

Adjustable according to the Base Material, Purpose, and Work Conditions

Photocatalyst Coating **PALCCOAT**® Series

Photocatalyst **Standard Type**

Harmless Water-Soluble Coating

<b>ST-P</b>	Undercoating for Exterior Walls	<ul style="list-style-type: none"> <li>When the photocatalyst is to be applied to an organic base material, this undercoating is used as a protective layer for preventing the photocatalysis process from occurring directly on the base material. This is mainly used for organic base materials such as coated surfaces and plasterwork.</li> </ul>
<b>ST</b>	Topcoat for Exterior Walls	<ul style="list-style-type: none"> <li>This can be used as a topcoat for various exterior walls such as coated surfaces and plasterwork.</li> <li>The undercoating is not needed for inorganic materials such as tiles.</li> </ul>
<b>MOLD</b>	Topcoat for Exposed Concrete	<ul style="list-style-type: none"> <li>This has been enhanced to suppress mold and algae which easily grow on concrete.</li> </ul>
<b>VLG</b>	For Interiors	<ul style="list-style-type: none"> <li>This strongly reacts to room lighting (visible light) resulting effective in sterilization, deodorization, and air purification.</li> <li>Silver ion has been added so that the deodorization function can be maintained even during the night.</li> <li>In addition to interiors, this can be used as a topcoat for exterior walls that receive thin light.</li> </ul>



Photocatalyst **Clear Type**

Highly Transparent Alcohol Dispersion Coating

<b>Clear G</b>	Clear Type for Glass	<ul style="list-style-type: none"> <li>Alcohol dispersion increases the volatility so that a clear coating can be created.</li> <li>High hydrophilic property prevents dirt.</li> </ul>
<b>Clear P</b>	Undercoating for Exterior Walls	<ul style="list-style-type: none"> <li>A highly transparent coating can be created so that the design of the based material is not affected.</li> <li>Suitable for dark and glossy base materials.</li> <li>Available for acrylics, tent materials, and organic base materials with high water repellency.</li> </ul>
<b>Clear T</b>	Topcoat for Exterior Walls	<ul style="list-style-type: none"> <li>High transparency can be achieved so that the design of the based material is not affected</li> <li>Suitable for dark and glossy base materials.</li> </ul>

\* The effectiveness of our company's work is guaranteed for at least five years. (Note: Depending on the conditions at the actual site.)  
 \* For liquid solution sales, the purchaser takes work responsibility. (Construction point documents are available at sale separately.)  
 \* Work training can be provided upon request. (Dispatch work instruction)  
 \* Please contact us if more details are needed for the liquid solution.

■Contact

Proven and Reliable Photocatalyst Technology  
**PALCCOAT**® Group

■Manufacturer / Engineering



**Souma Co., Ltd.**

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PIAJ Photocatalysis Industry Association of Japan Member

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PALCCOAT

PALCCOAT

Water-Soluble Titanium Dioxide  
**Photocatalyst Coating**



Titanium  
 Dioxide  
 Photocatalyst  
 Technology



TiO<sub>2</sub>  
 PALCCOAT<sup>®</sup>  
 HO<sub>2</sub>

X

O<sub>2</sub>-

H<sub>2</sub>O

H<sub>2</sub>O

# Photocatalyst **PALCCOAT** continuously dissolves various pollutants, odors, and harmful materials, makes them harmless and creates a more comfortable environment.

We are threatened by various invisible harmful substances on a daily basis. We surrounded by various risks including air pollution from exhaust gas, sick house syndrome caused by building materials, fungi and bacteria that can be harmful to humans, as well as pathogens and viruses that are spread through the air. In addition, dirt, mold, and rain stains on building exteriors, yellowish color of interior wall surfaces, and various odors from tobacco, food garbage, animals, mold, bathrooms, and new building materials. Now PALCCOAT makes it possible to achieve everyone's desire to protect their health and maintain the beauty and cleanness of buildings and living environments.

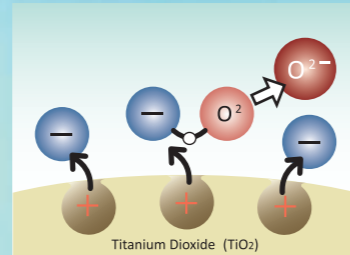


## What is a Photocatalyst?

Photocatalyst

Because of its characteristics of titanium oxide, strong oxidative decomposition occurs at the surface of the place where light energy of being like sunlight or room light hits and then various materials approaching to are broken down. Meanwhile the titanium dioxide itself does not change, so this reaction repeats every time light is received.

## How Photocatalysis Works



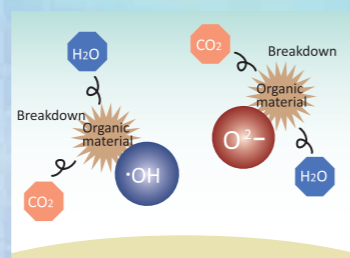
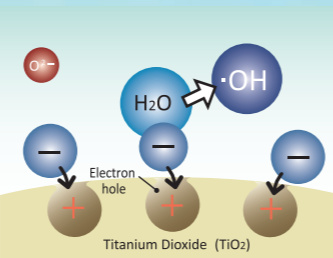
**1** When Titanium dioxide receives energy from light, electrons (-) are released from the surface. The electrons released are combined with oxygen in the air then creates "O<sub>2</sub><sup>-</sup>" (Superoxide anion).

## What is Titanium Dioxide?

Titanium Dioxide

Titanium dioxide is a white powder (superfine particles) that has long been used as a white pigment. It is used for a wide variety of usages such as in coatings, dental material, toothpaste, and cosmetics. It is also used as a food additive for coloring in white chocolate, sweets, and chewing gums because it is tasteless, odorless, and is harmless to humans.

**2** The surface where the electrons were released is tinged with the electric charge<sup>\*1</sup> of plus, and takes electrons from moisture<sup>\*2</sup> of the air and then return to its original state. On the other hand, the moisture that lost the electron becomes a hydroxyl radical (•OH).



**3** The "O<sub>2</sub><sup>-</sup>" and "•OH" that resulted in a process of transfer of this electron can produce strong oxidative decomposition, which decompose organic compounds such as oil causing dirt and adhesion, bacteria, harmful chemical gas, viruses, and molds even into simple harmless substances that then are released into air.

\*1. This is referred to as an "Electron hole", and this is called as "Hole of plus (Electron hole)" or just a hole.  
\*2. Before reacting with H<sub>2</sub>O, there are cases where electrons are taken and broken down directly from organic compounds.

## PALCCOAT has replied to various needs of customers with sufficient track record and confidence from them.

JR Matsumoto Station



New construction of the Matsumoto Station West Entrance on the JR Shinonoi Line

Exterior Wall of a New Restaurant



Prevents rain stains and color fading

Company Building Exteriors



Apartment Exterior Walls



Appearance can be maintained, which improves the occupancy rate

Exterior Walls of an Individual Residence



Appearance can be maintained for years by applying a coating to home exteriors

Signboard



Southern European Style Roofing Tiles



Originality can be maintained

School Facilities



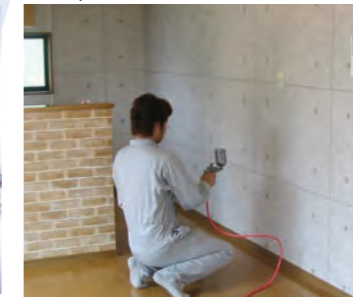
Countermeasure for Sick School Syndrome at an elementary school in Tokyo

Retirement Homes



Sterilization and odor elimination

New Apartments



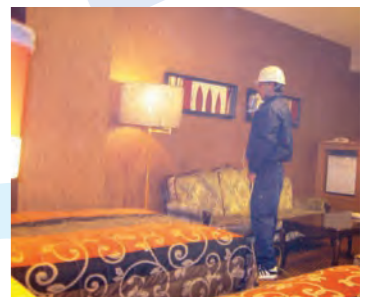
Countermeasure for Sick House Syndrome before movement

Construction Equipment Leasing Company



Application to steel sheets

Hotel Rooms



Cleanliness from the sterilization and deodorization properties can be appealed

Hotel Kitchens



Sterilization to prevent food poisoning

Smoking Areas



Eliminates odor and prevents Yellowish

Food Processing Plants



Air purification at a sake brewery

Kindergartens and Nursery Schools



Coating the insides of daycare centers provides a sense of safety

Taxi Interiors



Sterilization and deodorization inside of cars provides a comfortable space for customers

Bus Interiors



Elimination of new car smell (VOC gas) in a kindergarten bus Air purification inside of buses and prevention of motion sickness

Coatings on Clothes



Used by many dry cleaners

Photocatalyst Coated Mask



Flu virus can be broken down and eliminated

# PALCCOAT® PALCOAT has a proven track record, and can be used to fill various needs.

## Benefits of Photocatalyst Coatings

Maintains Appearance / Improves Asset Value / Purifies the Environment / Eliminates Odors / Sterilizes / Prevents Yellowish / Countermeasure for Sick House Syndrome

### JR Nishi-Funabashi Station Building



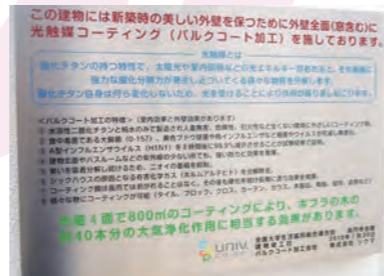
Construction of an escalator for the shopping area at Nishi-Funabashi Station

Coating on the station's exterior and glass

Antifouling coating on the skylight glass of the Arcade

Even the sign is coated

### Coating on the Nationwide University Cooperation Building



A sign was posted related to the coating to appeal environmental protection measures

### Washing and Coating Exterior Walls of a Food Processing Plant

Maintaining appearance improves image

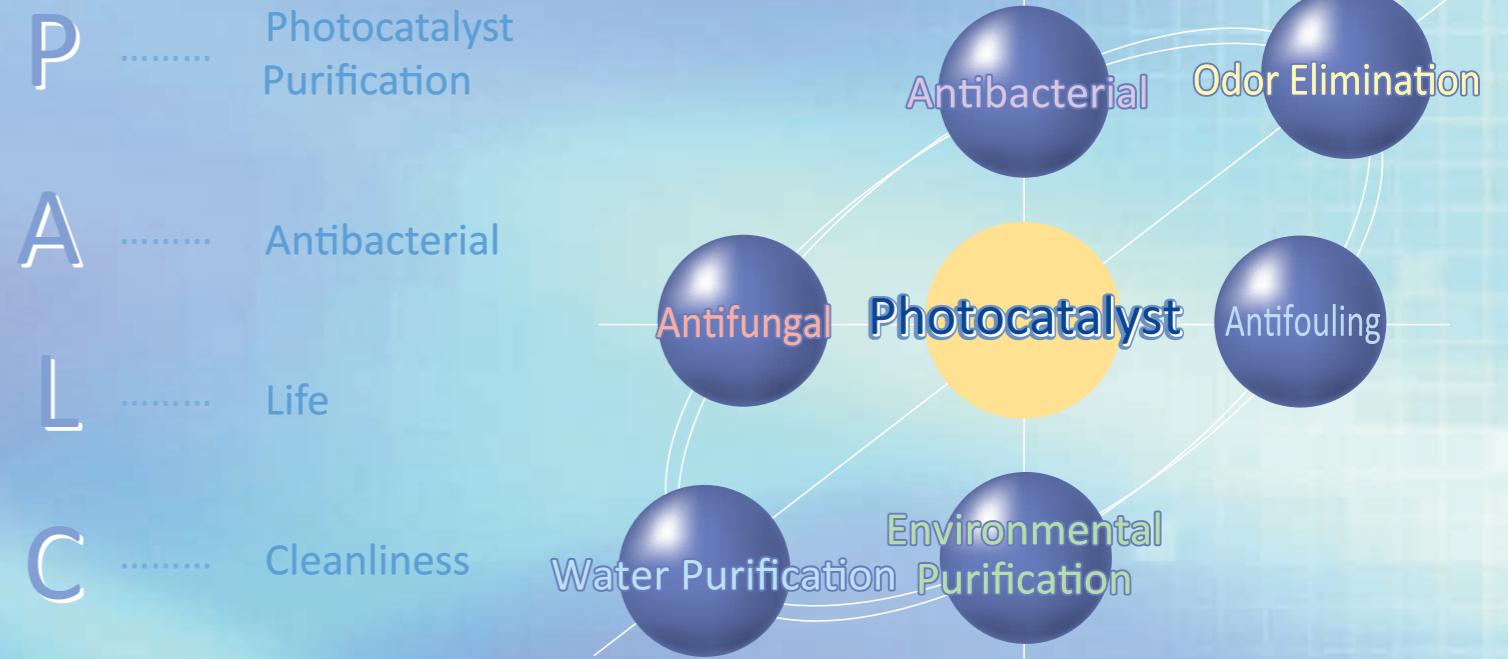


Coating in a scissor lift

Coating on the exterior walls breaks down pollutants in the air, which purifies the environment

Cleaning

# PALCCOAT

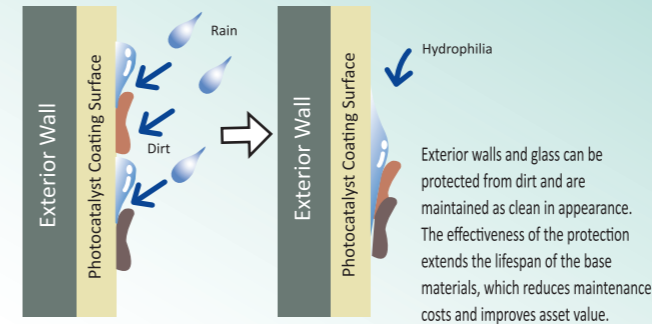


**PALCCOAT** is a coating system that uses "Photocatalysis" to purify the environment so that living environments can be kept clean thanks to its antibacterial effect.

## The Photocatalyst PALCCOAT® Used in Various Situations PALCCOAT®

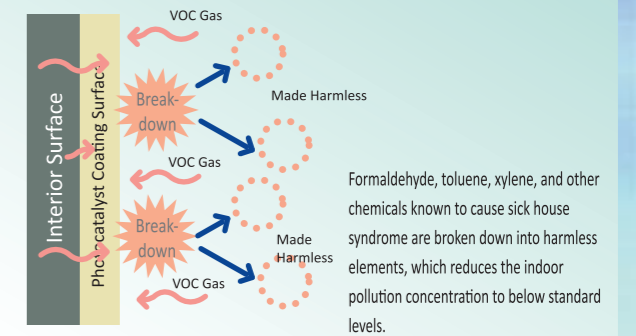
### Function of Asset Maintenance (Self-Cleaning Function)

Rain Stains, Dirt, and Mold are Removed from Building Exteriors



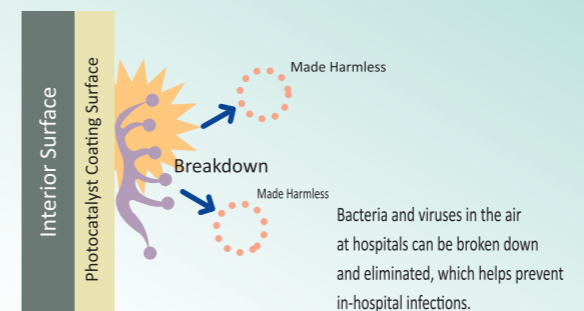
### Function of Sick House Syndrome Countermeasure

Hazardous Chemicals from Construction Materials are Broken Down



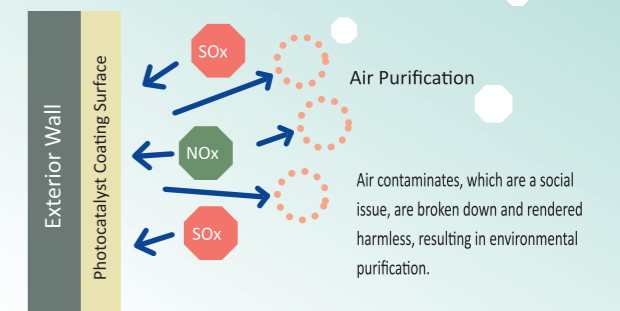
### Function of Suppression of In-Hospital Infections

Function for Breaking Down Bacteria and Viruses in the Air



### Function of Environmental Purification Function

Harmful Contaminates in the Air are Broken Down



## Benefits for Exterior Walls

### 1. Maintaining Building Appearance

The cleanness of exterior walls is maintained by preventing dirt from attaching. After the coating is applied, dirt does not appear even after five years.



#### ■ Process of Breakdown / Dirt Elimination [Organic Material Decomposition Test (Red Ink Fading Test)]

The photos on the right show a time lapse for a white tile with the coating on the left half that is applied with a commercially available red ink. (Conditions: 20W UV lamp 1m above tile)



### 2. Mold Suppression

The mold prevention function is effective on areas that receive limited UV light such as north-facing walls and bathrooms. An application test was conducted on a wall where mold already existed. After eight weeks, a good result was found as shown in the photos on the right.

#### ■ Mold Prevention Test on Exterior Wall



## Benefits for Interiors

A new and improved version of the photoreactive type, which was already effective indoors. The composition ratio of the photoreactive sol was increased and silver ion was also added. The new VLAG for indoor use is effective even in rooms with thin light, and the silver ions maintain the sterilization and deodorization properties in dark areas.

### 1. Deodorization

Various odors that are occurred during daily activities can become unpleasant when absorbed by walls, curtains and furniture. The photocatalyst repeatedly breaks down and eliminates such odors so that odor accumulation is suppressed, resulting in a more comfortable environment. Example) Pet smells, cooking smells in kitchens, new car smell, body odor, etc.

### 2. Sterilization

Bacteria and viruses such as coliform bacteria (O-157), staph aureus, bird flu, and Norovirus, which occur food poisoning, can be eliminated, and even dead bacteria (verotoxins) can be broken down and rendered harmless. Viruses can be reduced by 99.9%! [Table 2]

### 3. Air Purification

Toxic volatile gases (VOCs) that can cause sick house syndrome are broken down and rendered harmless. In addition, NOx and SOx that cause air pollution can also be made harmless.

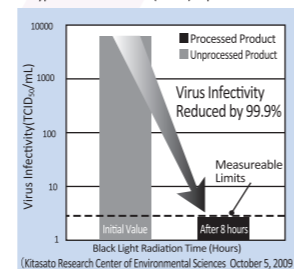
#### ■ Antibacterial Test <Coliform> [Table 1] Test No.: 017868-2

	Number of Inoculations	After 18 Hours	Activity Value of Bacteriostasis
Nylon Cloth	logA 4.2	logB 5.6	
Cotton Cloth	logA 4.2	logB' 7.4	
LOHAS Towel	logA 4.2	logC 1.3	4.3

Sept. 9, 2005 Inspection Institute: Boken Quality Evaluation Institute Kinki Office  
Antibacterial test using LOHAS Style by PALCCOAT towel

Test Items: Antibacterial test [Table 1]  
Test Method: According to JIS L 1902 Quantitative test bacteria emulsion absorption method. However, the washing method is according to the JIS L 0217103 test method. [JAFET standard detergent was used.]  
Measurement method for viable bacteria count: Pour plate culture method (Note) Florescent light radiated for 18 hours during cultivation (about 5,500 lux)

#### ■ Type A Influenza Virus (H1N1) Experimental Value [Table 2]



(Kitasato Research Center of Environmental Sciences, October 5, 2009)

## Application Method

Application is made to indoor walls and ceilings and to exterior wall by spraying. Titanium dioxide reacts to light, resulting in various effects. Application can also be done using a roller or brush according to the situation.



## Harmless Water-Soluble Coating Agent

The photocatalyst coating agent PALCCOAT Standard Type contains only water-soluble titanium dioxide and pure water and is an environmentally friendly coating agent which is harmless to humans and animals, is nonhazardous, and is nonflammable.

It has been proven to be harmless to humans and animals by a toxicity test.

There was no change in the weight of male mice according to the "Acute Toxicity Test Using Male Mice" safety test conducted by the Japan Food Research Laboratory.

#### ■ Changes in Weight

Administered Group	Before Exposure	After Exposure (Days)	
		7	14
Study Group	27.0±0.8 (5)	29.7±0.7 (5)	31.4±1.7 (5)
Control Group	26.9±0.8 (5)	29.7±1.3 (5)	1.9±1.8 (5)

Weight is expressed using the average ± standard deviation (Unit: g), and the number in parentheses indicates the number of animals.

No abnormalities were found in the "Mutation Test" or "Primary Skin Irritation Test Conducted on Rabbits."

## Long-Lasting Coating

The formed coating cannot be peeled off by rain or wind once it has dried for two hours. After this, the coating continues to harden, and after a few weeks the hardness becomes stable at a pencil hardness of 2H or harder\*.

This coating is strong and can withstand harsh natural conditions, and can maintain its effectiveness for a long time.

\*Differs according to the temperature and humidity.

#### JIS D 0205:1987 Test Method of Weatherability for Automotive Parts

According to WAN-IS(H)  
Black Panel Temperature: 63 Degrees  
Test Time: 3,000 hours

No abnormalities were found from testing conducted using the above conditions.

## Effective Even with Interior Lights

As with the red ink tile test stated on the left page, it was confirmed that red ink can be broken down according to a test using visible light.

Pigment degradation with a short wavelength cutoff filter

High degradation is possible even in the visible light range (410nm to 490nm). The deodorization and sterilization functions also work indoors.

\* A 9,000 lux white fluorescent light was used.

#### ■ Before Exposure to Florescent Lighting



#### ■ After Exposure to Florescent Lighting (30 minutes)



Inspection Institute: SAGA Ceramics Research Laboratory

## Certification System by the Photocatalysis Industry Association of Japan

The Photocatalysis Industry Association of Japan (PIAJ) established their criteria for evaluating photocatalyst materials and their applied products in order to improve product quality and performance. They also operate the certification system for forming a healthy photocatalyst market.

Product Name	PALCCOAT ST		
Photocatalyst Type	Titanium dioxide material		
Photocatalyst Processed Portion	Coating material		
Effect of the Photocatalyst	Measurement method is according to JIS R1703-1 and JIS R1703-2		
Self-Cleaning Effect	Certified Base Material	Glass / Ceramics	
	Contact Angle *1	less than 5°	This is the index for dirt breakdown performance.
	Decomposition Activity Index *1	12.6	This is the index for dirt breakdown performance.
	Certified Base Material	Resin	
Antibacterial effect	Contact Angle *1	less than 11.2°	This is the index for dirt breakdown performance.
	Decomposition Activity Index *1	24	This is the index for dirt breakdown performance.
	Certified Base Material	Glass / Ceramics	
	Measurement method is according to JIS R 17 0 2		
Air purification Effect (Acetaldehyde)	Certified Base Material	Glass / Ceramics	
	Amount of Acetaldehyde Removed *3	1.60µmol/h	Using this product in an area of 1m <sup>2</sup> per 1m <sup>3</sup> of room volume can be expected to reduce acetaldehyde in the room air by 48% during the day.
	Self-Cleaning: Outdoor, Antibacterial: Outdoor, near the window where sunlight enters in the daytime, Air purification: The interior of a house or building where sunlight enters through the window		
	Measurement method is according to JIS R 17 0 1-2		
Location Used	Safety		
	Acute oral toxicity, primary skin irritation, and mutagenicity have been confirmed to meet the safety standards set by the Photocatalysis Industry Association of Japan.		
Conditions for Usage	If too much dirt is attached to a surface self-cleaning and antibacterial effect cannot be achieved, so regular cleaning is recommended.		
	*1 According to the certification criteria set by the Photocatalysis Industry Association of Japan, the contact angle should be 30° or less, with a smaller contact angle indicating better performance. Certification requires a decomposition activity index of 5nmol/L/min or higher, with a higher index indicating better performance.		
	*2 According to the certification criteria set by the Photocatalysis Industry Association of Japan, the Antibacterial activity value should be "2.0" or more, and the effect of light irradiation is "0.3" or more. An antibacterial activity value of "2.0" means that the number of bacteria is reduced to 1/100, and "3.0" means that the number of bacteria is reduced to 1/1000. In addition, the effect of light irradiation is "0.3", which means that the number of bacteria has been reduced to about half by irradiation light compared to the under the condition of not exposing light.		
	*3 The certification standard of the Photocatalysis Industry Association is acetaldehyde removal amount of 0.17 µmol / h or more. This value is the amount of acetaldehyde removed per 50 cm <sup>2</sup> , and the higher this value is the effect of reducing acetaldehyde in the room.		
	*Expressed according to the guidelines set by the Photocatalysis Industry Association of Japan.		

The PIAJ mark is the certification mark given to photocatalyst products that meet standard values. PALCCOAT ST acquired the following PIAJ mark for "Self-Cleaning" performance.



Self-Cleaning  
Air Purification (acetaldehyde)  
Anti-Bacterial

## Lecture for Photocatalyst Coating Technology Using Water-Soluble Titanium Dioxide



Attendants listened carefully to Dr. Ichinose in a study group

A patent for "Anatase Dispersion and its Manufacturing Method" invented by Dr. Ichinose was granted in January of 1999. Further study of photocatalysis technology has progressed, and newly developed technologies have allowed for a wider range of applications.

SAGA Ceramics Research Laboratory  
Fellow Researchers - Doctor of Engineering, Hiromichi Ichinose  
Developer of the water-soluble titanium dioxide coating agent  
For promoting science and technology in 2001, he received an award from the Minister of Education, Culture, Sports, Science and Technology