H polymer with organic residues (contains carbon)	Pure Si-N-H polymer without carbon
After curing	SiO_2 layer with carbon residues; less carbon residues under high temp baking	Pure SiO_2 layer (glass ceramic)
Cracking Threshold of Resin	30+µm layer	< 2 µm layer
Electrical insulation	Good (carbon contamination)	Excellent (same as glass ceramic)
Hardness/flexibility	Soft/bendable	Hard/brittle
Chemical Barrier (H_2O, O_2 & other gases)	Good	Excellent

FORMULATIONS IN DETAIL:
PRODUCT CHARACTERISTICS

Effects	Dura	Dura VF	Dura HD	Sapphire BC	Sapphire
Easy-clean / stain repellent	*****	*****	*****	*****	*****
Water repellent	****	****	****	**	***
Graffiti protection	*****	*****	*****	****	*****
Scratch protection	***	***	*****	*****	*****
Hardness	up to 9H	up to 9H	9H	>9H	>9H
Corrosion protection	***	***	****	****	*****
Anti aging	****	****	****	****	****
Easy to apply	****	*****	****	****	**
Density of cured film	***	***	****	*****	*****
Number of max. possible layers (in time-lag of)	3 (5 min)	3 (5 min)	2 (5 min)	5 (1 h)	2 (1 h)
Gloss	*****	***	****	****	***
Durability	****	****	*****	****	*****
Temperature stability (°C)	600	600	800	1000	1000

rating

***** excellent

****

***

**

* not recommended

FORMULATIONS IN DETAIL:
SUITABLE SURFACES

	Dura	Dura VF	Dura HD	Sapphire BC	Sapphire
Car bodywork	*****	*****	*****	*****	*
Plastics	**	*****	***	***	*
Metals	*****	*****	*****	*****	*****
Minerals	*****	*****	*****	*****	*****
Unfinished wood	*****	*****	*****	*****	*****
Lacquered wood	**	*****	**	**	**
Gelcoat	*****	*****	*****	*****	**
Pu	**	*****	**	**	**
Glass	*****	*****	****	*****	**
Leather	*	***	*	*	*

rating

***** excellent

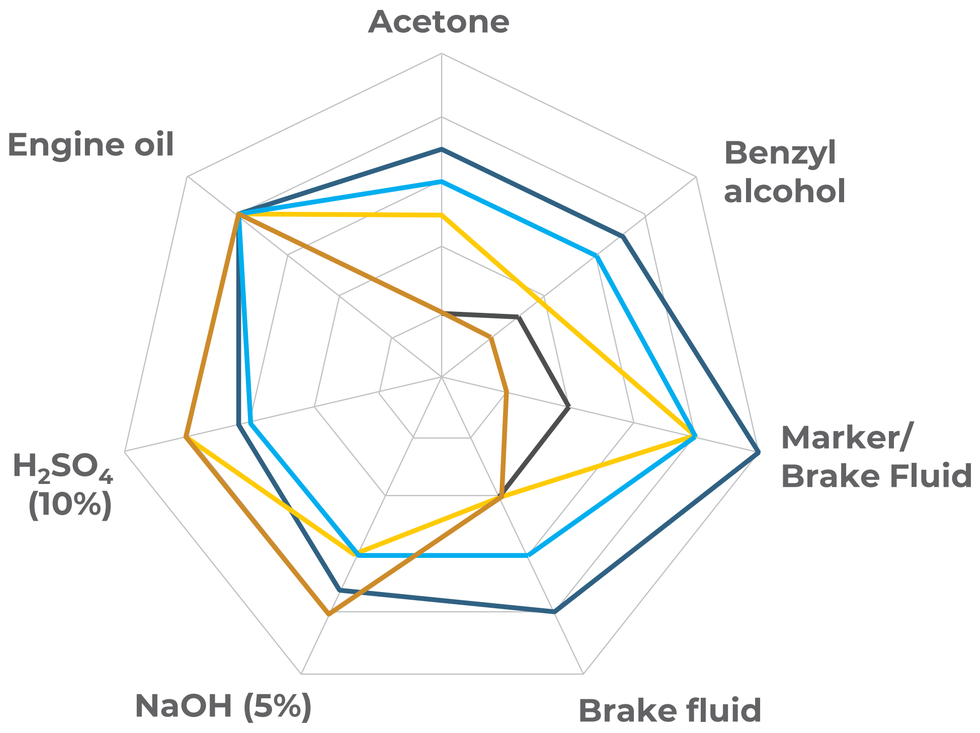
**** |

compatibility check
*** required

** ↓

* not recommended

FORMULATIONS IN DETAIL:
CHEMICAL RESISTANCE



Chemical Resistance of DURA

5: No Effect – No detectable change in the material surface.

4: Excellent – Slight detectable change in colour or gloss, but no change in function or life of the surface.

3: Good – A clearly discernible change in colour or gloss, but no significant impairment of surface life or function.

2: Fair – Considerable change in appearance due to dis-coloration or etching, possibly resulting in deterioration of function over an extended period of time.

1: Fail – Pitting, cratering or erosion of the surface. Obvious and significant deterioration.

- DU
- DUA
- AM
- 2K PU
- Silicone

DU: *Dura derivates*

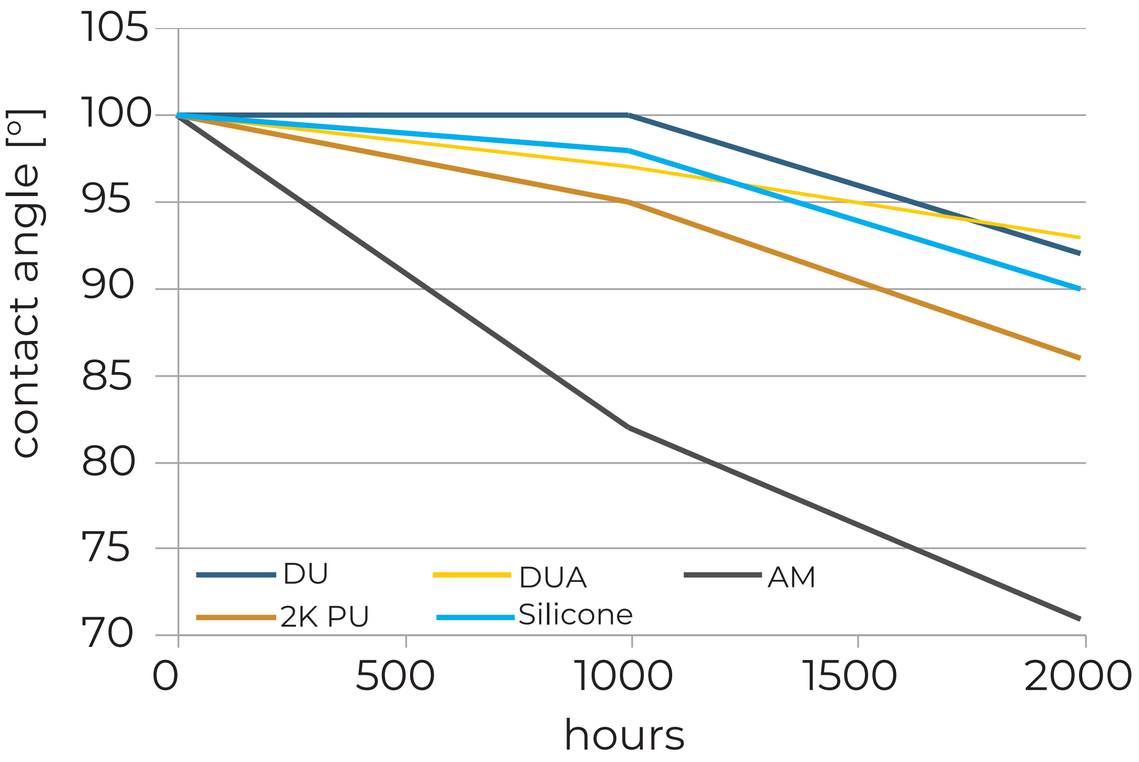
DUA: *Dura as additive in lacquer*

AM: *Alkyd melamine system*

PU: *2K Polyurethane system*

FORMULATIONS IN DETAIL:
WEATHERING RESISTANCE

Weathering Resistance of DURA



- DIN EN ISO 11341 paints and varnishes
- Artificial weathering and exposure to artificial radiation
- Exposure to filtered xenon-arc radiation (2000 hours)

DU: *Dura derivates*

DUA: *Dura as additive in lacquer*

AM: *Alkyd melamine system*

PU: *2K Polyurethane system*

FORMULATIONS IN DETAIL: APPLICATION

PRODUCT APPLICATION AND TOOLS

All product versions are supplied ready-to-use. Depending on the substrate they can be applied with microfiber applicators or paint rollers (microfiber-flocking). The product is also suitable for spray application.

Spray Application

Process: HVLP-compressed air

Working pressure: approx. 2–3 bar

Nozzles: 0.8–1.3 mm

The spray gun can be cleaned with for example *n*-Butyl acetate.

Shelf life: 12 months from delivery date, at 20 °C

FORMULATIONS IN DETAIL: APPLICATION

CONDITION OF SUBSTRATE

The substrate to be coated must be clean, grease-free and completely dry. Areas which are difficult to reach, such as cavities or drainage channels etc. should be dried with absorbent cloths or blown dry with compressed air. On contact with a damp substrate surface, ceramic coatings react prematurely and cannot form a permanent bond. The substrate and environmental temperature must be between + 5°C and + 30°C, the relative humidity at 30 % - 80 %.

Dura, Dura VF and Dura HD: full curing at room temperature in 5-7 days

The recommended curing conditions (until water resistant) are:

- Room temperature: 8–12 hours
- 80°C: two hours
- 130°C – 180°C: one hour

Sapphire and Sapphire Base coat: full curing at room temperature in 24 hours

The recommended curing conditions (until water resistant) are:

- Room temperature: 6 hours
- 80°C: 1 hour
- 130°C – 180°C: 30 min

FORMULATIONS IN DETAIL:
SAFETY AND STORAGE

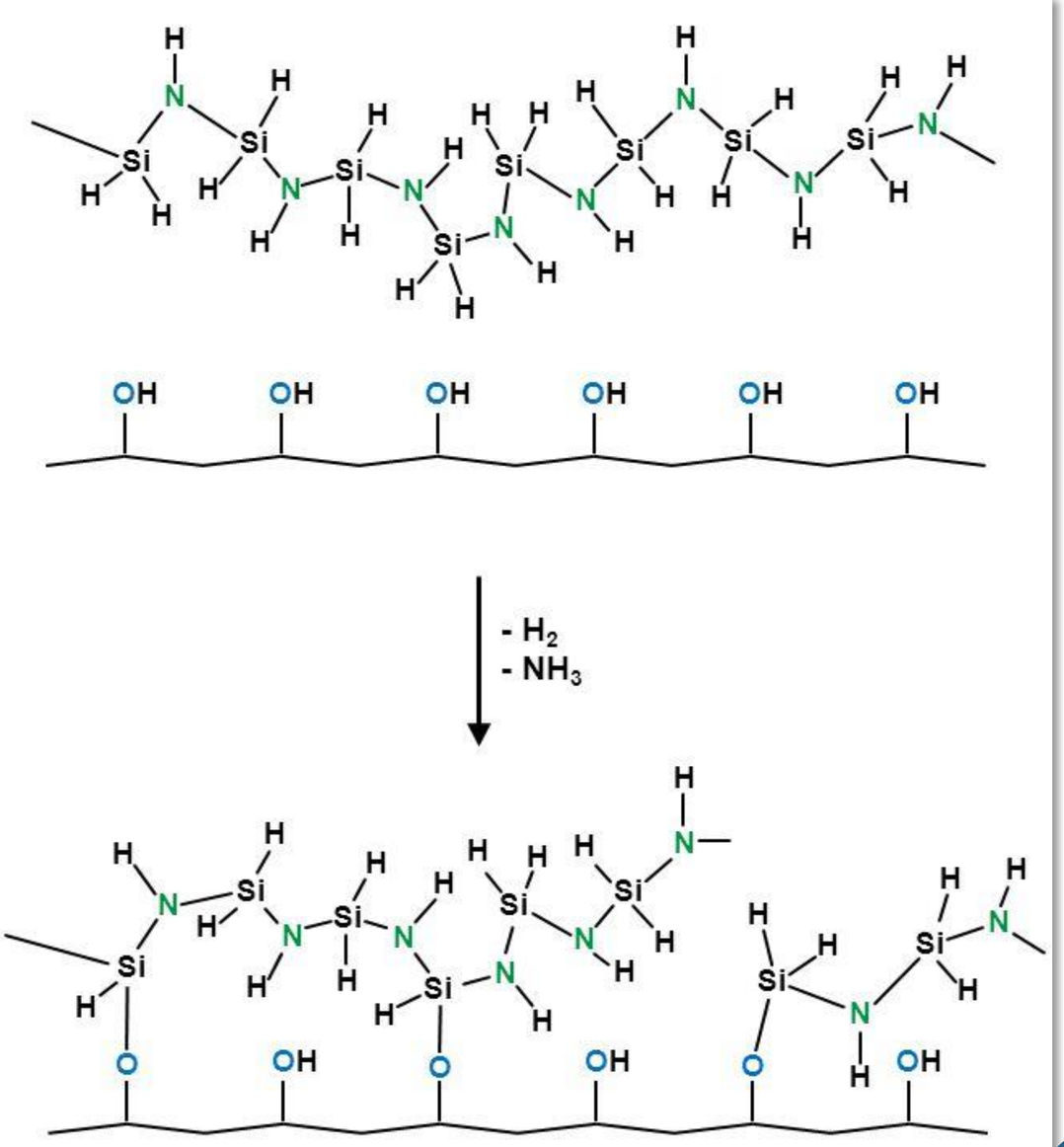
SAFETY

Safety instructions are detailed on the material safety data sheet and should be followed unconditionally.

- Wear solvent-resistant gloves (e.g. butyl or nitrile rubber gloves) when applying the product.
- Wear suitable eye protection (safety glasses or face mask).
- Provide adequate ventilation of working area.
- Wearing a half-mask with filter types A2 B2 E2 K2 Hg/P3 when applying the product is recommended.
- The solution must not be mixed or diluted with other solvents.
- Store in a cool (10°C) dry place with adequate ventilation.
- Open the container periodically to release overpressure (ammonia, hydrogen).
- Keep away from fire, sparks, water, moisture, alcohols and other chemical substances.

STORAGE

Ceramic coatings should be stored in a cool (10°C), dry place with sufficient ventilation. Ventilate sealed containers regularly (once per month) to release pressure. Ventilation dates should be verifiable. This activity will minimize the accumulation of ammonia, hydrogen and self-igniting silane gas.



Avoid Scam and Fraud! – characteristics of 9H ceramic coatings

1. Ammonium hydroxide smell – Polysilazanes can only be manufactured using it
2. Sensitivity to humidity – they react with air humidity to create a chemical bond
3. Sold in pressure resistant aluminium or glass bottles – they can resist pressure in the bottle
4. No ethanol – solvent odour! – this is from silane or polysiloxane technology with only a fraction of durability and protection

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Material and Engineering Laboratory-Taipei

TEST REPORT

REPORT NO. : HV-18-06732
PAGE : 1 OF 3
REPORT DATE : Jan. 07, 2019

NANO-CARE DEUTSCHLAND AG
ALFRED-NOBEL-STRASSE 10, 66793 SAARWELLINGEN

Product Name:	NANOFLEX DURA
Product Type:	CERAMIC COATING
Product Color:	TRANSPARENT
Manufacturer:	NANO-CARE DEUTSCHLAND AG
Supplier:	NANO-CARE DEUTSCHLAND AG
Buyer/Order No. :	061119
Product Submitted By:	NANO-CARE DEUTSCHLAND AG
Date of Receive:	DECEMBER 24, 2018
Date of Testing:	DECEMBER 24, 2018 ~ JANUARY 07, 2019
Remark:	The information mentioned in the above section is provided by Client (Exclude Date of Sample Received and Date of Testing)

The laboratory tests according to the test requests and samples provided by client, and the results are as follows:

Test Required : Pencil Hardness

Test Method : Please see attached sheets

Test Result : Please see attached sheets

The value of required specifications are for reference only.
Conformity judgement is the Applicant's final verdict.

Signed for and on behalf of
SGS Taiwan Ltd.

SGS

Material and Engineering Laboratory-Taipei

TEST REPORT

REPORT NO. : HV-18-06732
PAGE : 2 OF 3
REPORT DATE : Jan. 07, 2019

Pencil Hardness

Test Equipment :

Name	Brand	Model
Pencil	MITSU-BISHI	uni

Test Method :

JIS K5400(1990) Testing Methods for Paints

Test Condition :

The variety of pencil hardness :
6B - 5B - 4B - 3B - 2B - B - HB - F - H - 2H - 3H - 4H - 5H - 6H - 7H - 8H - 9H
Soft <----------> Hard
Load : 1000g
Evaluation Method : Scratch Hardness

Test Result :

Test Item(s)	Test Result(s)
Pencil Hardness	9H

The value of required specifications are for reference only.
Conformity judgement is the Applicant's final verdict.

SGS

Material and Engineering Laboratory-Taipei

TEST REPORT

REPORT NO. : HV-18-06732
PAGE : 3 OF 3
REPORT DATE : Jan. 07, 2019

Sample Photo :

Test Sample

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