

Nanotechnology solves dirt sticking problem.



**For Exterior materials & Solar Panel
Anti-static Super hydrophilic Self-Cleaning coat**



YouTube



Sketch



**Sketch
Business Management**

Anti-static, Super-Hydrophilic Self-Cleaning Anti-fouling coating

Development the Super Hydrophilic Coating with Anti-static

To address the challenges of anti-fouling in major coatings that use fluorine and photocatalyst nanomaterials, we have developed a new concept for anti-fouling solutions.

In anti-fouling coatings, preventing the adhesion of dirt is crucial. Guided by the theme "Reduce dirt adhesion and make cleaning easier," we have created a new anti-fouling coating. This coating suppresses the adhesion of inorganic (and some organic) dirt, such as yellow sand and carbon, using an antistatic function. It also utilizes a super-hydrophilic effect to enable rain and other natural elements to easily wash away dirt, regardless of the presence of light.

Furthermore, by adding photocatalyst or non-photocatalyst materials and nanocarbon, we have enhanced the anti-fouling performance, increased coating hardness, and tailored product performance to suit specific substrates and applications. This has also allowed us to offer patented product lines.

This product is 100% inorganic and is suitable for a wide range of exterior materials, including walls, painted surfaces, glass, mirrors, and solar panels.

The inorganic adhesion binder using nano-silica reduces the adhesion of yellow sand and carbon through the antistatic effect of nano-sized tin oxide. While it does not completely eliminate dust, it minimizes it as much as possible, similar to the conditions in a clean room.

The functionality of the inorganic adhesion binder, combined with a nano-sized uneven surface structure based on the Wenzel Model, creates a permanent superhydrophilic film regardless of the presence of light. When it rains, water penetrates the nano-sized uneven surface, effectively removing dirt. This makes cleaning significantly easier.



100% Inorganic

The demand for anti-fouling coatings

Various causes of pollutants and dirt in the air

- ◆ With the development of regions such as China, Southeast Asia, and Middle Eastern countries, global air pollution has become increasingly severe. The atmosphere contains various substances, and the causes of pollution differ depending on the region.
- ◆ Dirt can be categorized into organic and inorganic types, and the repeated adhesion and solidification of these contaminants transform them into more stubborn forms over time. The increase in acid rain, yellow sand, and PM2.5 further exacerbates the issue. In the case of building exteriors, it becomes difficult to maintain aesthetics and landscapes, giving the appearance of an unclean city.
- ◆ Southeast Asia tends to favor glass-covered buildings, but dirt accumulation on exterior window glass makes it challenging to maintain a clean appearance. Furthermore, dirt adhesion on solar panels can reduce power generation efficiency by as much as 20–30%, leading to serious problems. These issues significantly increase regular cleaning costs, creating a burden on the revenue structure.
- ◆ To reduce these cleaning costs, it is essential to implement methods that decrease the frequency of cleaning while maintaining aesthetic appeal.



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?

- Suppresses dirt adhesion and allows attached dirt to be easily removed.
- Offers cost advantages compared to regular cleaning expenses.
- Transparent, with minimal impact on the appearance of the base material.
- Composed of 100% inorganic material, providing chemical resistance, excellent durability, and environmental resistance.

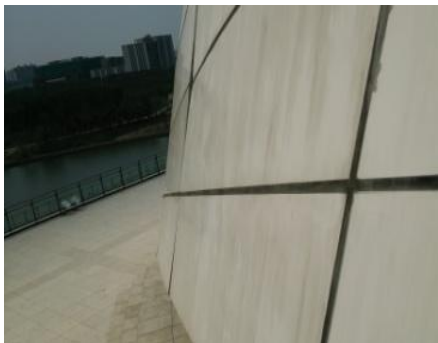
Problems with Other Companies' Anti-Fouling Coating Products

There are two types of low-pollution coatings (or paints): hydrophobic and hydrophilic.

Hydrophobic low-pollution paints (or coatings)

Since the coating surface is hydrophobic, water stains and rain marks easily accumulate, making dirt stand out. If the contact angle is extremely high, dirt does not adhere in the first place and can be easily removed as it rolls off like a droplet.

However, there are currently no products with long-lasting weather resistance, and over time, the contact angle decreases, making dirt accumulate more easily in the same manner.



Hydrophilic low-pollution paints (or coatings)

Compared to hydrophobic coatings, hydrophilic coatings make dirt less noticeable as it spreads out rather than accumulating in one spot. The ability to wash away dirt depends on how low the water droplet contact angle is. Standard hydrophilic low-pollution paints do not have a particularly low contact angle. While they tend to accumulate less dirt than hydrophobic coatings, over time, dirt still builds up, leading to visible discoloration and differences in appearance.

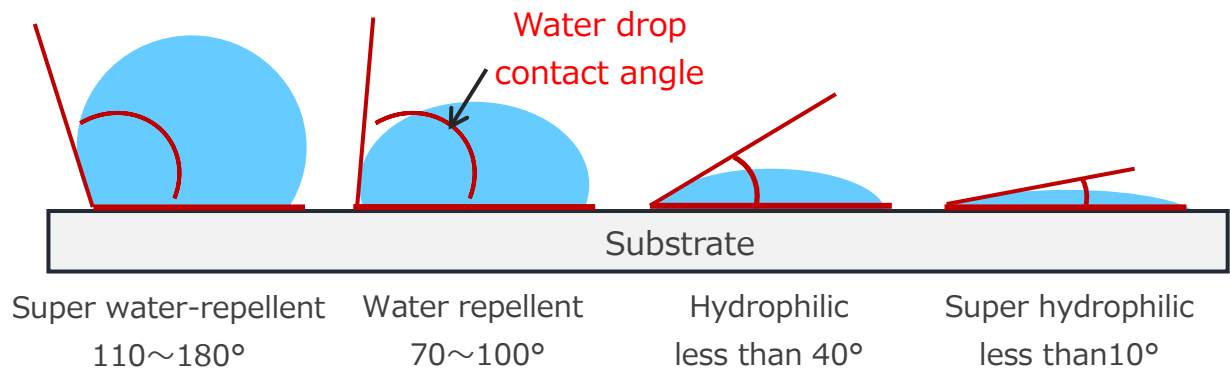


Even within the same hydrophilic type, differences in contact angle result in color variations after 5 years."

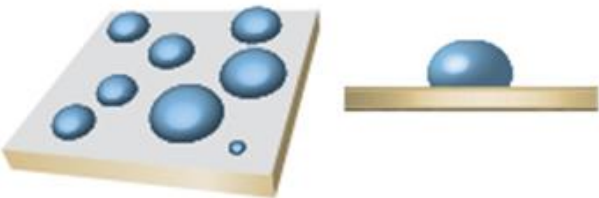
Which can keep the clean Water-repellent or Super hydrophilic coating?

Water drop contact angle

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



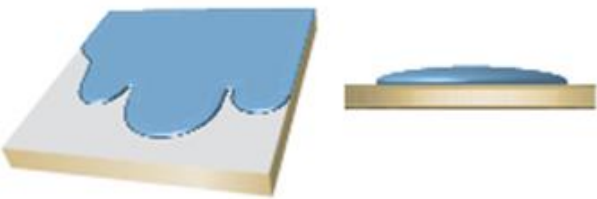
Water-repellent:
Water is rolling on the dirt.



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

VS

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



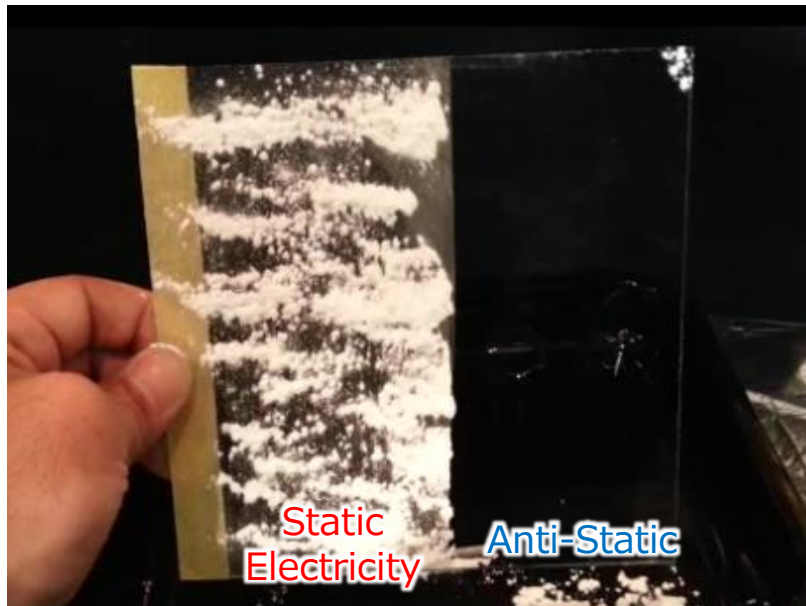
Hydrophilic exterior materials: tile, stone, etc.

| 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 |

What is the '**Super Glass Barrier**,' an anti-static super-hydrophilic anti-fouling coating?

This is an anti-fouling coating agent developed with the theme of "making dirt less likely to adhere and easily removable if it does." Even in environments without rain, its anti-static properties suppress the adhesion of dirt such as yellow sand and carbon. Additionally, any adhered dirt can be self-cleaned with its super-hydrophilic properties when rain or water is applied, regardless of the presence of light. With a 100% inorganic structure, it offers high durability and demonstrates excellent anti-fouling effects on exterior walls, exterior materials, and painted surfaces.

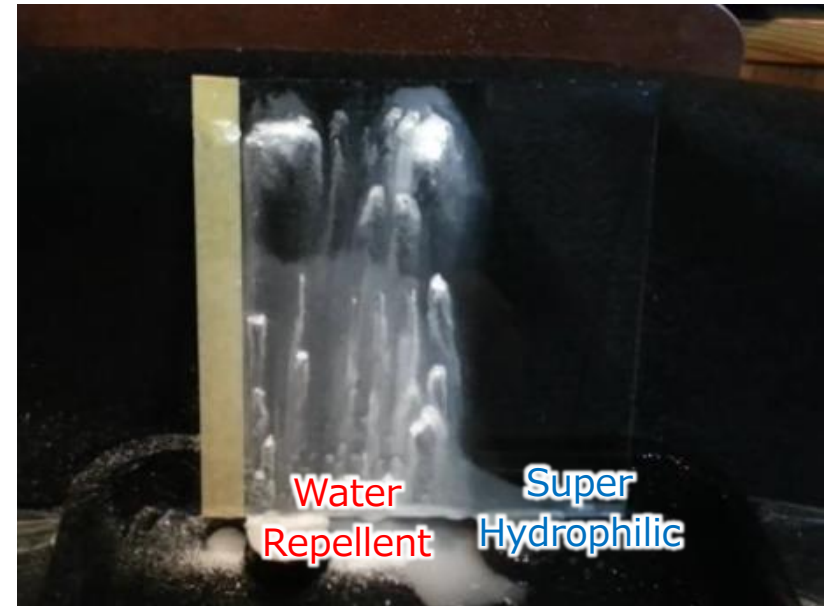
◆ **Anti-static**: Suppresses dirt adhesion



Simulated dirt (talcum powder) applied to glass



◆ **Super hydrophilic**: Self-cleaning with rain or water



Spray water

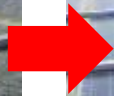
What is the anti-static and anti-fouling effect?

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

When the surface of a substrate becomes electrostatically charged, it attracts other materials and particles, such as dirt, dust, and sand from the air.

Anti-static properties reduce the electrical resistivity, allowing electricity to flow more easily and preventing the accumulation of static charge.

By discharging static electricity into the air, anti-static materials can suppress the adhesion of dirt, dust, and sand caused by static electricity.



suppress the adhesion of dirt

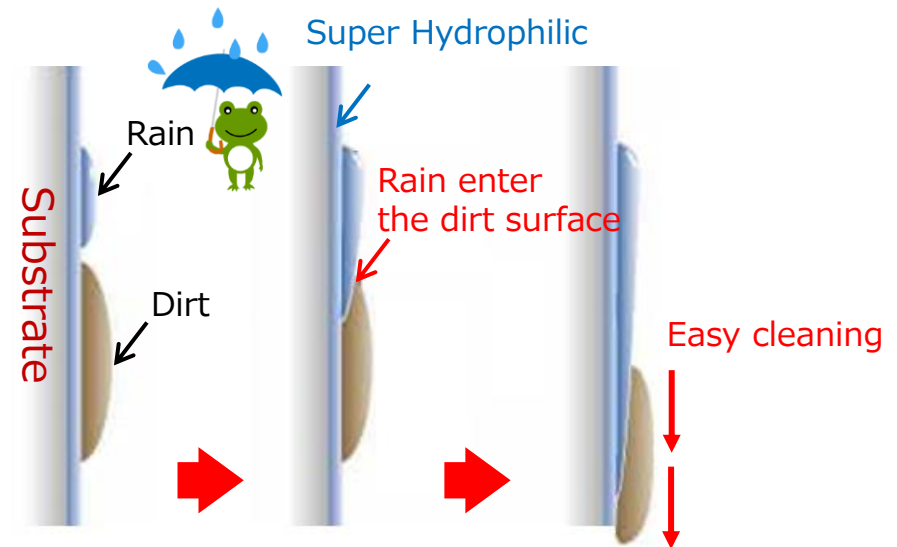
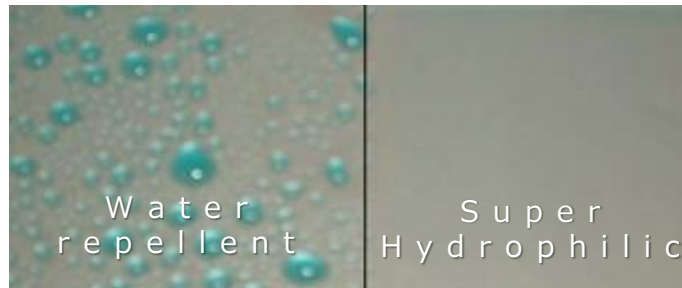
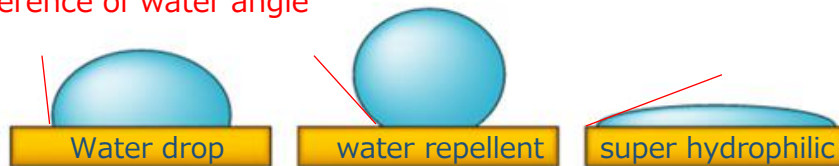
What is the super-hydrophilic self-cleaning effect?

Wash away dirt with rainwater using the super-hydrophilic effect.

Super-hydrophilic means a water contact angle of less than 10 degrees on the substrate.

On untreated surfaces, water droplets remain as they are. However, on hydrophilic surfaces, the droplets seep under the layer of dirt, lift it, and wash it away together. In contrast, water-repellent surfaces only repel water and do not have the ability to clean themselves.

Difference of water angle



Super Hydrophilic Performance

Super Hydrophilic

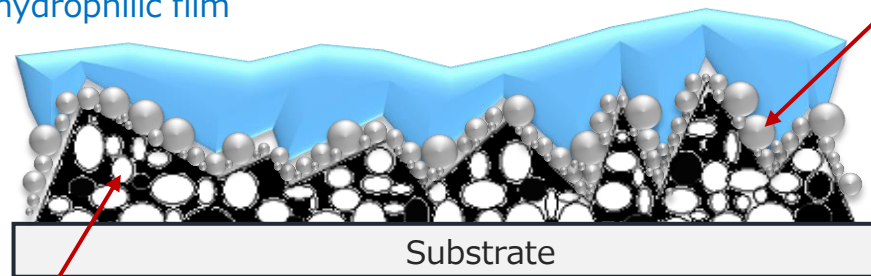
Using nano-sized silica particles ranging from 100 to 200, an uneven layer is formed on the glass surface. Unlike the super-hydrophilic effect of photocatalysts, it enables the creation of a constantly super-hydrophilic film without the need for light irradiation. With a contact angle of 5 degrees or less, rain or water penetrates beneath the dirt, washing it away

※Wenzel Model

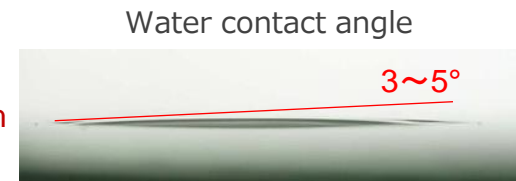
The Wenzel Model explains how surface roughness affects the wettability of a liquid (hydrophilicity or hydrophobicity). According to this model, the rougher the surface, the more hydrophilic surfaces enhance their hydrophilic properties.

Constantly form a super-hydrophilic film

Nano-sized tin oxide (antistatic function)



Less than 20~50nm



Measurement: High Environmental Engineering Co.,Ltd

Make the unevenness in 2 ~ 15nm of silica (inorganic 100% of the adhesion binder)

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

3 type of products

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

Ingredient ①SiO₂(Silica)··Super-hydrophilic & Adhesive binder
②SnO₂(Tin Oxide)··Anti-Static
③Methanol

Since the antistatic material=tin oxide is used, the surface resistance value for measuring the antistatic performance becomes $10^8 \Omega$, 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.

2、Solar Self Maintenance Coat CNT···· for Solar Panel surface

Ingredient ①SiO₂(Silica)··Super-hydrophilic & Adhesive binder
②SnO₂(Tin Oxide)··Anti-Static
③CNT(Single Walled Carbon Nano tube)·· Enhanced antistatic, hard coating, chemical resistance
④APT (Ammonium Tungsten)··Photocatalyst
⑤Methanol and Distilled Water

For solar panels, CNT is used for antistatic purposes, and APT is used as a photocatalyst. CNT significantly enhances antistatic functionality while improving chemical resistance, weather resistance, adhesion, and wear resistance. APT is a photocatalyst nano-material that does not require light. This nano-tungsten belongs to 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 efficiency.

3、Solar AR Maintenance Re-Coat·· for Solar Panel surface

Ingredient ①SiO₂(Silica)··Super-hydrophilic & Adhesive binder
②SnO₂(Tin Oxide)··Anti-Static
③APT (Tungsten oxide)··Photocatalyst
④Pt (Platinum) ···Chemical resistance & total performance up
⑤Methanol and Distilled Water

For solar panels, in addition to antistatic purposes, a photocatalyst APT is used, which decomposes organic contaminants such as pollen and resin from trees. However, an APT that does not reduce the transmittance of the solar panel is utilized, and platinum is also employed as a low-reflection material. This is also ideal for solar panels that cannot undergo periodic cleaning.

Physical properties

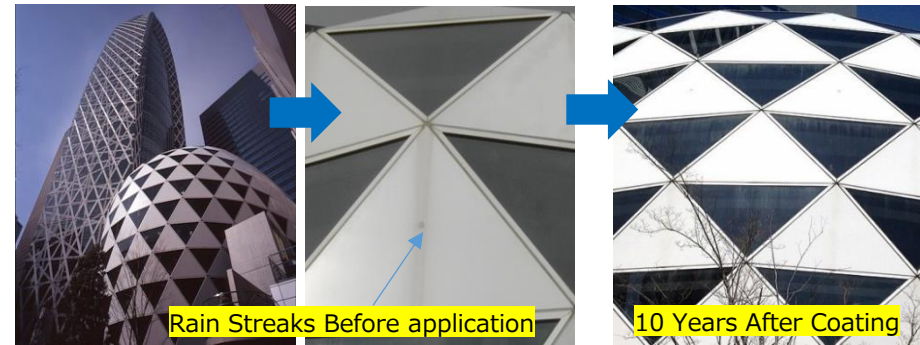
| Test | Description | Result |
|----------------------------------|---|--|
| Weathering test | Super UV / 300H | More than 10years |
| Water drop contact angle | Sessile drop method | Less than 5° |
| Adhesion | Boiling aqueous test/ 1H | 10 years |
| Pencil hardness | Change by the hardness of the 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 | $10^{8\Omega/\square} \sim 10^{9\Omega/\square}$ |
| Visible light transmittance | | 90%~92% |
| Heat-resistant | 200℃ / 1H | Not problem |
| Cool weather resistance | -18℃~20℃ | Not problem |

Anti-Fouling Coating Project Records for example

◆ Anti-fouling Heat Reflective Coating for Tokyo Big Sight West Hall Roof



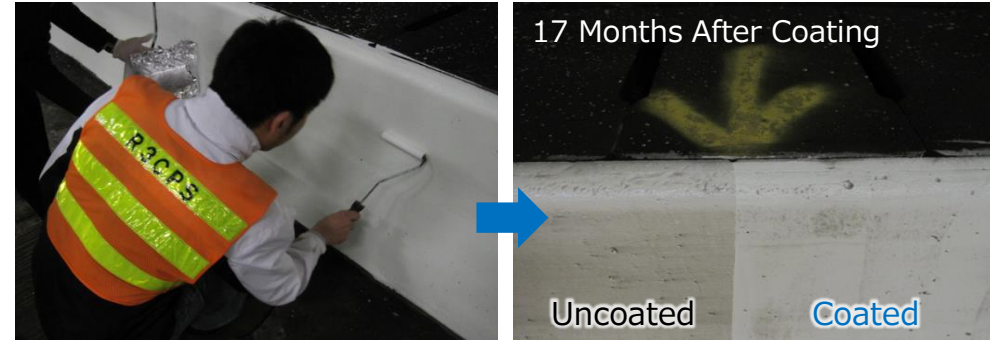
◆ Cocoon Tower in Shinjuku, Tokyo Prevention of Rain Streaks & Long-Term Aesthetic Maintenance



◆ Tianjin International Cruise Terminal / Exterior Concrete Application Area **550,000m²**



◆ Hong Kong Tai Lam Tunnel / Anti-Stain Protection for Concrete Application Area **240,000m²**



◆ Kagoshima Aquarium / Anti-soiling measures for high-reflective heat-shielding coatings - Volcanic ash countermeasures

