

Anti-Static, Super-Hydrophilic  
and Inorganic  
**Self-Cleaning/  
Anti-Fouling Coating**



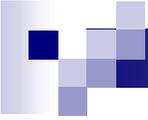
SKETCH CO.,LTD.

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# The Background of the Development of SKETCH Anti-Static, Super-Hydrophilic and Inorganic Binder

Emphasizing the Anti-Static Functions for the Problems in China,  
Southeast Asia, and Middle East countries

## Anti-Fouling Measures for the Exterior Window Panes

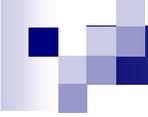
The main contaminants of the exterior window panes are the combination of dust, yellow sand, carbon from the exhaust gas, pollen, soot and so on.

Unlike exterior walls, transparency is important for window panes. It is especially so for the facilities where the view from the interior is valued: hotels, restaurants, sightseeing towers, showrooms, public buildings, rail cars, buses, vehicles and so on. The view has to be very clear at all times.

The window panes must not get fouled easily, and must require as few cleanings as possible when they did become fouled. As for the window panes for highrise buildings where daily cleaning is not possible, The self-cleaning function by the rain is the most required factor. The necessity for as few cleanings as possible is even more important, since major cleaning for highrise buildings is very costly.

In China, Southeast Asia and Middle East countries, there are many buildings with glass walls. As the labour cost is expected to rise in the near future, by applying anti-static and anti-fouling coating while the labour cost is relatively inexpensive. The cost of cleaning and maintenance in the future will be reduced greatly.

The cost for the materials are under 100 yen per square meter, The current labour cost for application is as low as under 50 yen per square meter. The coating can be applied to existing buildings as well as the new ones. For the new buildings, the panes can be treated at the glass factory before the construction.



## Advantages of SKETCH Anti-Fouling Coating

### The Problems of Anti-Fouling Coating That Uses Fluorine As the Main Component

Currently, the anti-fouling coatings applied in most cases are the water repelling coatings that uses fluorine as the main component. However, the cost of materials for this type of coating is as expensive as 500 yen per square meter or more, and the maintenance cost is also high. And the performance does not justify the price. The purpose of the water repelling coatings that uses fluorine as the main component is to make it easy to remove the dirt, And not to make it difficult to be fouled in the first place.

Since most of the fouling in China and Southeast Asia is the combination of dirt and carbon, the static on the fluorine coating encourages the fouling.

The fouling will, however, be easily removed since the fluorine coating has high weather resistance and resistance to chemicals.

### Anti-Fouling Measures for Road Materials and Resin Base Materials

### Anti-Fouling Measures for Tunnels and The Tiles in Underground Passages

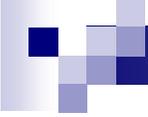
Resin material is even more static and encourages fouling than the fluorine coating. The best measure for anti-fouling is to apply anti-static function coating on the surface of the resin.

Compared to the usual base materials, the tiles commonly used in tunnels have the advantages that they don't become fouled easily, and can be cleaned more easily when fouled. However, the foul from the carbon in the exhaust gas does contaminate, and it requires a major cleaning work with road closure. By applying anti-static coating to the resin materials, it is possible to reduce the fouling by carbon and thus reduce the number of cleaning greatly, Making it suitable for places where there is high volume of traffic. One such example is the soundproof walls on highways.

# How Does SKETCH Anti-Fouling Coating Work?

## Anti-Fouling Measures Against the Cause of Fouling: Why Fouled? How to Prevent Being Fouled?

| Cause of Fouling  | Measure Analysis  | SKETCH Anti-Fouling Measures                                  |
|---|---|---|
| • dust, iron powder and oxide become electrified  | inorganic fouling which are not degradable by photocatalysis                                    | Anti-Static coating   |
| • carbon, coal ash, soot, exhaust gas   | organic fouling which are not degradable by photocatalysis                                      |   |
| • Pollen, sap, oil stain  | decompose by photocatalysis, or hard coating removes the fouling easily                         | Super-hydrophilic and hard coating removes the fouling easily |
| • Bird droppings and dead insects   | Increase the resistance to chemicals and hard coating or decompose by photocatalysis            | Increase the resistance to chemicals                          |
| • Deterioration and fading by chemical changes by NOX, SOX, acid rain and other chemicals | Increase the resistance to chemicals  |   |
| • Deterioration and fading by ultra-violet rays, and the Deterioration of forms           | Apply UV cut or inorganic coating   | inorganic coating   |
| • The growth of mildew and mold   | antibacterial treatment or photocatalysis treatment   |   |
| • antibacterial treatment or photocatalysis treatment                                     | apply inorganic coating rather than organic one   |   |
| • deposit of sodium chloride and minerals by salt damage                                  | Making the fouling easy to be cleaned off by increased resistance to chemicals and hard coating | increased resistance to chemicals and hard coating            |



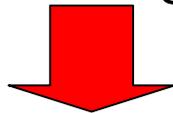
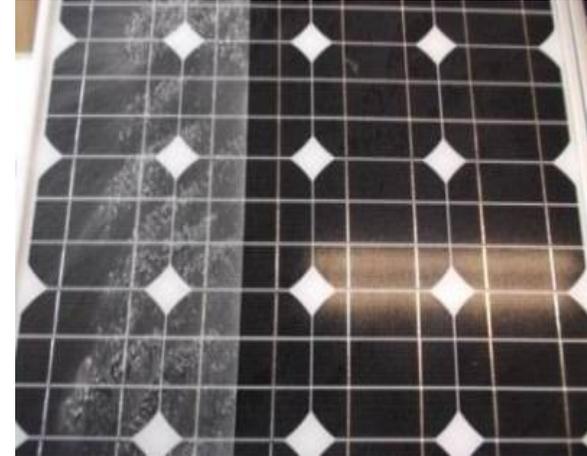
# The Features of SKETCH Inorganic Anti-Fouling Coating

- 100% Inorganic coating film; Safe and Semi-Permanent
- Five Features:
  - I. **Anti-Static**
  - II. **Super-Hydrophilic**
  - III. **High degree of hardness and weather resistance**
  - IV. **High degree of transparency**
  - V. **High degree of cohesion**
- Cold setting
- The film thickness  $0.1 \sim 0.2 \mu$

# I . Anti-Static

The Main Feature of SKETCH inorganic anti-fouling coating

Unlike inorganic materials like glass and tile, materials such as film, plastic and organic coating film tend to become static, Thus attracting the build-up of fouling like dust and carbon.



SKETCH Anti-Fouling Coating uses stannic oxide as the anti-static material. It prevents the build-up of fouling with yellow sand and carbon, Minimizes the adhesion and makes it easy to remove when it did adhere.

The Anti- Static Function by Electronic Conductivity ultrafine particles of stannic oxide ( $\text{SnO}_2$ ) or tin-doped indium oxide (ITO) contain a lot of free electrons. They possess features such as low electrical resistivity (surface electrical resistivity  $10(8) \sim 10(10) \Omega / \square$ ), not attracting fine dust and particles that float in the air, and not easily build up dirt, dust and exhaust gas. Especially in China, anti-static property is very important to protect the surface against coal ash and yellow sand.



### III. High degree of hardness and weather resistance

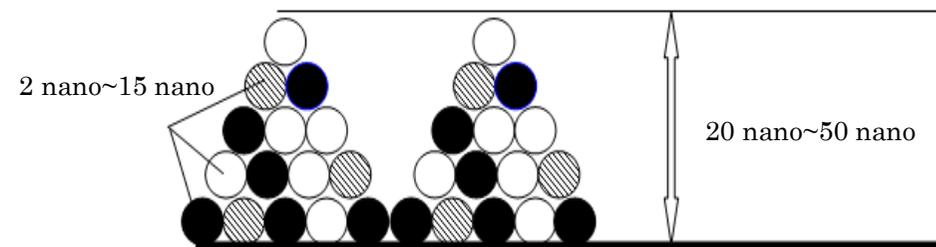
- SKETCH Anti-Fouling Coating cohere to the base material tightly. By applying super-hard nano materials such as Tungsten oxides and niobium pentoxide, we obtained the maximum hard coating and resistance to chemicals.
- passed the Super UV weather resistance test at 300H.
- inorganic 100% super weather resistance
- pencil hardness: 9H(glass)

## II . Super-Hydrophilic

### Super-Hydrophilic mechanisms of SKETCH anti-fouling coating

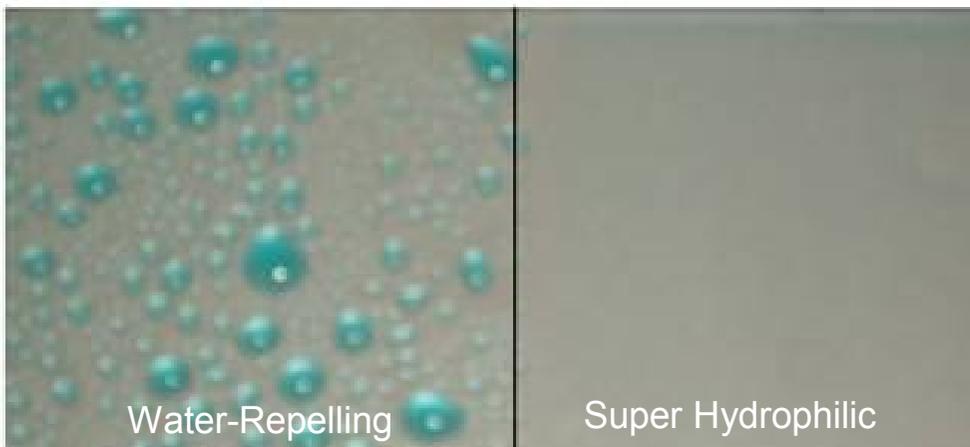
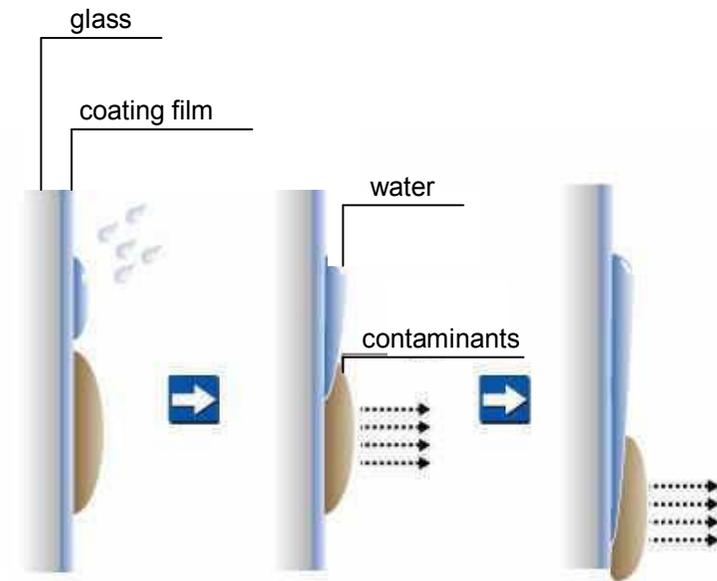
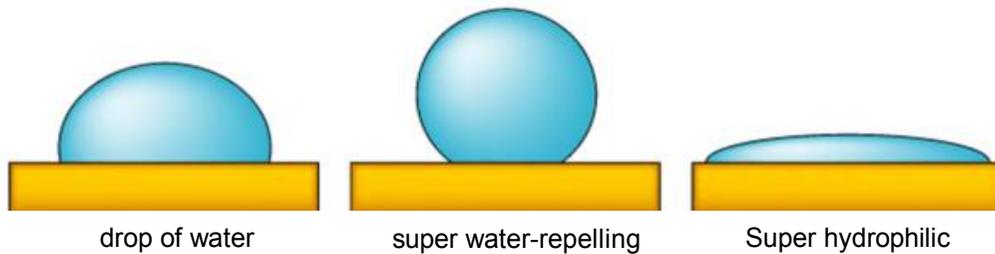
Using several different kinds of silica with different grain diameters and functional nanomaterials, Combined, stronger hydrophilic effect can be achieved with the theory of unevenness, or fractal theory✕.

✕Fractal Theory : The effect of hydrophilic property is enhanced with fine unevenness on the surface. When the surface particles are evenly aligned, the surface is super-water-repelling. And when they are uneven, the surface is super- hydrophilic. We succeeded in keeping the unevenness under 50 nano, using several silica and single nano materials. As a result, super hydrophilic layer is formed and remains at all times.



## What is Hydrophilic Property?

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.





## IV. High degree of transparency

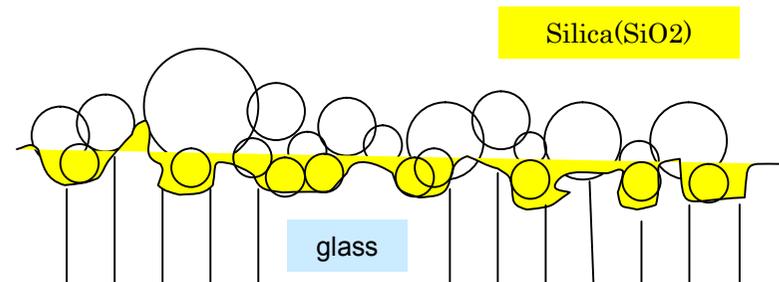
- With SKETCH inorganic 100% transparent binder as a base, by adding nano particles which are high-functioning materials, We succeeded in creating thin-layered, high-transparency coating agent.
- Easy to apply for anyone. Even after coating, it keeps the feature of the original base material.

## V. High degree of cohesion

Silica makes the base material and the functional materials cohere to each other tightly. By supporting the functional materials on the surface, it maximizes the property of functional materials.

### What is Silica?

Silica( $\text{SiO}_2$ ) has the property to tightly cohere to window panes and tiles.



# The Features of Glass

## ★ New Glass

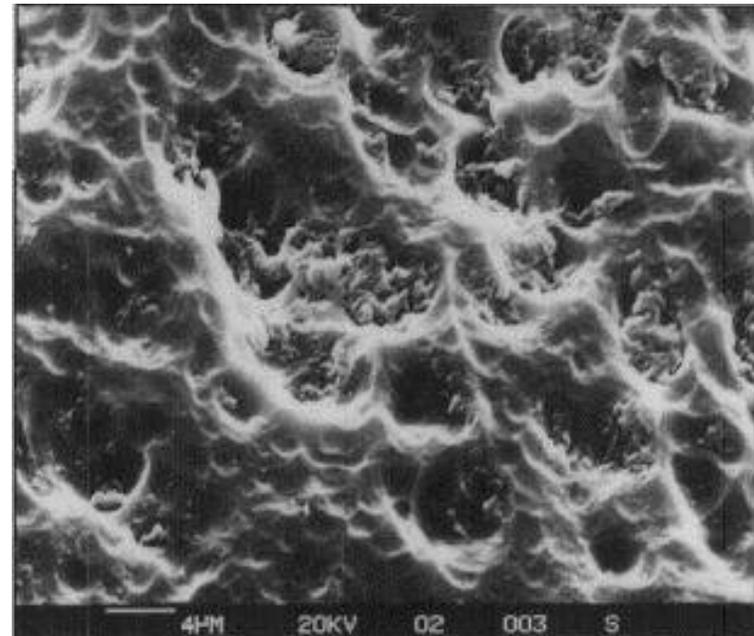
Transparent, Clear



## ★ Corroded Glass

Glass is a material that easily reacts

Weathering Phenomenon



photomicrograph

# The Cause and the Measures of The Weathering of Glass

## The Cause of the Fouling of the Glass

With chemical reactions, glass will develop blue tarnish and white tarnish. The blue tarnish causes the glass to develop iridescent (rainbow-colored) interference fringes. The white tarnish causes the glass turn obscured appearance that cannot be removed by wiping it.

## Why Does Weathering Occur?

- 1, When the sodium ion in glass reacts to the moisture in the air, strong alkali sodium hydroxide and sodium carbonate are created. Furthermore, they react with carbon dioxide (CO<sub>2</sub>) and form carbonates. The carbonates enlarges when they are dissolved in the moisture in the air, neutralized by the carbon dioxide (CO<sub>2</sub>) in the air and crystallized, Causing the weathering of the glass.
- 2, Glass is easily affected by alkaline, And it starts to melt at PH 9.8 or higher. Sodium hydroxide and sodium carbonate forms strong alkaline of PH12 or higher, and melt the glass. They form calcium and magnesium that are contained in the glass, and caused the weathering by calcium carbonate. As a result, the surface of the glass develops the white tarnish that is obscure and cannot be removed by wiping.
- 3, In the case of exterior window panes which are rained on, since the moisture in the air and the sodium ions react with each other and reduces it, The surface of glass develops rainbow-coloured interference fringes which range from black to iridescent.

## Preventing Glass Weathering and Fouling

The weathering of the glass is caused by the reaction of the sodium ions and the moisture in the air, making the glass surface to melt with strong alkali.

To prevent the weathering, so that the sodium ions cannot elute from the surface of the glass

### Composition Table of Glass

|                                 |                 |            |
|---------------------------------|-----------------|------------|
| ①SiO <sub>2</sub>               | silica          | 70~72%     |
| ②R <sub>2</sub> O               | alkali oxide    | 13~15%     |
| ③CaO                            | calcium oxide   | 8~12%      |
| ④MgO                            | magnesium oxide | 1~4%       |
| ⑤Al <sub>2</sub> O <sub>3</sub> | aluminum oxide  | 1~2%       |
| ⑥Fe <sub>2</sub> O <sub>3</sub> | iron oxide      | 0.07~0.15% |



# The Features of Super Glass Barrier

## Super Glass Barrier: For Exterior Walls

### Component

:Silica ··· Super-Hydrophilic Cohesion Binder Function

:Stannic Oxide ··· Anti-Static Function

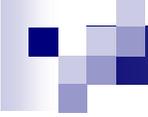
:Methanol

Using stannic oxide which is anti-static material, surface electrical resistivity of Anti-Static Feature is ( $10^8 \Omega/\square$ ) Therefore, it has a very fouling-preventive effect. Also, it has a high cohesion effect because it is alcohol based.

Super Glass Barrier have been used extensively to exterior walls and roofs as anti-fouling coating, as well as in tunnels to prevent the tiles from fouling, Super Glass Barrier can be applied and cohere to the base even when there is some moisture left in the base.

### Caution:

For the glass, Super Glass Barrier initially has anti-fouling effect because of its anti-static and super-hydrophilic property. However, the glass will be fouled soon because of the reaction with the chemicals that melts out from glass.



# The Features of Solar Self-Maintenance Coating

## Solar Self-Maintenance Coating : Exclusive for Solar Panels

### Component

- :Silica ··· Super-Hydrophilic Cohesion Binder Function
- :Stannic Oxide ··· Anti-Static Function
- :Tungsten Oxides ··· Resistance to Chemicals/ Hard Coating
- :Methanol and Water

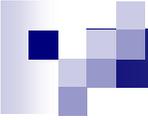
The feature of a solar panel has a small angle of inclination, and is that all dirt adheres easily.

Many of glass covers for a solar panel are using "white board glass (general term of the glass which has high transmissivity, and little elution of an ingredient).

The performance for which a coating material is asked is fouling prevention performance (decline in power generation efficiency is controlled).

The coating material should be 1. It is important that to avoid dropping-transmissivity of solar energy 2. Has resistance to chemicals .

To solve this issue, we developed an anti-fouling agent exclusively for the solar panels using the Super Glass Barrier as a base, with Tungsten oxides which does not lower the transmittivity of visible light, has resistance to chemicals and super alloy hard coating property.



# The Features of Hyper Glass Barrier

## Hyper Glass Barrier: For Exterior Window Panes

### Component

- :Silica ··· Super-Hydrophilic Cohesion Binder Function
- :Stannic Oxide ··· Anti-Static Function
- :Tungsten Oxides ··· Resistance to Chemicals/ Hard Coating
- :Niobium pentoxide ··· High refractive index/Hard Coating
- :Platinum ultrafine particles ··· Resistance to Chemicals
- :Methanol and Water

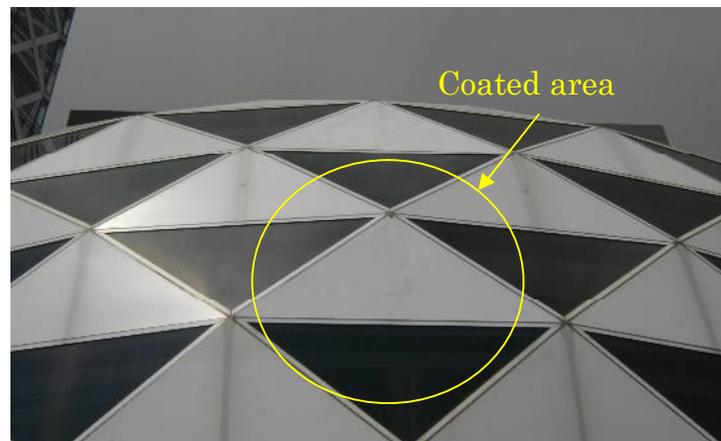
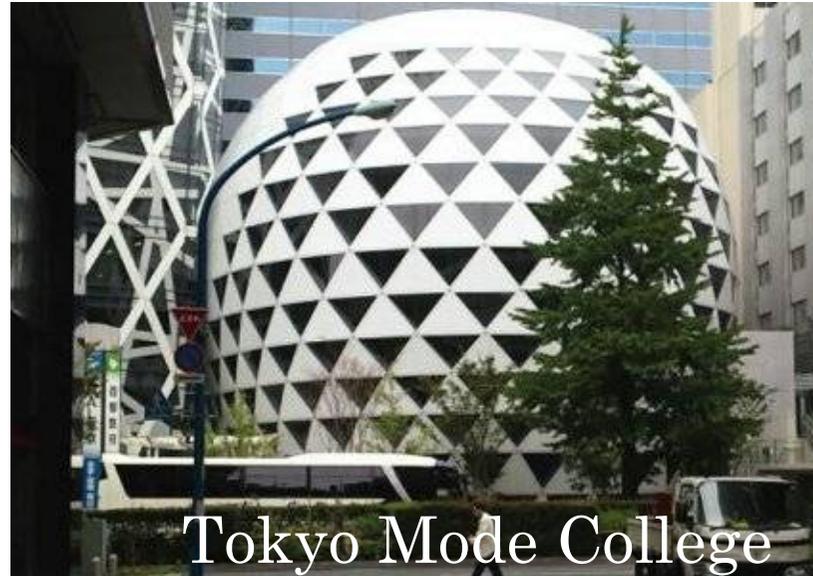
Transparency is the most important feature for glass.

The coating material should be 1. Transparency 2. Preventing chemical reactions 3. High degree of hardness and weather resistance

We added niobium pentoxide, which works as high refractive agent to prevent uneven coating. Furthermore, we developed anti-static, anti-fouling coating agent exclusive to glass coating with Tungsten oxides and Platinum ultrafine particles which enhances resistance to chemicals and hard coating.

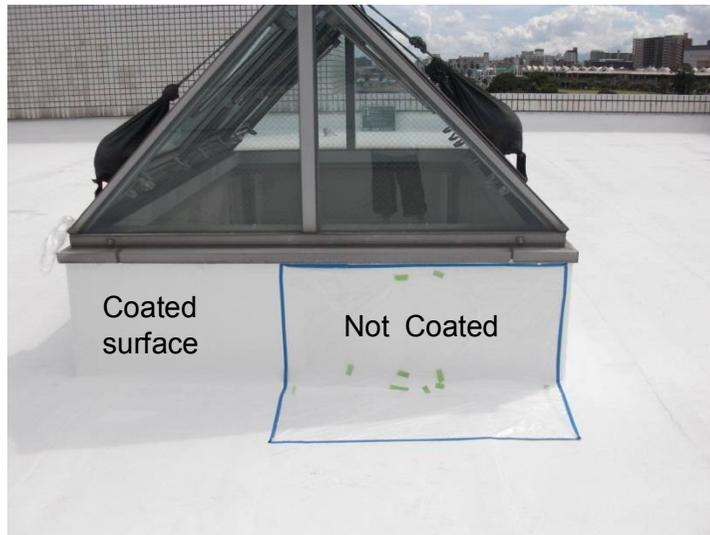
# Construction results(1): Aluminum Panels

Antifouling coating made sketches of fluorine panel used as a top coat.



# Construction results(2): Exterior Wall

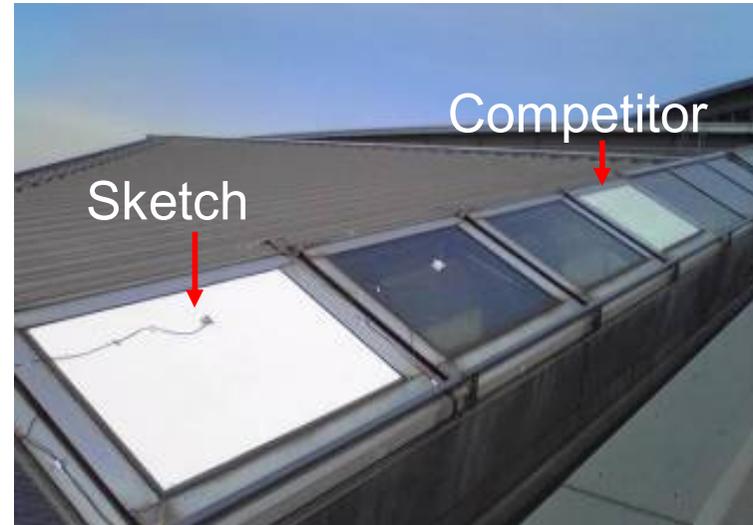
Adopted the antifouling coating made of sketch, preventing contamination of volcanic ash that piled up in the (flat) roof.



# Construction results(3): Exterior Wall

Applied to the glass skylight (external insulation coat + antifouling coat) .

The sketch made no problem, was adopted therefore the result of competition with other (Rooftop) companies, other companies contamination has occurred at 1 month.



# Construction results(4):

## Hot spring Spa (Glass)

Before Applying



After Applied



# Construction results(5): etc.

## Hinachi Dam



## Enasan Tunnel



## West JR Bus Company



## SUBARU Airplane on Display

