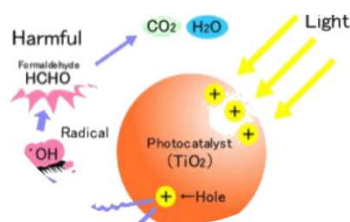


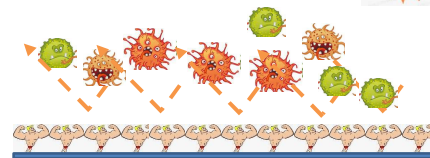
EproSafe Air Introduction to photocatalytic coating materials



Photocatalyst – TiO₂



In chemistry, photocatalysis is the acceleration of a photoreaction in the presence of a catalyst. In catalysed photolysis, light is absorbed by an adsorbed substrate. In photogenerated catalysis, the photocatalytic activity (PCA) depends on the ability of the catalyst to create electron-hole pairs, which generate free radicals (e.g. hydroxyl radicals: $\cdot\text{OH}$) able to undergo secondary reactions. Its practical application was made possible by the discovery of water electrolysis by means of titanium dioxide



The photocatalyst is active when lighting, and continuously decomposing germs dropped from human touch and spittle.

Photocatalyst



Photocatalyst depends on light energy to achieve disinfection, sterilization, and self-cleaning effect. Current photocatalysts made of sintered powders are mostly dissolved in a solution of the appropriate dispersing solvent. However, the adhesion on glass and transmittance are usually poor. EproSafe Air develops the photocatalyst which has overcome disadvantages of adhesion and penetration degree. Light can effectively filter out and reflect through the product even for short wavelength light source. The application of photocatalyst is mainly on glass, but it can also apply to other substrates. Scope can be extended to different industries needed to deploy and process.

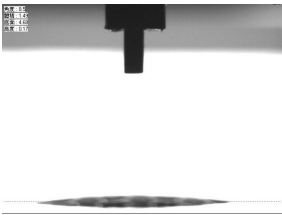
- Sol-Gel based liquid solution
- Good stability / Safety
- Excellent ease of use, without adding other chemicals
- Coating process
- Coating on any architecture substrate
- May pass through the glass transition temperature
- Coating method
- Spray / Roller
- Membranous features
- Inorganic material
- Deodorization - Sterilized
- Photocatalyst
- UV light and visible light absorption

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Water-based

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Photocatalyst coating performance

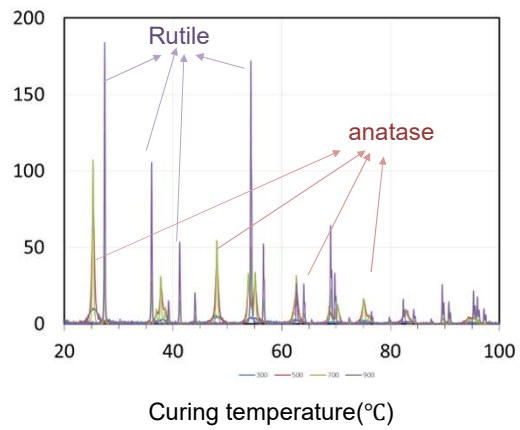
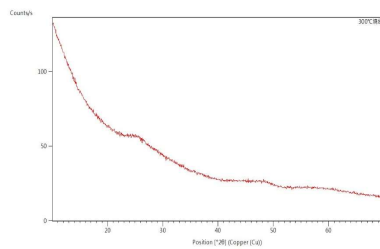


Performance

Item	PSG-S5	Test method	Reference
Adhesion	5B	3M scotch 600 Tape	ASTM3359
Water contact angle	<10°	Goniometer (after UV light exposure)	
Oleic acid decomposition test	70° → <20°		CNS 15378-1
Pencil hardness	7H	1kg	ASTM3363
Gloss 60°	>170	Gloss meter	
Sterilization	>80%	National Cheng Kung University (UV light)	TN-002
Sterilization	>99.99%	Food Industry Research and Development Institute (visible light)	TN-002

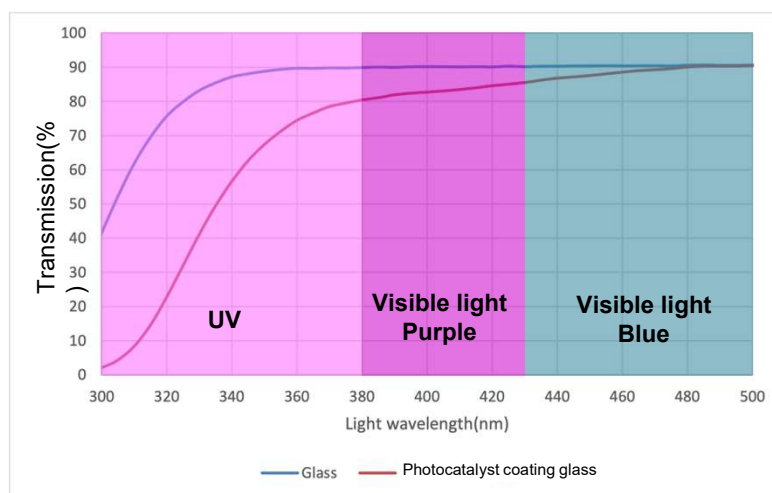
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Photocatalyst crystallization



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Photocatalyst spectrum



Quality Water Air photocatalyst absorb not only UV light, but short wavelength visible light

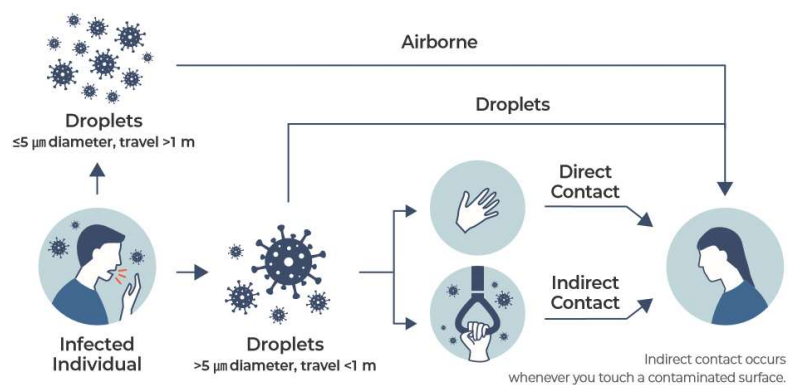
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Photocatalyst sterilization



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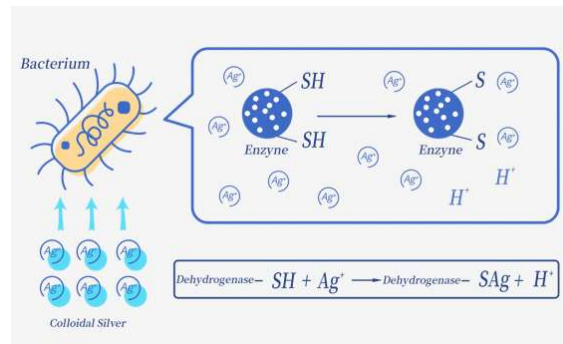
Why do we need antimicrobial films?



While **social distancing** does reduce the risks of infection, surfaces must also be protected to prevent transmission.

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Nano-silver



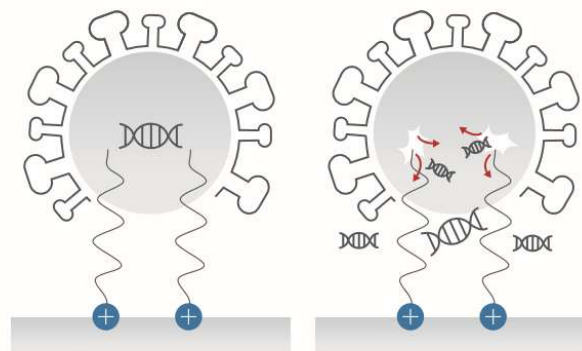
Silver

Silver and copper are same principle to kill bacteria

Colloidal silver particles combine with the (-SH) group of enzyme protein in bacteria, blocking its respiratory chain. Even infiltrating directly into the cell, damaged bacterial genetic material, making it impossible to produce resistant offspring.

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Nano-silver



01 Micropolymer networks kill microbes by puncturing their cellular membranes.

02 After the wall is damaged, genetic material and other internal components escape, killing the microbe.

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Photocatalyst & Nano-silver



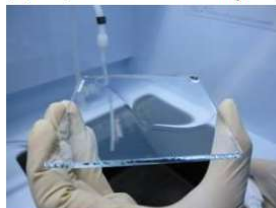
	Photocatalyst	Nano-Silver
Efficient of sterilization	Highest(UV & Sunlight) Medium(Visible light) None(No light)	Medium
Safety	High	Some countries concern
appearance	Light yellow	Light gray
Life time	Over 2 years	3 – 6 months

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Photocatalyst coating glass

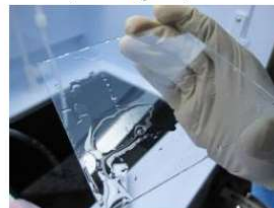


Hydrophilic smart film on glass



Contact angle 5°

Normal glass



Contact angle 40° ~60°

Super Hydrophilic

- Low surface energy
- Low surface electric resistance
- Low static electricity
- Reduce dust static adsorption

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Photocatalyst Organic, Harmful gases, Dirty...decomposition

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Oleic acid decomposition test

Stainless substrate



UV exposure 48 hours

After light exposure, the surface of photocatalyst becomes hydrophilic.
When oleic acid is applied to the surface, it exhibits hydrophobic properties.
After the photocatalyst decomposes the oleic acid upon light exposure, the surface returns to being hydrophilic.

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Photocatalyst decomposition test - Blue ink



UV exposure
24 hours

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Solar panel outdoor test result

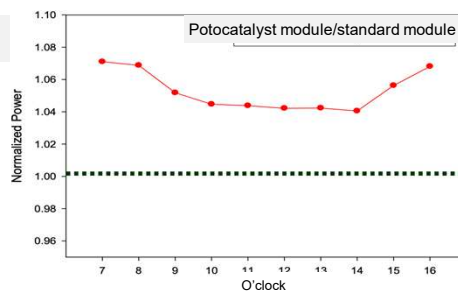
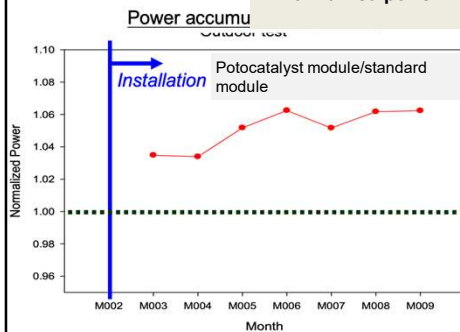


March & April solar module output		
	Photocatalyst coating solar module	Standard module
Total kWh	14.9	14.4
kWh/kW	2.1	2.0

June to August solar module output		
	Photocatalyst coating solar module	Standard module
Total kWh	46.7	44.4
kWh/kW	3.4	3.2

After 3 months, photocatalyst coating module generate more **5.5% power** than standard module due to clean surface

Normalized power = (photocatalyst coating solar module) / (standard solar module)



Photocatalyst reliability test



	Picture	
Salt mist test on stainless substrate (Dip in 10% NaCl one week)	Non-coating	coating

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Reliability Test Summary



Test item	Test condition	Test result	Standard condition	Standard reference
Damp heat	2000 hours	$\Delta T < 0.1\%$	1000 hours	IEC 61215
Thermal cycling	400 cycles	$\Delta T < 0.6\%$	200 cycles	IEC 61215
Humidity freeze	20 cycles	$\Delta T < 0.3\%$	10 cycles	IEC 61215
UV	60 kWh	$\Delta T < 0.3\%$	15 kWh	IEC 61215
Salt mist	96 hours	$\Delta T < 0.6\%$	96 hours	IEC 61701
Acid Resistance	1M HCl	$\Delta T < 0.3\%$	1M HCl	

ΔT should be lower than 0.8%

Quality Water Germany Air

Damp-heat Test Result



Mesurement	400-1100nm transmittance (%)		
sample	3 (3.2mm soda lime glass)		
Transmission of glass	Transmission of glass (after DH 1000 hours)	Transmission of glass (after DH 1000 hours)	Transmission difference
93.34%	93.21%	93.32%	-0.05%

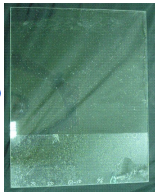
UV-Vis 750S



KSON



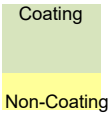
Reference



After DH1000



After DH2000



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Thermal Cycle



Measurement	400-1100nm transmittance (%)		
Sample	3 (3.2mm soda lime glass)		
Transmission of glass	Transmission of glass (after TC 200 cycles)	Transmission of glass (after TC 400 cycles)	Transmission difference
93.27%	92.65%	92.71%	-0.56%

UV-Vis 750S



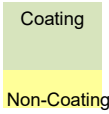
KSON



Reference



After TC400



Quality Water Germany Air

Humidity Freeze



Measurement	400-1100nm transmittance (%)	
Sample	3 (3.2mm soda lime glass)	
Transmission of glass	Transmission of glass (after HF 20 cycles)	Transmission difference
93.29%	93.26%	-0.03%

UV-Vis 750S



KSON



Reference



After humidity freeze test

Coating

Non-Coating

EproSafe Air

UV Exposure



Measurement	400-1100nm transmittance (%)	
Sample	3 (3.2mm soda lime glass)	
Transmission of glass	Transmission of glass (after UV 60kWh)	Transmission difference
93.38%	93.28%	-0.10%

UV-Vis 750S



UV04-1017



Reference



After UV

Coating

Non-Coating

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Important Notice to Purchaser: This technical information is based on tests that we believe are reliable. Your results may be different in test types and conditions.