Nanotechnology solves dirt sticking problem.

To Nature, Earth & Humans ECO Sketch

An anti-fouling coating prioritizing anti-static properties rather than photocatalysis.

Development the Super Hydrophilic Coating with Anti-static

At our company, we have recognized the drawbacks of fluorine coatings and photocatalytic coatings, which have been considered representative anti-fouling coatings. To overcome these challenges, we have undergone a major shift in our approach to anti-fouling.

We believe that the best approach is for dirt not to adhere in the first place. With the theme of "making it difficult for dirt to adhere and easy to remove if it does," we have developed an anti-fouling coating that is a world-first in combining 100% inorganic anti-static properties and super-hydrophilic self-cleaning properties, which can repel inorganic dirt such as yellow sand and carbon regardless of the presence of light.

This coating exhibits excellent anti-fouling effects on exterior walls, exterior materials, painted surfaces, external window glass, solar panel surfaces, and more.

Based on an inorganic adhesive binder, our coating utilizes the anti-static effect of tin oxide to prevent the adhesion of yellow sand and carbon dirt, minimizing their accumulation. While it does not completely prevent adhesion, it significantly reduces it, similar to a cleanroom environment. Unlike porous materials such as titanium dioxide, our coating is designed with nano-sized uniform irregularities using silica (SiO_2), which minimizes the adhesion of dirt.

In conjunction with the functionality of the inorganic adhesive binder, the nano-sized irregularities based on fractal theory* enable the formation of a super-hydrophilic film regardless of the presence of light. When it rains, water easily enters the nano-sized irregularities, effectively lifting and removing dirt. This means that even if the surface becomes dirty, it can be easily cleaned with a simple wash.

Fractal theory is a theory that states that the hydrophilic effect is enhanced by the fine irregularities on the surface of a material. When the irregularities are arranged in a clean and uniform manner, the surface exhibits super-hydrophobicity. Conversely, when the irregularities are arranged in an uneven manner, the surface becomes super-hydrophilic. Based on this theory, by designing fine and uniform irregularities on the surface, we achieve a constant hydrophilic effect.

There are several reasons why anti-fouling coatings are in demand.

1. Maintenance and Cleaning Efforts: Anti-fouling coatings help reduce the accumulation of dirt, grime, and other contaminants on surfaces. This results in easier maintenance and cleaning processes, saving time, effort, and resources.

2. Aesthetic Appeal: Fouling, such as stains, discoloration, or biological growth, can negatively impact the appearance of surfaces. Anti-fouling coatings help preserve the original aesthetic appeal of various materials, including walls, exteriors, windows, and other surfaces.

3. Longevity and Durability: Fouling can contribute to the degradation and deterioration of surfaces over time. Anti-fouling coatings act as protective layers, extending the lifespan of materials by minimizing the impact of environmental factors and preventing damage caused by dirt, chemicals, or biological agents.

4. Improved Functionality: In certain applications, such as solar panels or optical devices, fouling can reduce the efficiency and performance of the equipment. Anti-fouling coatings help maintain optimal functionality by preventing the accumulation of dirt or debris that can obstruct light transmission or disrupt performance.

5. Cost Savings: Regular cleaning, maintenance, and repairs due to fouling can be costly. By applying anti-fouling coatings, the frequency and intensity of these activities can be significantly reduced, resulting in long-term cost savings.

Overall, anti-fouling coatings are sought after to maintain cleanliness, preserve aesthetics, enhance durability, improve functionality, and reduce maintenance efforts and associated expenses.

Why does it get dirty? What are the countermeasures?

Causes of dirt	Solutions	Function/Performance
Dust, iron powder, oxide	Anti-Static	Suppress adhesion of inorganic stains and organic stains that cannot be decomposed
Carbon, coal ash, smoke, exhaust gas		
Pollen, sap, oil stains	Super-Hydrophilic	Make it easy to remove dirt that adheres and is difficult to remove with rainwater
Animal droppings, carcasses of insects	Chemical resistance, hard coat property	Strongly to strong acid and alkali, a hard coat, and easy to clean.
NOX, SOX, Acid rain, Degradation due to chemical change		
Deterioration fading , shape deterioration due to ultraviolet rays	100% inorganic film	100% inorganic coating suppresses deterioration
Stain caused by mold		
Degradation and fading due to heat and oxidation		

Requirement for Anti-fouling coating?

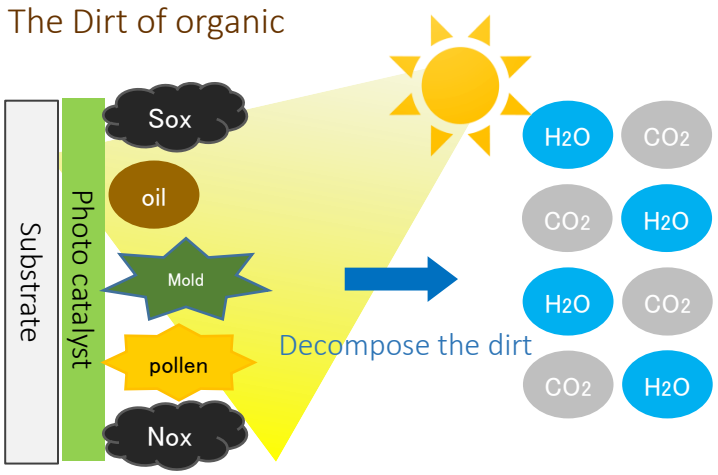
- Reduce the adhesion of dirt, also easy to fall attached dirt
- When compared to the cost of cleaning, there is a merit of cost
- High-transparent and does not impair the texture of the base material
- Inorganic 100%, there is a chemical resistance, excellent durability and environmental resistance

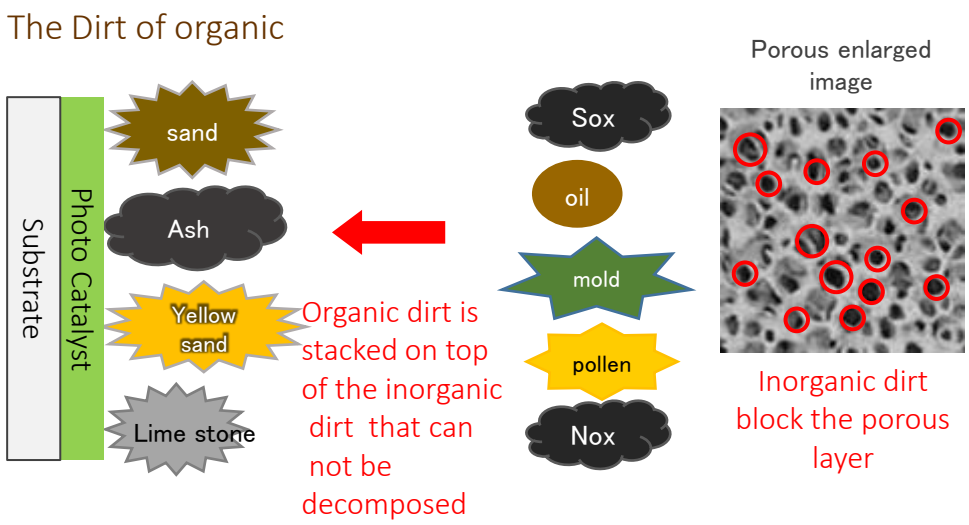
Compare to other products

The Problem of a photo catalyst coating

Photo catalytic antifouling coat effects the dirt of organic gathered on the surface of the porous decomposed by ultraviolet rays. Also, drop the dirt in the rain water by hydrophilic function. China and Southeast Asia is the dirt of inorganic sand and carbon.

Photo catalyst coating decomposes dirt of organic, but it can not decompose the dirt of inorganic. So, it will dirty more by collecting dirt on the surface of the porous. In addition, decomposition and the hydrophilic function of the organic matter in the ultraviolet light can not be exhibited.





Issues of other products

Issues of fluorine coat (Water-Repellent Hydrophobic Coat)

Fluorine-based antifouling Coating has been used, it is an issue that antifouling effect does not perform as it expected although it is expensive.

Fluorine-based coating has an excellent chemical resistance, good weather resistance, and environmental resistance, there is a feature to be easy to clean the attached dirt. But it does not have a function to reduce the adhesion of dirt.

It is charged and can not be suppressed the adhesion of dirt, because the coat surface becomes water repellent, and stand out the dirt of a drop water and rain dripping mark.

In addition, the fluorine-based coating is weak to ultraviolet light because of organic material, and aging degradation.

Function of Anti-Static & Super Hydrophilic Self-Cleaning Coat

Reduce the dust as much as possible with antistatic effect!!

What is anti-static?

When the surface of the substrate is charged (Charged electrostatically), and then electric is sticking with other materials and particles, such as dirt, dust and sand in the air.

Antistatic is easy to flow electricity to reduce the volume resistivity.

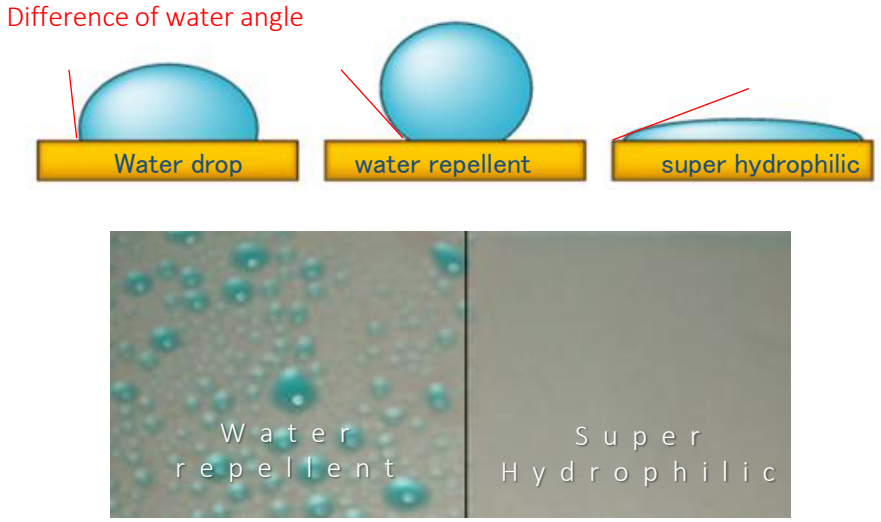
Since the anti-static material is discharged into the air and can be reduced to accumulate static electricity, it is possible to suppress the adhesion of dirt, dust and sand caused by static electricity or the like.

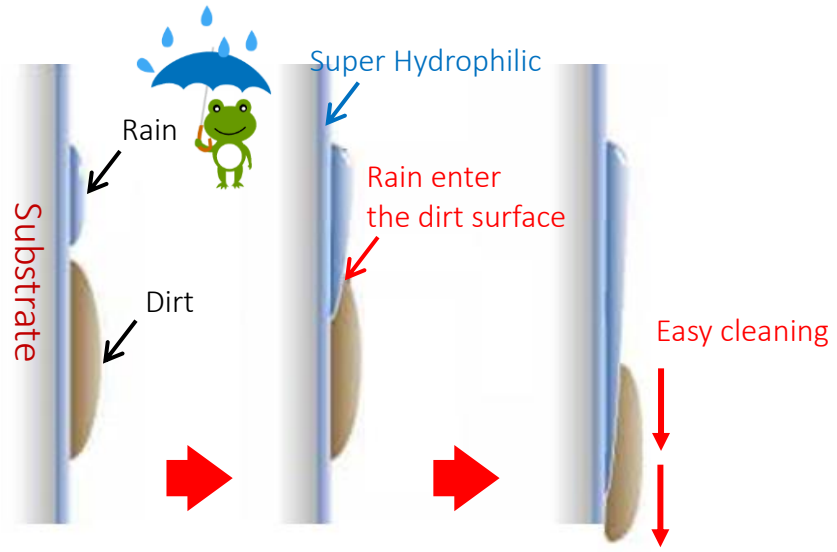
suppress the adhesion of dirt

Function of Anti-Static & Super Hydrophilic Self-Cleaning Coat (2)

Wash away the dirt in the rainwater with super-hydrophilic effect

Super hydrophilic means less than 10 degree of water angle to the substrate.
Water droplets remain as they are on the untreated surface, But they will seep into the layer under the fouling on the hydrophilic surface, thus removing it. The water-repellent surface only repels the water, and has no function to clean itself.

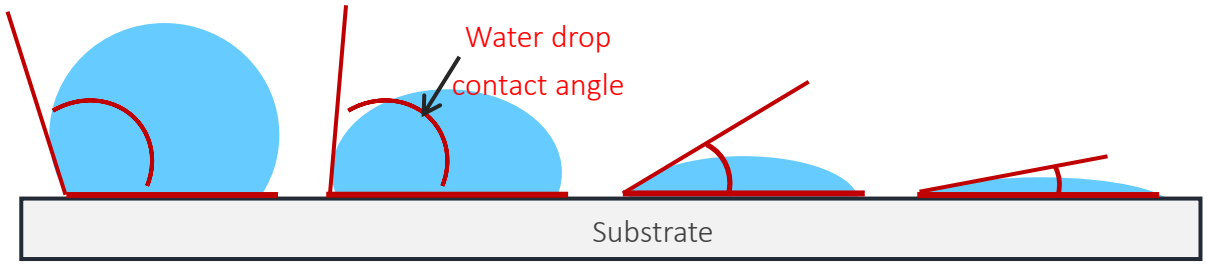




Which can keep the clean Water-repellent or Super hydrophilic coating?

Water drop contact angle

When Water drop contact angle is small, the dirt is easy to take off.



Super water-repellent 110～180°

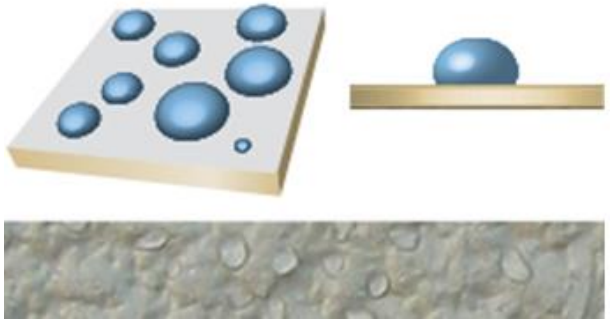
Water repellent 70～100°

Hydrophilic less than 40°

Super hydrophilic less than10°

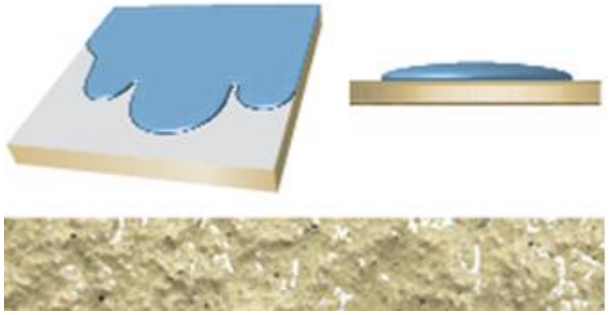
Painting	Water drop angle(°)	Dirtiness by water drop angle
Teflon	110～115	Easy to take off the dirt
Fluorine resin paint	100～105	Easy to adhere the dirt
Silicone paint	100～105	**Easy to adhere the dirt**
Acrylic urethane paint	85	**Easy to adhere the dirt**
NOF Bell clean paint	30～40	Difficult to adhere the dirt
Titanium oxide coating	～10～	Photo catalyst/Super hydrophilic
SUPER GLASS BARRIER	Less than 3～5	Antistatic/Super hydrophilic

Water-repellent:
Water is rolling on the dirt.



Exterior material of the water-repellent: general organic coating film, etc.

Hydrophilic: water is spread on a flat
Water enters the bottom of the dirt



Hydrophilic exterior materials: tile, stone, etc.

Super Hydrophilic Performance

Super Hydrophilic

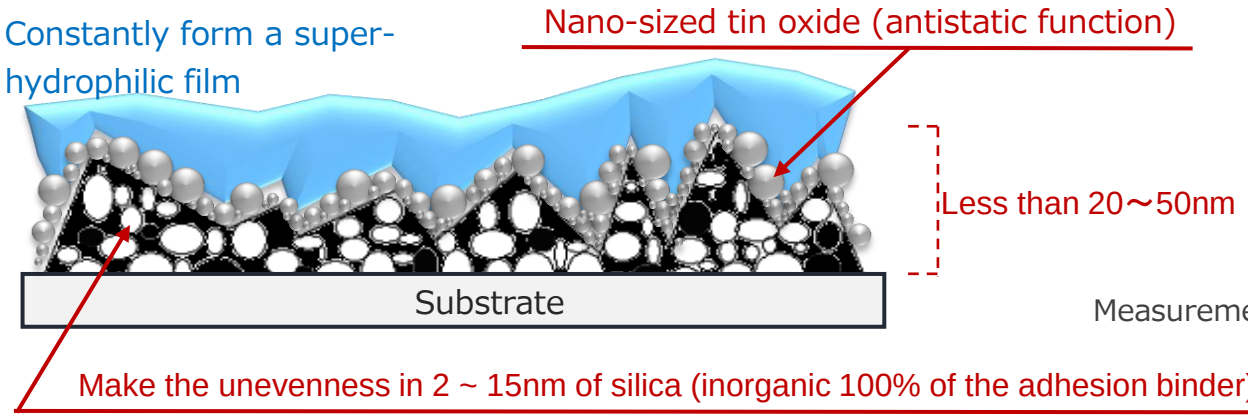
Creating an even on the surface of the glass by using 100 to 200 Nano-sized silica, unlike the super-hydrophilic effect of the photo catalyst, it can make a constantly super-hydrophilic film without the irradiation of light. Contact angle is 5 degrees or less , so the rain or water enters the bottom of the dirt and it washes away the dirt.

※Fractal theory

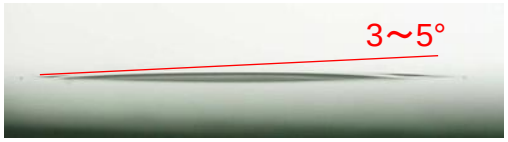
Effect of the hydrophilic can be improved by fine unevenness of the surface.

Unevenness lines uniform becomes a super water-repellent status;

on the other hand, it lines unevenly becomes super-hydrophilic status



Water contact angle



Measurement: High Environmental Engineering Co.,ltd

Inorganic 100% adhesion binder technology of super glass barrier is the world's highest level.

4 type of products

1、Super Glass Barrier (SGB)･･ for Painting wall, aluminum panel, tile, concrete, bricks, stone

Ingredient ①SiO_2(Silica)…Super-hydrophilic & Adhesive binder
②SnO_2(Tin Oxide)･･･Anti-Static
③Methanol

Since the antistatic material=tin oxide is used, the surface resistance value for measuring the antistatic performance becomes 10^8 Ω, and the stain prevention effect is high. Also, because of high adhesion performance and high transparency, it is possible to apply without changing the texture of the base material and it can be applied without curing.

2、Solar Self Maintenance Coat CNT････ for Solar Panel surface, Glass, Mirror

Patent No. 7146223 on September 26, 2022
For glass substrates and solar panels
Antistatic antifouling coating agent

Ingredient ①SiO_2(Silica)…Super-hydrophilic & Adhesive binder
②SnO_2(Tin Oxide)･･･Anti-Static
③CNT(Single Walled Carbon Nano tube)･･ Enhanced antistatic, hard coating, chemical resistance
④APT (Ammonium Para Tungsten)･･･Photocatalyst
⑤Methanol and Distilled Water

For Solar Panel, in addition to antistatic use CNT, photocatalyst APT. CNT has Greatly improved antistatic function, improved chemical resistance, weather resistance, adhesion, and wear resistance. APT is photocatalyst nano material which does not require light. This nano-tungsten is the world's smallest class of tungsten particles with a particle size of 5 to 10 nm compared to the conventional particle size of 20 to 40 nm. Nanoparticles with extremely high surface area per unit deposition maximize catalytic effectiveness.

3、Solar Heat Dissipation Coat･･ for back panel of Solar Panel

Ingredient ①SiO_2(Silica)…Super-hydrophilic & Adhesive binder
②SnO_2(Tin Oxide)･･･Anti-Static
③MNT(Multi Walled Carbon Nano tube)･･･Heat dissipation effect
④Methanol and Distilled Water

Solar heat dissipation coat is a coating agent that can be applied at room temperature with heat dissipation, antistatic, abrasion resistance, and chemical resistance characteristics by using MWCNT. By applying it to the back surface of the solar panel (back sheet), it suppresses the increase in panel temperature = the decrease in power generation efficiency.

4、Resin Primer･･ for resin material such as acrylic board, PC plate and so on

Ingredient ①SiO_2(Silica)…Super-hydrophilic & Adhesive binder
②SnO_2(Tin Oxide)･･･Anti-Static
③Methanol and Distilled Water

Antifouling coating by base material

Super Glass Barrier (SGB) Series; List of antifouling coating types by base material

Target base material	Application Procedure	Advantages of antifouling coating	Application tools required
①Exterial wall, Painting wall ②Tile ③Aluminum Panel ④Concrete, Bricks, Stone	①Cleaning with water ②Application of anti-penetration agent only for penetrating Substrate Only ③Application of Super Glass Barrier	①Long-term beauty maintenance ②Reduce regular cleaning costs	① anti-penetration agent ②Super Glass Barrier ③Spray Gun, Roller, squeegee application tools
⑤ Solar Panel surface	①Cleaning with water ②Application of Solar Self Maintenance Coat CNT (SSMC-CNT)	①Suppression of deterioration in power generation efficiency due to adhesion of dirt ②Reduce regular cleaning costs ③Suppression of deterioration in power generation efficiency by promoting ice melting	① Water, spray, hose, tank Cleaning tools ②SSMC-CNT ③Squeegee application tools
⑥ Back panel of Solar Panel	①wipe with water in the case only that it got dirty. ②Application of Solar Heat Dissipation Coat(SHDC)	①Suppresses decrease in power generation efficiency due to temperature rise of solar panel	①SHDC ②Roller application tools
⑦ window Glass,Mirror	①Removing oil film by Glass Cleaner with water. ②Application of Solar Self Maintenance Coat CNT (SSMC-CNT)	①Long-term beauty maintenance ②Reduce regular cleaning costs ③ Keep clear view without water-stain	①Glass cleaner ②Polishing tool ②SSMC-CNT ③Squeegee application tools

Physical properties

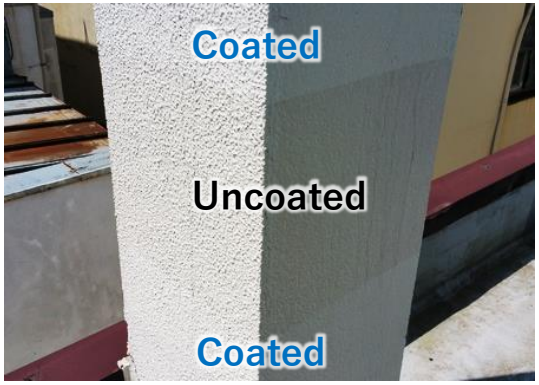
Test	Description	Result
Weathering test	Super UV / 300H	More than 10years
Water drop contact angle	Sessile drop method	Less than 5°
Adhesion	Boiling aqueous test/ 1H	10 years
Pencil hardness	Change by the hardness of the base material	4H～9H
Adhesiveness	Foundation tape method	100/100
Adhesion and moisture resistance	Steam test / 1H	Not problem
Chemical resistance	Hydrochloric acid 5% / 5min	Not problem
	Caustic soda 5% / 5min	Not problem
Surface resistance value	Super Glass Barrier	$10^{8\Omega}$～$10^{9\Omega}$
Visible light transmittance		90%～92%
Heat-resistant	200℃ / 1H	Not problem
Cool weather resistance	-18℃～20℃	Not problem

Antifouling effect and color difference of the Super Glass Barrier

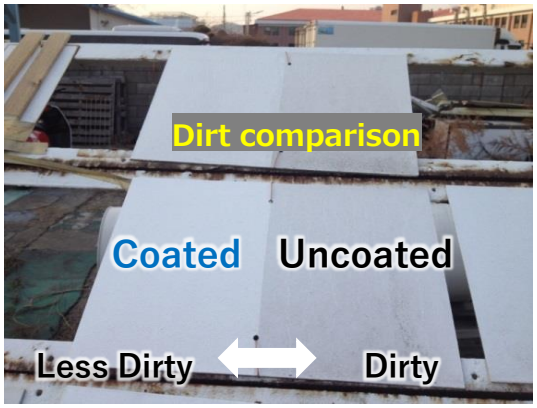
Antifouling effect in exterior materials

◆ Water-based painted wall material Jolypate 5 years after coating

◆ Ceramic silicon-based water-based paint 6 years after coating



◆ Exposure test 4month later in South Korea



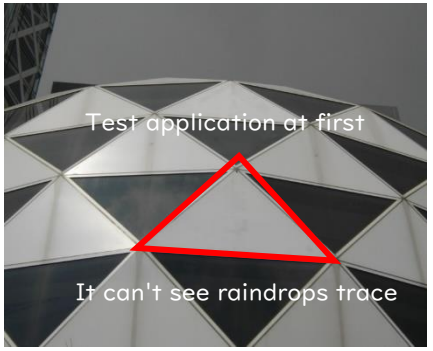
Coating application example

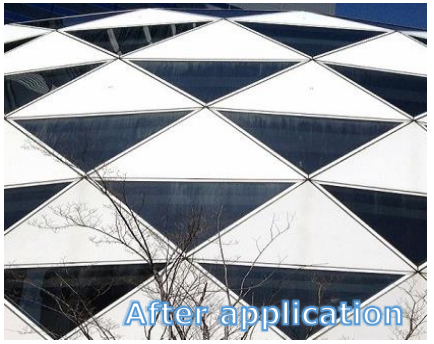
◆An antifouling coat is applied on top of the heat reflection paint to the roof of the Kagoshima Aquarium, and a comparison is made with an uncoated area.

Areas where the anti-soiling coating has not been applied over the paint are gradually becoming blackened by volcanic ash or dirt each year. It is evident that the areas where the coating has been applied are noticeably cleaner, effectively inhibiting the decrease in reflectivity of the heat-insulating paint.

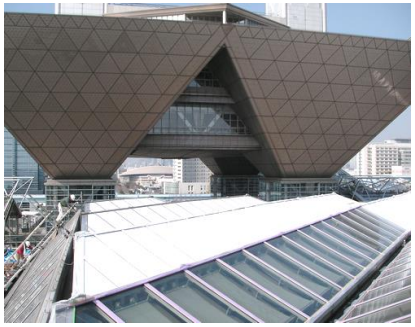
Coating application example

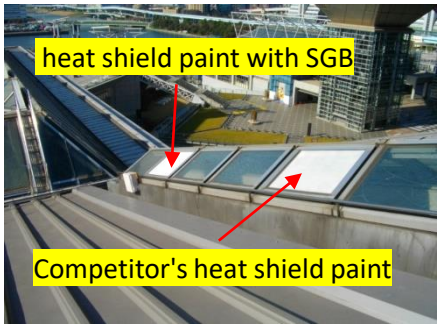
◆ Antifouling effect was confirmed even after 10 years after applying an antifouling coating to the exterior panels of a building in Shinjuku Station, Tokyo.

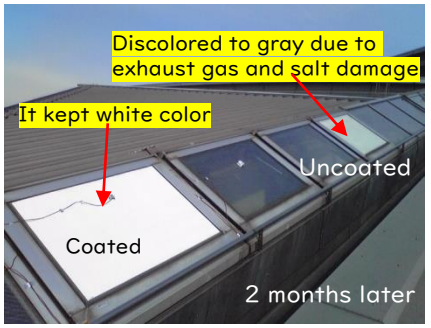


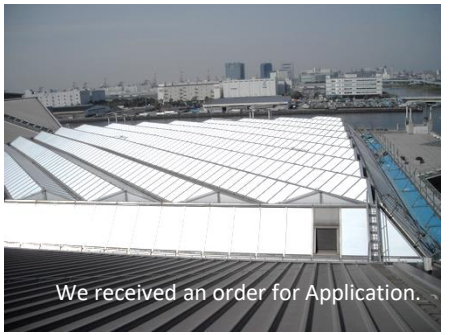


◆ Tokyo Big Sight / 2months of verification and results for areas coated with Thermal insulation paint and areas not coated







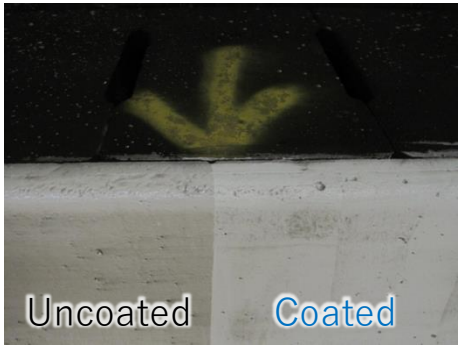


Other companies only use thermal insulation paints,We apply an antifouling coat on top of the heat shield paint.

Coating application example

◆ Tianjin International Cruise Terminal for exterior concrete
Coating Area 43,000 sqm

◆Verification of antifouling effect on concrete
in Hong Kong Tai Lam Tunnel.
At the time of verification after 1 year and 6 months.



◆Nanjing Youth Olympic Center / Application to Exterior Fiberglass Concrete
Coating Area 100,000sqm