paintistanbul TURKCOAT CONGRESS

Color & Comfort

CERANATE by DIC: From Concept to Creation
A PFAS-free, High-Durability Coating Resin

Masahiro Ito

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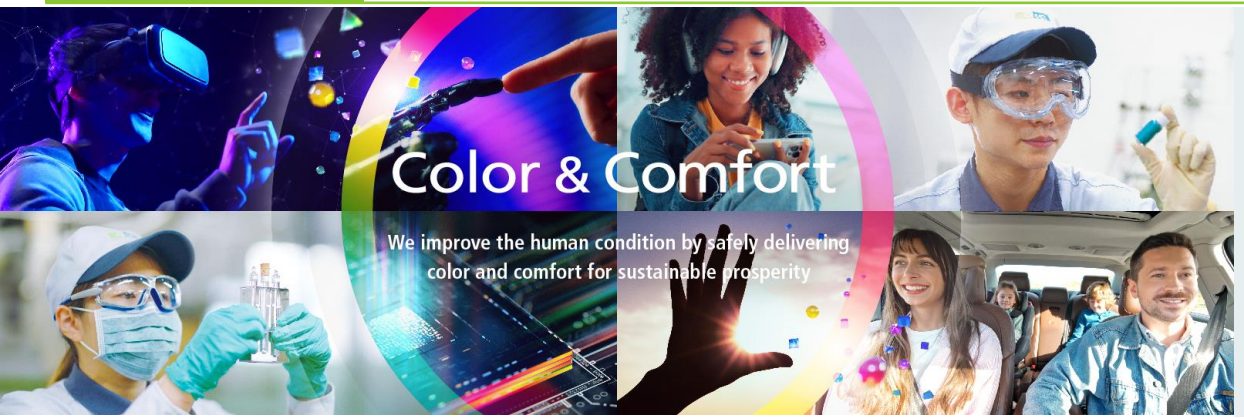
DIC Asia Pacific, Polymer Technical Center

BOSAD BOYA SANAYİCİLERİ DERNEĞİ THE ASSOCIATION OF PAINT INDUSTRY

ChemMedia PUBLISHER | CONGRESS | EVENTS | AGENCY

About DIC

Company Name	DIC Corporation
Corporate Headquarters	DIC Building, 7-20, Nihonbashi 3-chome, Chuo-ku, Tokyo, Japan
Date of Foundation	February 15, 1908
Paid-in Capital	¥96.6 billion
Description of Business	Manufacture and sale of printing inks, organic pigments and synthetic resins
Number of Employees	Consolidated: 21,184 Nonconsolidated: 3,947 (As of December 31, 2024)
Number of Group Companies	171 (Domestic: 24, Overseas: 147) (As of December 31, 2024)
Consolidated Net Sales	¥1,077.1 billion (Fiscal year 2024)
Consolidated Operating Income	¥44.5 billion (Fiscal year 2024)



We improve the human condition by safely delivering color and comfort for sustainable prosperity

Widely known as a chemical manufacturer, DIC operates globally in over 60 countries and regions. A global leader in printing inks, organic pigments, and high-performance resins, DIC Group companies deliver *Color and Comfort* through various products and services. DIC is actively tackling challenging issues on multiple fronts, creating new value beyond chemistry to create a better future for Mother Earth and all her people.

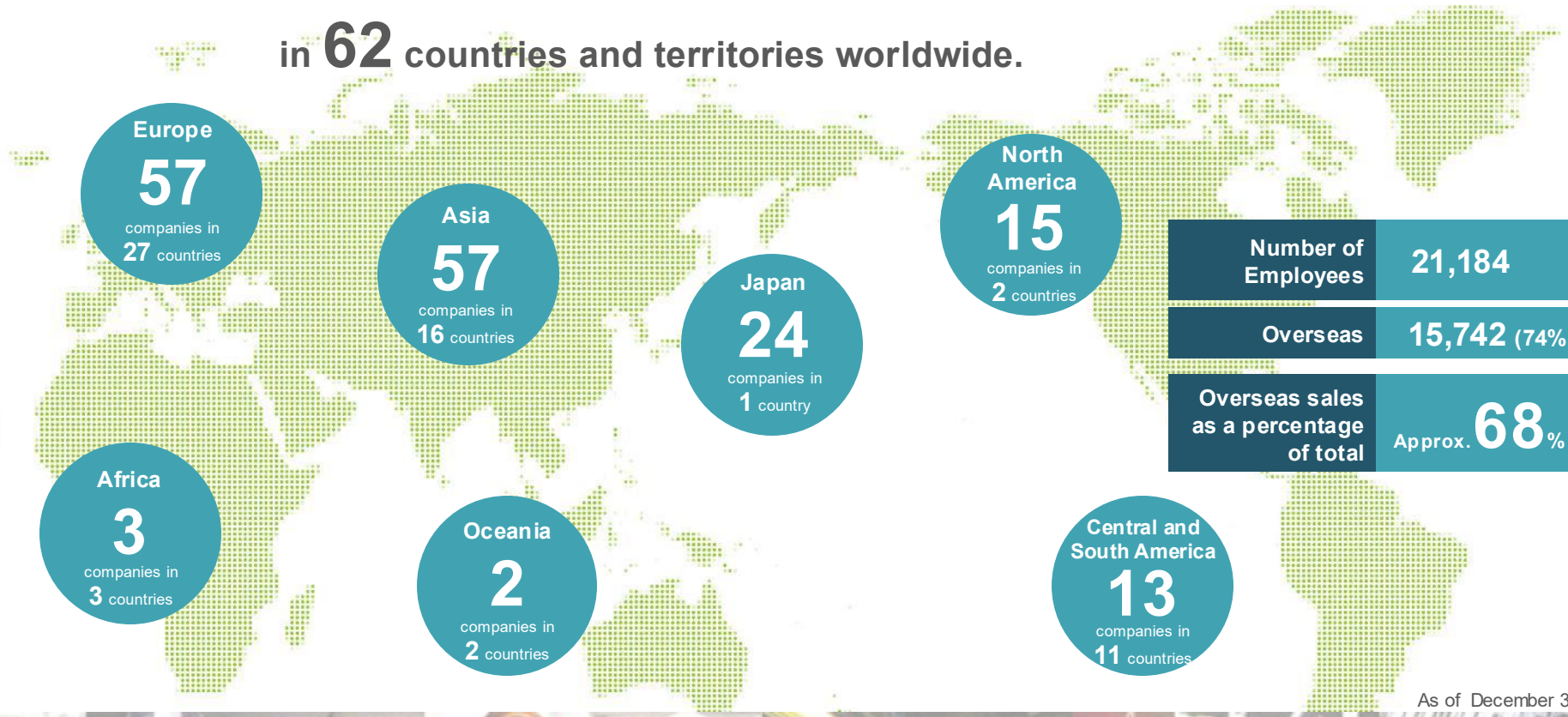
https://www.dic-global.com/en/about/

Extensive Global Network

DIC group has 171 companies, including Sun Chemical Corporation, in 62 countries and territories worldwide.

Color & Comfort

SunChemical®
a member of the DIC group Color & Comfort



Number of Employees	21,184
Overseas	15,742 (74%)
Overseas sales as a percentage of total	Approx. 68%

As of December 31, 2024

https://www.dic-global.com/en/about/group.html

DIC Polymers business outlook

- **One of the largest global specialty resin manufactures for paint and coating applications**
- **Product Portfolio**
  - Water/Solvent-borne resin
    - Acrylic resin
    - Polyester resin
    - Polyurethane resin
    - UV curable resin
    - Epoxy resin
    - Phenolic resin
    - Modifier / Plasticizer
  - Unsaturated polyester resin
  - Alkyl phenol
  - Metal carboxylates
  - Sulphur chemicals
- **Global 13 plants**
- **R&D: Japan, Thailand, and China**

OEM's coating resins
Polyurethane for leather

UV-curable resins

Leveraging advanced technologies to create innovative solutions for sustainability challenges

Applications

Industrial

Paint & Coatings, Leather, Fiber sizing etc..




Digital

Semi-conductor, Optical film, solder resist etc..




Sustainable Technology

- Bio-Based
- Low VOC (Waterborne, Powder, UV curable etc..)
- New Chemistry (In-organic material etc..)

Chemistries

Acrylic	Polyurethane	Polyester/Alkyd	Epoxy
Modifier/Plasticizer	Phenolic	Fluorochemicals	Alkylphenols
Metal carboxylates	Epoxy Hardener	UPR	Others

Global Polymer/Coating Resin Manufacturing Sites and Polymer Technical Center

DIC Performance Resins
Vienna, Austria

TOD New Material
Guandong, China

DIC Synthetic Resins
Zhongshan, China

Changzhou Huari New Material
Changzhou, China

DIC Zhangjiagang Chemicals Polymer Technical Center
Zhangjiagang, China

SAPICI S.p.A
Milan, Italy

Sakai, Japan

Hokuriku, Japan

DIC Ideal Pvt. Ltd.
Maharashtra, India

DIC Siam Chemical Polymer Technical Center
Bangkok, Thailand

DIC Epoxy Malaysia
Johor, Malaysia

Pardic Jaya Chemicals
Jakarta, Indonesia

Chiba, Japan

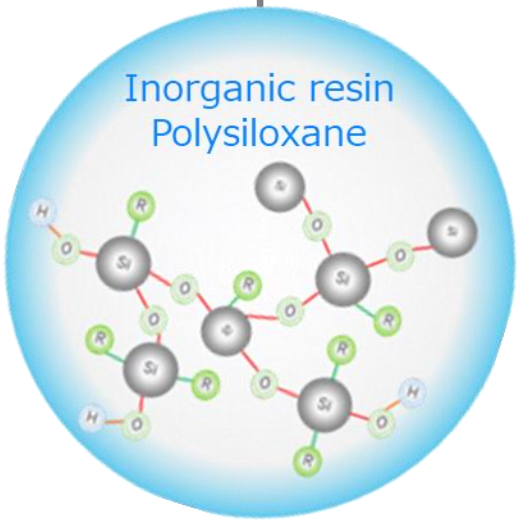
Inorganic-Organic composite resin

CERANATE

Inorganic-Organic composite resin「CERANATE」

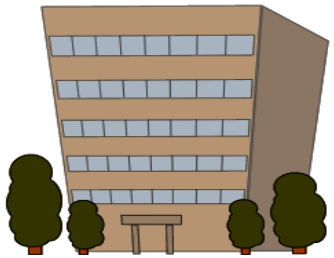
Organic resin
Aclyl,Urethane,etc

- Flexibility
- Handling ability
- Cost performance
- Pigment dispersibility
- Deterioration of efficiency



- PFAS-free
- Weather resistance
- Dirt-shedding resistance
- Thermal stability
- Brittle
- Expensive

Examples of Usage



Architectural **paint**

Building structures

Coating for Automobile

Solar Cell

Roof Panel

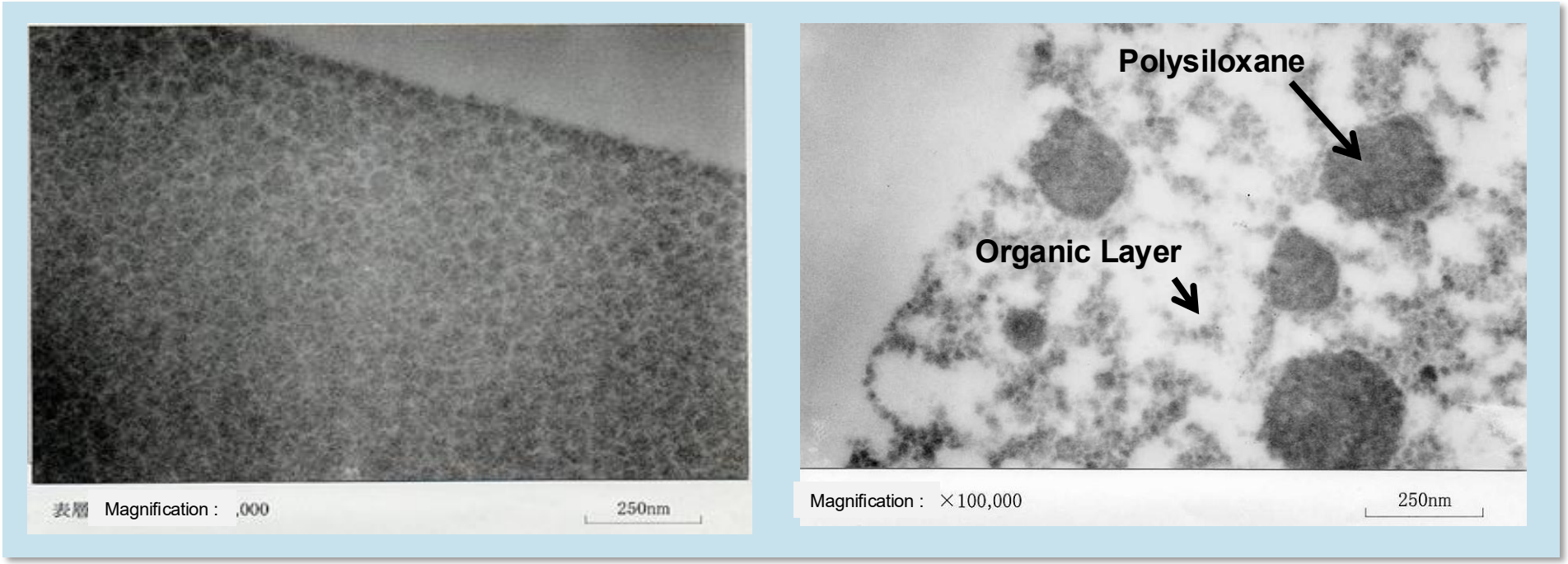
Inorganic-Organic composite resin「CERANATE」

CERANATE

Polysiloxane forms a chemical bond with the organic resin

Typical resin

Blending polysiloxane with an organic resin

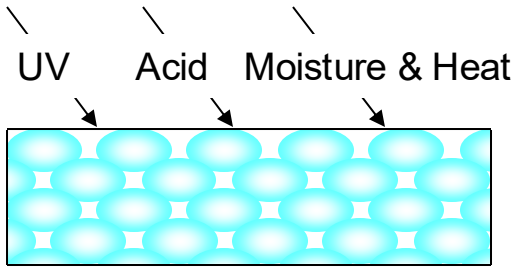


A homogeneous film at the nanoscale

Morphology of Coating Film (Observed by TEM)

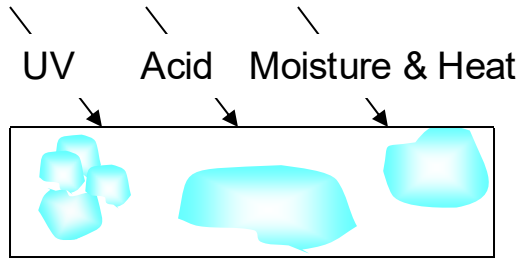
Inorganic-Organic composite resin「CERANATE」

CERANATE



a) Forming a nano-scale uniform layer of inorganic and organic components
b) Formation of a structured inorganic matrix

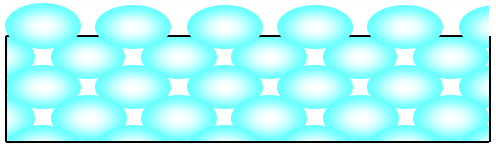
Typical resin



a) Formation of micron-size secondary silica particle
b) Formation of continuous layer by organic component

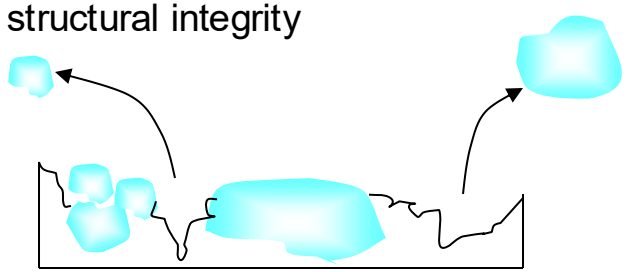
Long Term Exposure

Part of the organic component at the coating surface has decomposed; however, the regular inorganic component prevents deterioration of the coating.



- Maintains transparency and gloss
- Exhibits dirt-shedding properties

The decomposition of organic components and the absence of micron-sized silica particles may compromise the coating's structural integrity



- Loss of gloss and development of surface haze
- Yellowing has been observed
- Surface cracking is evident

Inorganic-Organic composite resin「CERANATE」

Features

- Environmentally responsible formulation achieved by removing PFAS
- Demonstrates outstanding light and weather durability equivalent to that of fluoropolymer coatings
- Superior dirt-shedding performance for exterior applications
- Exhibits excellent adhesion to glass, metal, and plastic substrates

Products

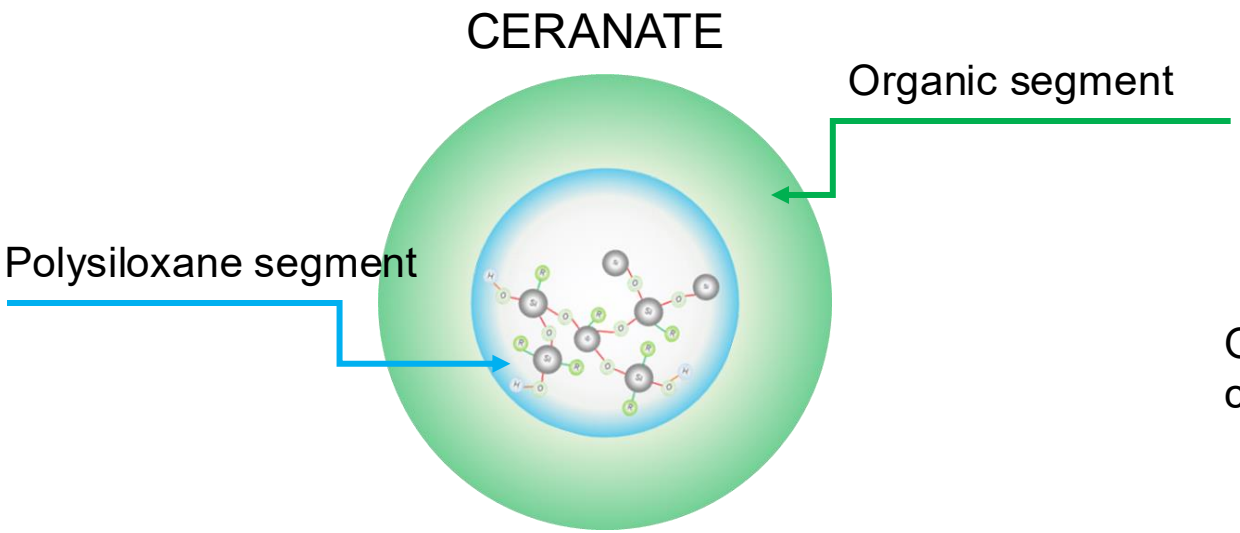
CERANATE	Product Type	Coating System	Organic Component	Features
WSA-1080	Water-borne	2K	Acrylic	Eco-friendly High Durability
WHW-822	Water-borne	1K	Polyurethane	High Flexibility
LSA-500	Solvent-borne	2K	Acrylic	High Durability Quick-Drying

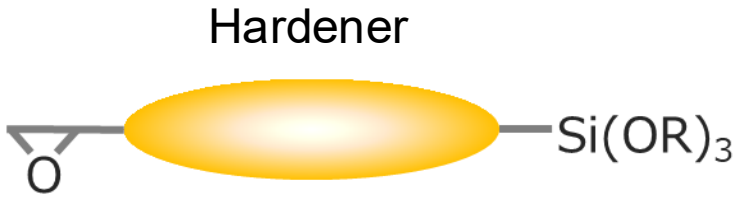
CERANATE WSA-1080

Waterborne polysiloxane - acrylic composite resin for 2K coating

- 2K type waterborne resin with outstanding weather resistance equivalent to fluoro resin
- For exterior, excellent dirt-shedding resistance
- High environmental durability
- High transparency
- Good adherence to a variety of material such as metals, glass, plastics

Structure: self-emulsifiable aqueous dispersion





Organic
cross-linkable part

Inorganic
cross-linkable part

CAS RN 2530-83-8

CERANATE WSA-1080

□Typical properties

Appearance	Milky white
Non-volatile (wt%)	39.0－41.0
Viscosity (mPa･s) (25℃)	20-1000 mPa･s
pH	7.5-8.5
Volatile matters	Water: 50-60%
	Isopropylalcohol: less than 1%
	N,N-dimethyl-2-aminoethanol: 1-5%
	Dipropylene glycol monobutyl ether: 1-5%
Polysiloxane contents (solid)	Approx. 30%
MFT （℃） *	MAX 30℃**

*Minimum film forming temperature(℃)
**When resin is kept at 5℃ to 20℃, MFT is up to 30 degrees Celsius.
When using recommended formuration,
Minimum film forming temperature is less than 5 ℃.

□Coating formulation for clear coating

Components		Weight
[A] Base resin	CERANATE WSA-1080 (Non-volatile: 40%)	100.0
	Dipropylene glycol monobutyl ether	3.0
	Deionized water	5.0
[B] Hardener	3-Glycidoxypropyltrimethoxysilane	5.3

Non-volatile ＝ 40%
WSA-1080/3-Glycidoxypropyltrimethoxysilane (solid)＝100/13.3
Epoxy/COOH ＝ 1.0

Usable time: 20°C for approximately 8 hours, 40°C for approximately 4 hours

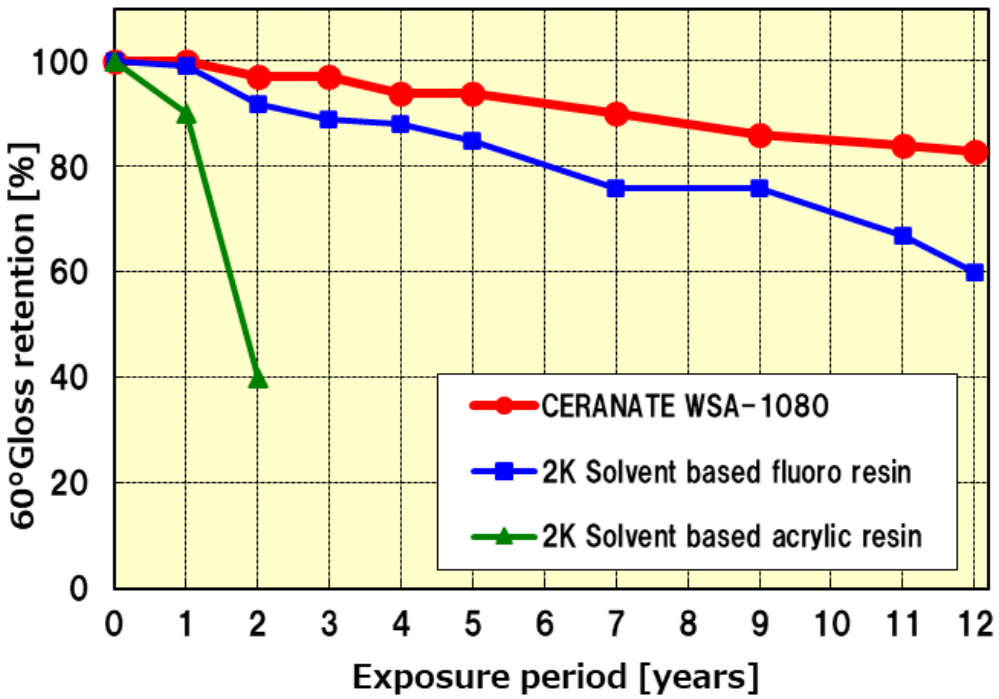
Weight increase in the amount of hardener is capable to get higher crosslink density, but in that case, usable time is shortened.
Example) In case of Epoxy/COOH ＝ 1.5, usable time at 20°C is approx. is 5 hours, or usable time at 40°C for approx. is 2 hours

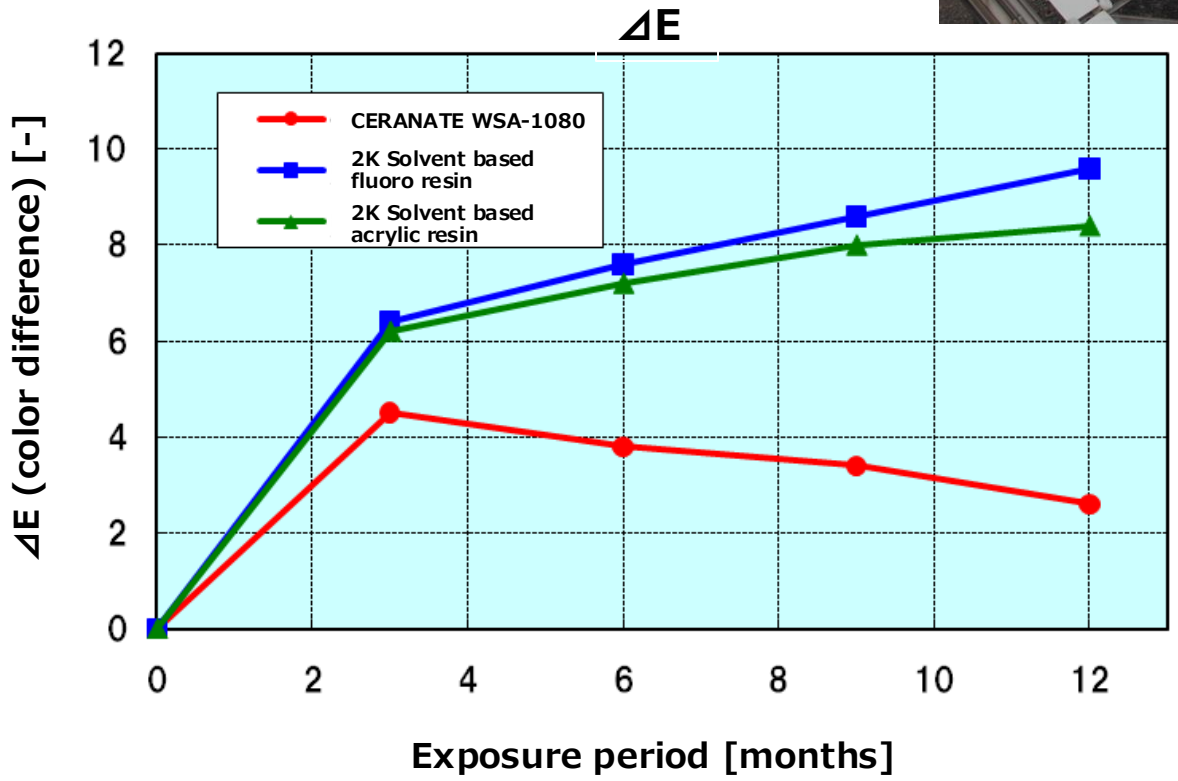
Note: The selection of ultraviolet light absorbers, photo stabilizers, and other additives should be tailored to the intended application.

CERANATE WSA-1080 Weather resistance & Dirt-shedding property

☐ Exterior exposure of clear coating film / Test location: Okinawa and Osaka Japan

- Delivers weather-resistance and self-cleaning with a maintenance-free design

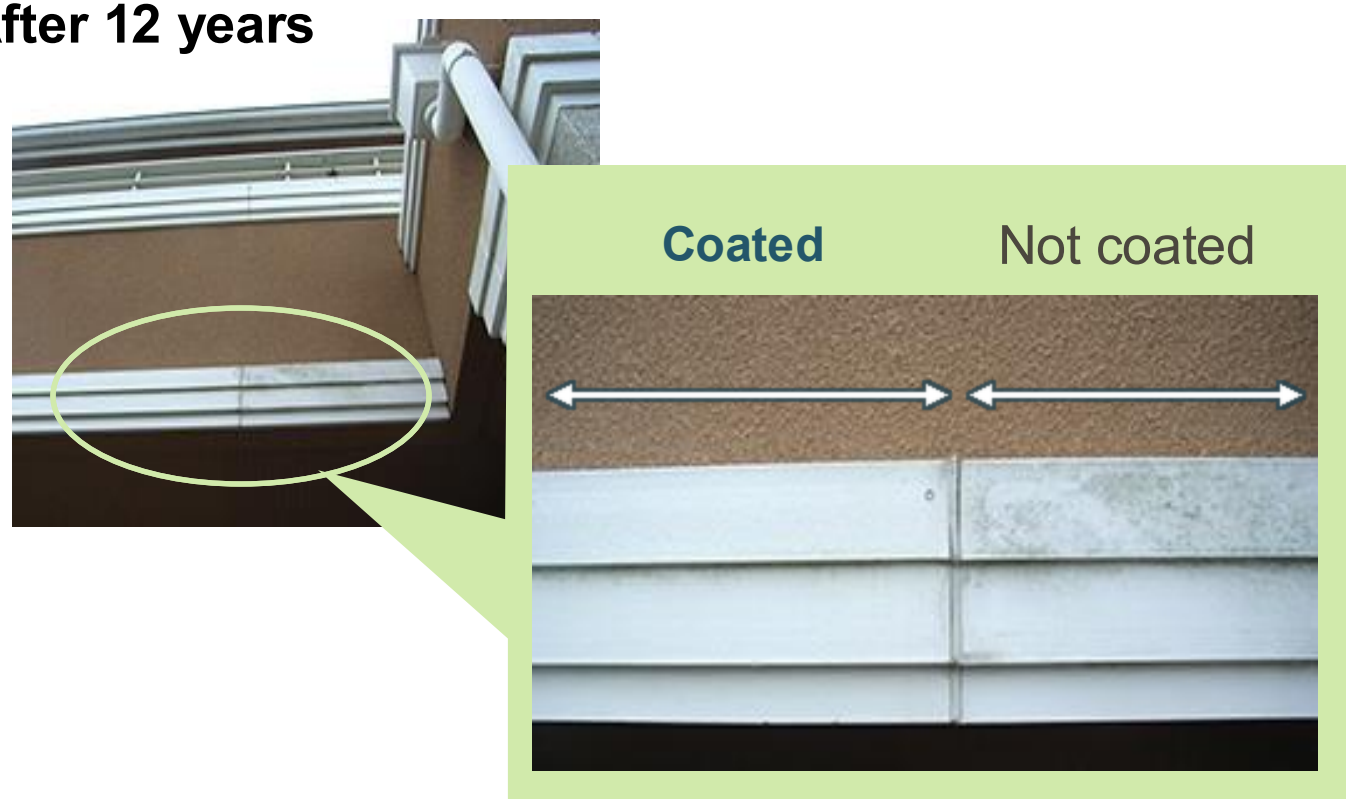


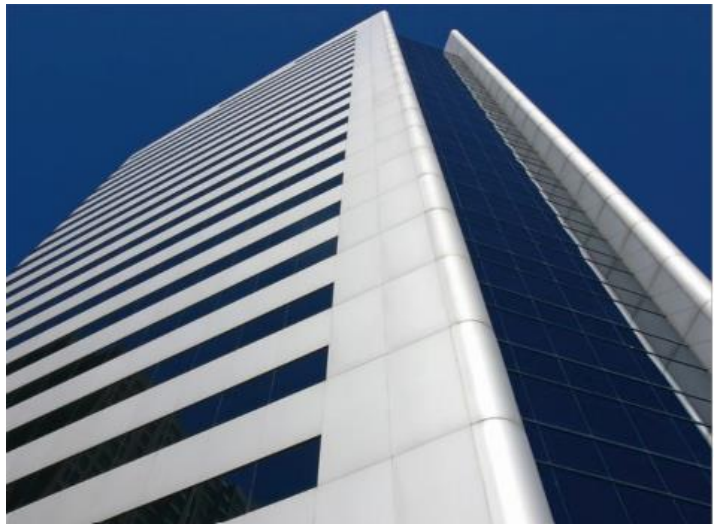


◇Substrate: Aluminum plate with white enamel acrylic urethane primer
◇Each film contained optimal amount of UVA and HALS.

CERANATE WSA-1080 Weather resistance & Dirt-shedding property

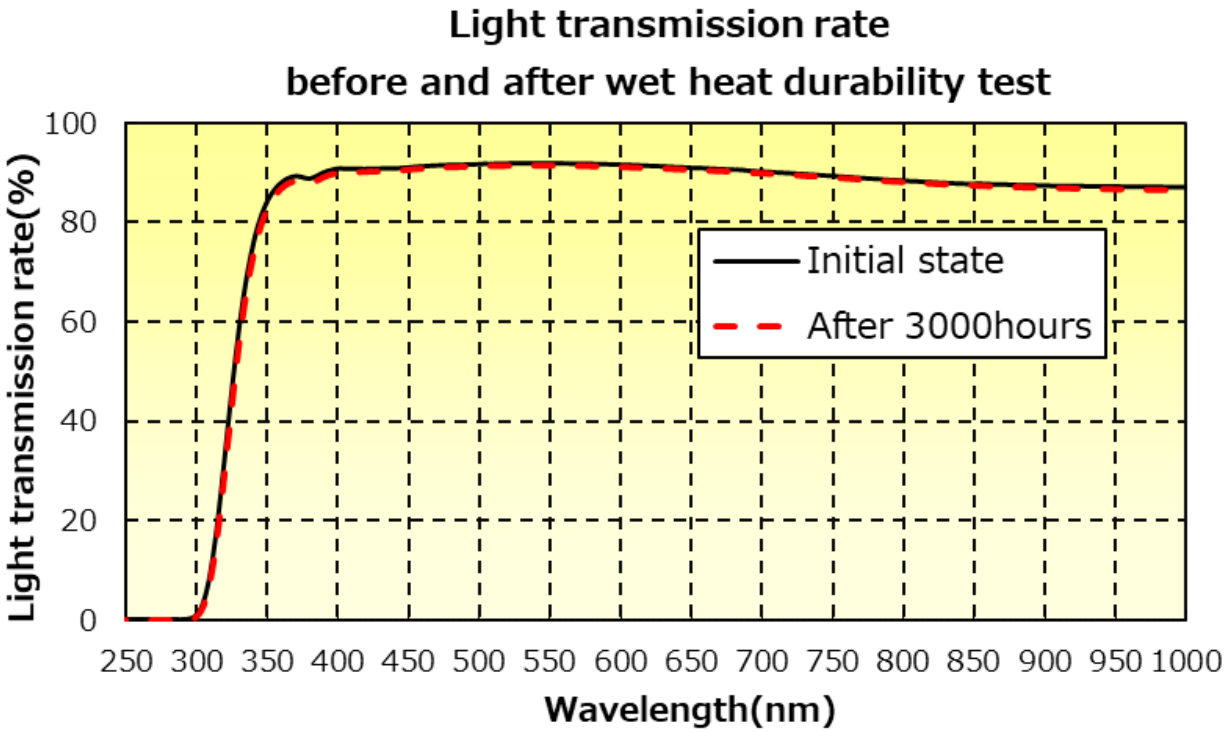
After 12 years





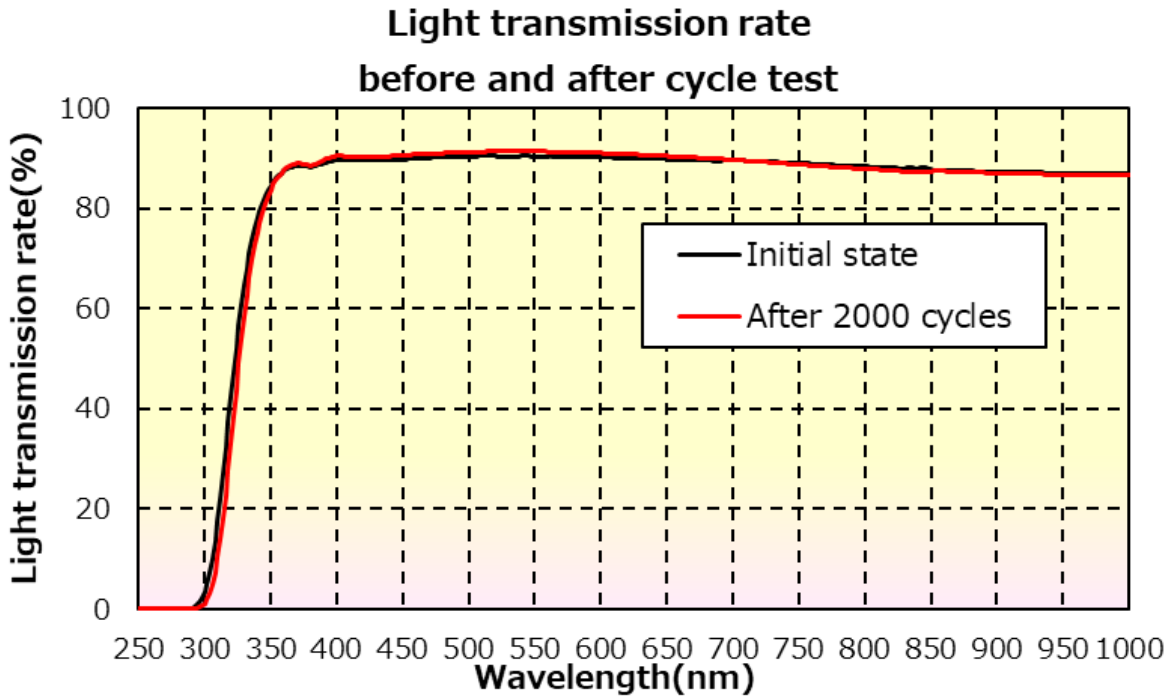
The hydrophilic surface of CERANATE activates its self-cleaning performance with rainwater, preventing dirt from adhering to exterior walls over long periods.

CERANATE WSA-1080 High Durability



Test condition: 85℃×85%×**3000 hours**

◇Substrate: Glass



Test condition: 90℃×15min. ⇔ -40℃×15min×**2000 cycle**

◇Substrate: Glass

CERANATE WSA-1080 Performance

☐Curing condition: exposed at 23℃ for 7days
☐Cured film thickness: 30 μm

Evaluation items	Evaluation methods	WSA-1080 2K
Gel fraction (%)	**Weight fraction after dipped in acetone for 24 hours**	94
60° Gloss (%)	**Specular reflection**	89
Pencil hardness	**Scratch**	F - H
Erichsen (mm)	**Pushing surface**	> 7
Impact resistance (cm)	**DuPont ½ inch・500 g**	20
Resistance to hot water	**40°C × 7days**	No damage
Acid resistance	**5% sulfuric acid aqueous solution: 23°C × 7days**	No damage
Alkali resistance	**5% NaOH solution: 23°C × 1day**	Gloss loss

・Substrate: Aluminum plate with white enamel acrylic urethane primer

CERANATE WSA-1080 Adhesive property

☐ Cross-hatch peeling test

Curing condition: 80°C×20min. ⇒ Room temperature for 3days
Cured film thickness: 10 μm

	23oC×7days		80oC×20min	
	Primarily evaluation	Secondary evaluation *1	Primarily evaluation	Secondary evaluation*1
【Metal】				
Stainless	100/100	100/100	100/100	100/100
Untreated steal	100/100	100/100	100/100	100/100
Copper	100/100	100/100	100/100	100/100
Untreated aluminum	100/100	100/100	100/100	100/100
【Non-metal】				
Polycarbonate	100/100	50/100	100/100	50/100
Untreated PET	100/100	90/100	100/100	100/100
ABS	90/100	70/100	100/100	100/100
PMMA	80/100	70/100	100/100	0/100
Glass	100/100	100/100	100/100	100/100

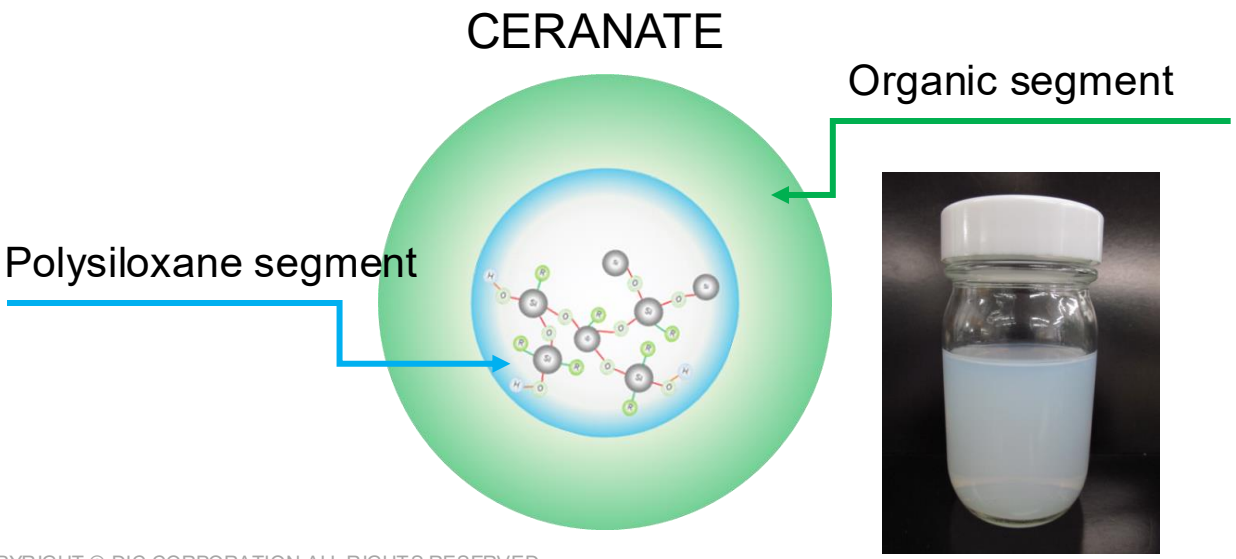
*1 Secondary evaluation(Durability in wet heat atmosphere)
: After placing it in 50°C×95%RH atmosphere for 10 days, remove and evaluate

CERANATE WHW-822

Waterborne polysiloxane - polyurethane composite resin

- A one-component waterborne resin offering exceptional weather resistance comparable to fluororesins
- Offers superior dirt-shedding performance for exterior applications
- Exhibits excellent elongation properties, enabling versatility across a wide range of applications
- Demonstrates elasticity ranging from 100% to 300%

Structure:self-emulsifiable aqueous dispersion



□Typical properties

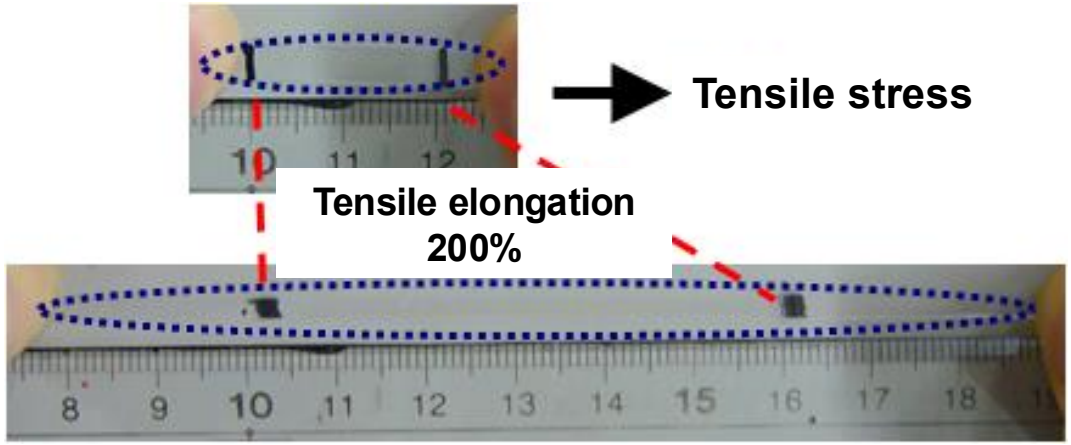
Appearance	Milky white
Non-volatile (wt%)	34.0－36.0
Viscosity (mPa·s) (25℃)	10-1000 mPa·s
pH	7.5-8.5
Volatile matters	Water: 55-65%
	Isopropylalcohol: less than 1%
	N,N-dimethyl-2-aminoethanol: 1-5%
	Diethylene glycol monobutyl ether: 0.5-1.5%
Polysiloxane contents (solid)	Approx. 30%

CERANATE WHW-822 Physical property

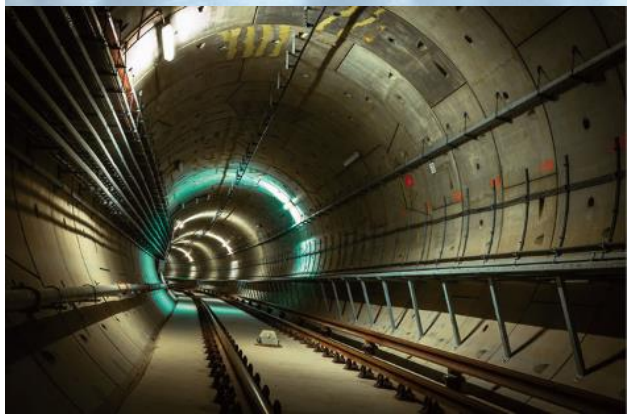
		WHW-822 (1K cured)
Initial water contact angle (°)	Drop method	85-90
Flow beginning temperature	Heat to 350°C	No move
Film physical properties		
Tensile strength (MPa)	Film thickness = 200 μm	5-10
Elasticity (%)	Film thickness = 200 μm	100-300

An example of tensile property

- **High elongation**: Able to apply a wide range of substrates and bases due to excellent workability and followability



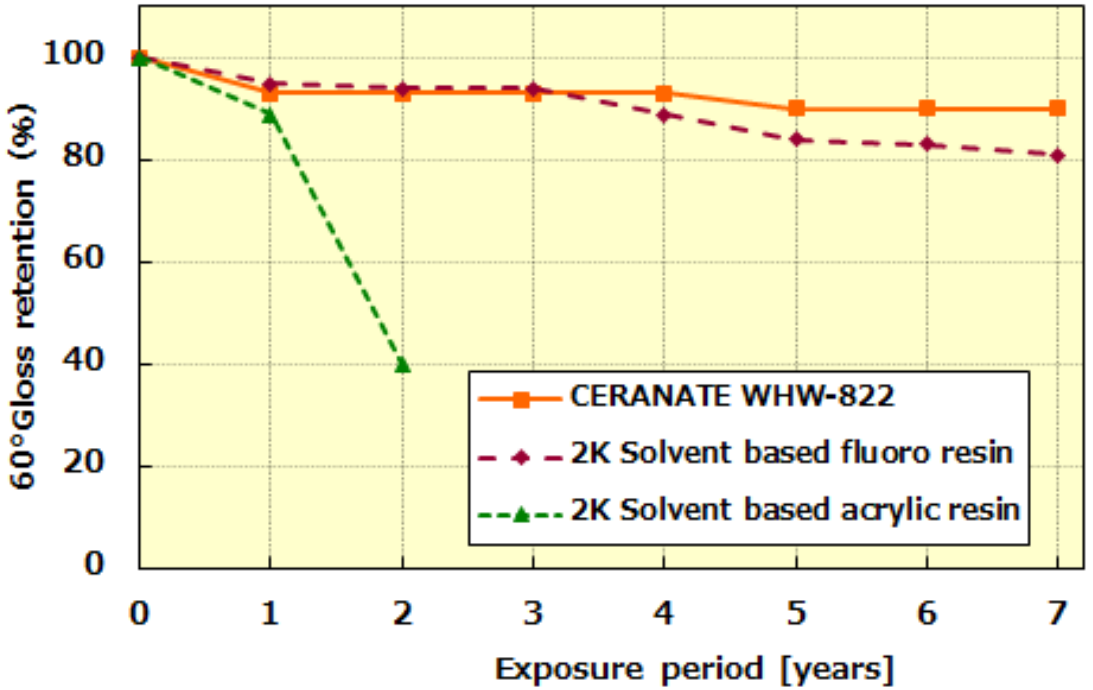
Coating film: clear
Test piece: 5mm width, 60 mm length, 0.2 mm thickness rectangles
Cure condition :23℃,1day → 140℃,5min → 23℃,1day



CERANATE WHW-822 Weather resistance & Dirt-shedding property

☐ Exterior exposure of clear coating film / Test location: Okinawa and Osaka Japan

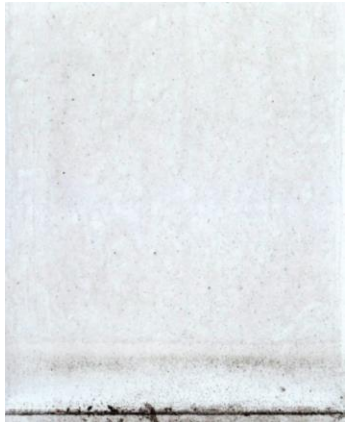
● Delivers weather-resistance and self-cleaning with a maintenance-free design



CERANATE WHW-822

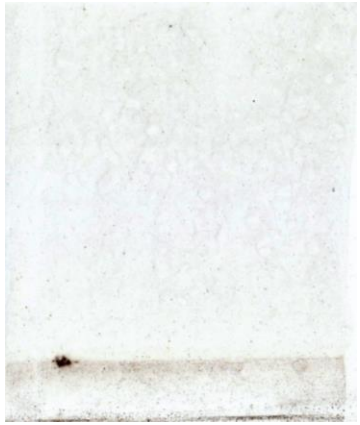
ΔL=2.8

Solvent type
2K acrylic resin



ΔL=6.9

Solvent type
2K fluoro resin



ΔL=6.9

◇Substrate: Aluminum plate with white enamel acrylic urethane primer

◇Each film contained optimal amount of UVA and HALS.

CERANATE WHW-822 Performance

Evaluation items	Evaluation methods	Curing condition	
		23°C, 7days	140°C, 20min. → 23°C, 7days
Gel fraction (%)	Weight fraction after dipped in acetone for 24 hours	88	92
60° Gloss (%)	Specular reflection	88	88
Pencil hardness	Scratch	6B	4B
Erichsen (mm)	Pushing surface	＞7	＞7
Impact resistance (cm)	DuPont ½ inch・500 g	＞50	＞50
Resistance to hot water	40°C, 7days	No damage	No damage
Acid resistance	5% sulfuric acid aqueous solution: 23°C, 7days	No damage	No damage
Alkali resistance	5% NaOH solution: 23°C, 1day	Minimal gloss loss	Minimal gloss loss
Ethanol resistance	1100g load /50 times rubbing	Dissolved	Partially dissolved
MEK resistance	1100g load /50 times rubbing	Dissolved	Partially dissolved

・Substrate: Electro-coated middle coat polished by water, Japan root service Inc.
・Cured film thickness: approx. 10 μm

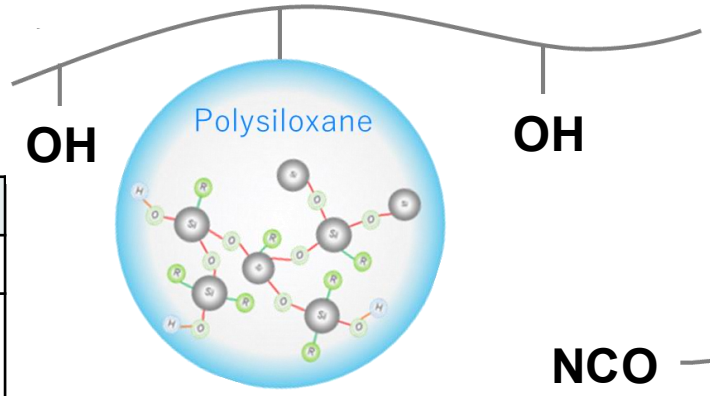
CERANATE LSA-500

Solvent type polysiloxane - acrylic composite resin for 2K coating

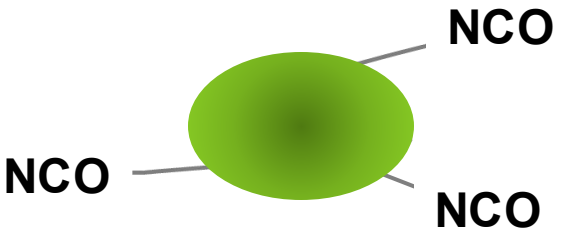
- 2K solvent-based resin with weather resistance equivalent to fluororesins.
- Offers superior dirt-shedding performance for exterior applications
- Exhibits strong adhesion to a wide range of materials such as glass and plastics
- Offers high flexibility enabled by a two-component urethane curing system
- Offers excellent clarity and transparency

□Typical properties

Appearance	Colorless clear liquid
Non-volatile	54-56 %
	n-Butyl acetate: 35-40 % Propylene glycol monomethyl ether acetate:5-10 %
Viscosity	200-500 mPa·s
OH value (solid)	70±5 mgKOH/g
Acid value (solid)	4±2 mgKOH/g
Polysiloxane contents	Approx. 30%



CERANATE LSA-500



POLURGREEN MT 100 01
HDI-based polyisocyanate
SAPICI

CERANATE LSA-500

□Coating formulation for clear coating

Components		Weight
Base resin	CERANATE LSA-500 (Solid-Content: 55%)	100.0
Hardener	POLURGREEN MT 100 01 *1	12.3
Thinner	n-Butyl acetate	10.1
Total		122.4
Solid Content ＝ 55% LSA-500/POLURGREEN MT 100 01 (solid)＝100/22.4 NCO/OH ＝ 1.0		

*1) POLURGREEN MT 100 01 : Polyisocyanate hardener, SAPICI

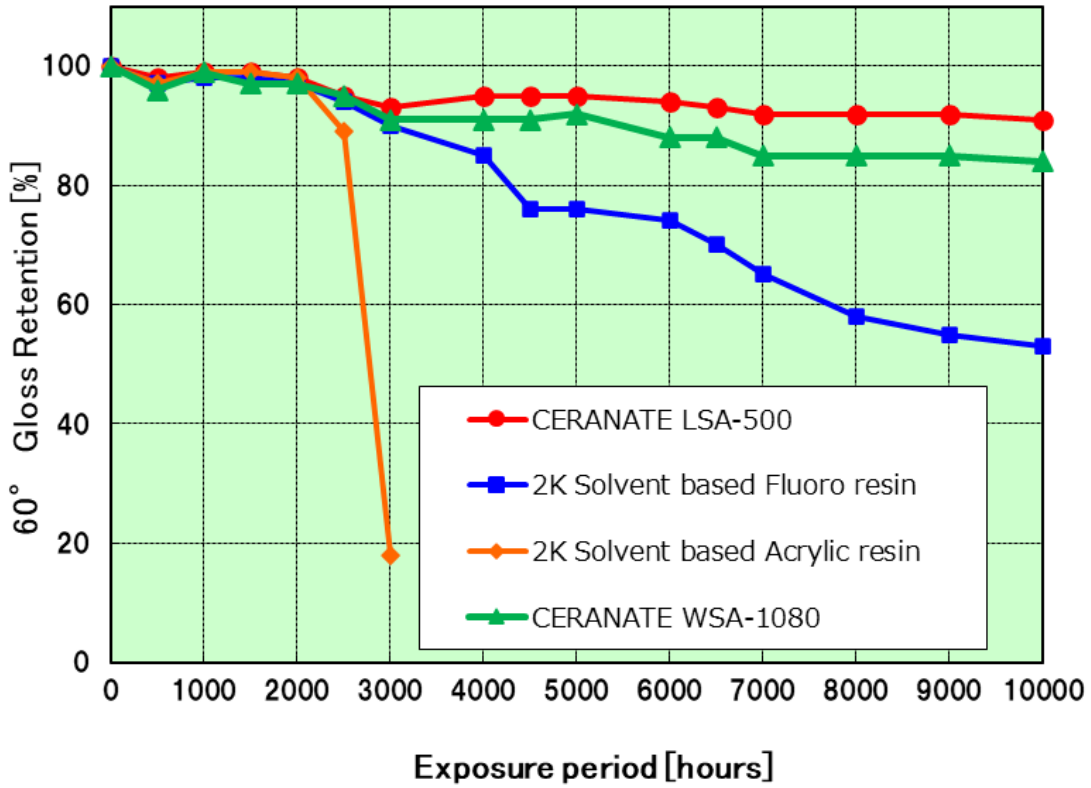
Pot life: 20°C for approx. 8 hours
Increasing the amount of hardener can enhance crosslink density; however, this also reduce s the usable working time.

Note: The selection of ultraviolet light absorbers, photo stabilizers, and other additives should be tailored to the intended application.

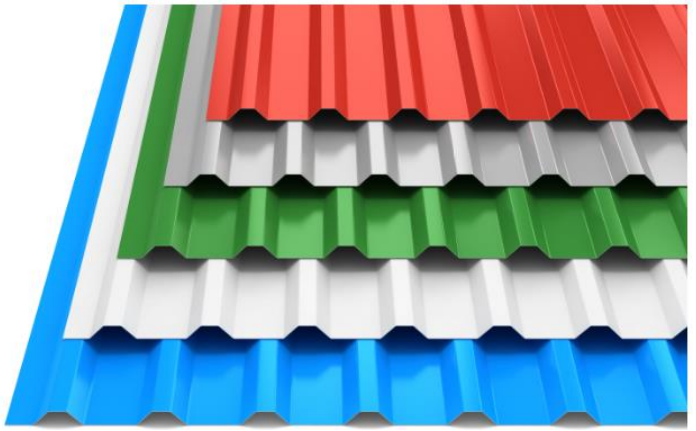
CERANATE LSA-500 Weather resistance

□ Accelerated Weathering Test (Xenon Weather Meter)

- Condition: ●Light Intensity; 180 W/m^2 (300-400 nm) ●BP Temp./ Humidity Level in a Chamber; 63°C/50%
  ●1 Cycle; 108 min. Exposed by Light ⇒ 12 min. Exposed by Both Light and Shower
- Cured Film Thickness: Approx. 10 μm



◇Substrate: Aluminum plate with white enamel acrylic urethane primer
◇Each film contained optimal amount of UVA and HALS.



CERANATE LSA-500 Adhesive property

☐ Cross-hatch peeling test

Cured film thickness: 10 μm

Test items	Primarily evaluation	Secondary evaluation *1
hot-dip galvanized steel sheet	100/100	100/100
Copper	100/100	100/100
Polycarbonate	100/100	100/100
Untreated PET	100/100	100/100
Glass	100/100	100/100

*1 Secondary evaluation(Durability in wet heat atmosphere)
: After placing it in 50°C×95%RH atmosphere for 10 days, remove and evaluate

CERANATE LSA-500 Performance

Evaluation Items	Evaluation Methods	Curing Condition	
		23°C/7days	140°C/20min. → 23°C7days
Gel Fraction (%)	Weight fraction after dipped in acetone for 24 hours	85	95
60 degree Gloss (%)	Specular reflection	89	89
Pencil Hardness	Scratch	H B	H
Erichsen (mm)	Pushing surface	＞7	＞7
Impact Resistance (cm)	DuPont ½ inch・500g	**＞50**	**＞50**
Resistance to Hot Water	40°C× 7 days	**No damage**	**No damage**
Acid Resistance	5% sulfuric acid aqueous solution:23°C × 7days	**No damage**	**No damage**
Alkali Resistance	5% NaOH solution: 23°C × 1day	Slightly damaged	Slightly damaged
Solvent Resistance			
Xylene	1100g load/50 times rubbing	Partially scratched **No dissolved**	Partially scratched **No dissolved**
MEK		Partially scratched Partially dissolved	
Ethanol			

- Cured Film Thickness: Approx. 20 μm, Dry
- Substrate: Aluminum Plate with White Enamel Acrylic Urethane Primer

Evaluation items	Evaluation methods	Substrate
Bending test	Gardner type mandrel bending test	Tin (Thickness : 0.3mm)

	LSA-500 Clear coating	**LSA-500 Enamel coating**
Thickness : 10μm	φ1/8 No damage	φ1/8 No damage
Thickness : 20μm	φ1/8 No damage	φ1/8 No damage
Thickness : 30μm	φ1/8 No damage	φ1/8 No damage

- Curing condition: 140°C×20min.

Selection Guide for CERANATE

Product	Resin type	Organic part	End-use
CERANATE WSA-1080	2K Water borne	Acrylic	Durable, low-maintenance exterior for buildings Protective coating for solar panel films
CERANATE WHW-822	1K Water borne	Urethane	Low-pollution exterior wall paint for repainting Shatter-resistant glass coating Concrete protective coating
CERANATE LSA-500	2K Solvent borne	Acrylic	Coating for automotive exterior parts Coating for bicycle parts

Color & Comfort

For product inquiries, please contact us via this email address or through the QR code

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