Materials Innovation

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Functional Emulsion **SIFCLEAR™**

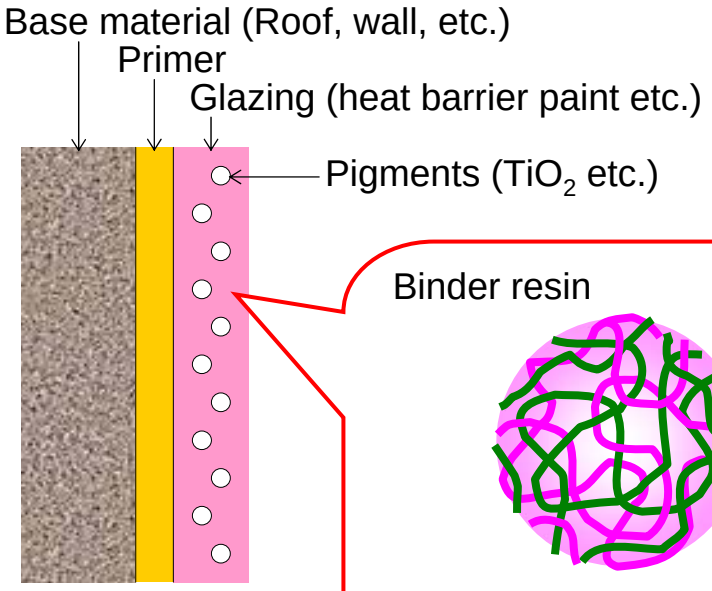
JSR Corporation

Performance Chemicals Division, Dept.2

About SIFCLEAR

The feature of SIFCLEAR

1. **High weather resistances** due to the **fluorine** and the **silicone** functinalities.
2. **High stain resistance** by optimized **hydrophobic** and **hydrophilic**.
3. Heat reflection paint with SIFCLEAR has **ever lasting heat reflection effect** thanks to high stain resistance.
4. Both **baking** and **air drying** are possible.
5. Since it is water-borne resin, it is an **environment-friendly material**.



Cross section of painted surface

SIFCLEAR is water-borne emulsion made of **hydrophobic units** and **hydrophilic units** compatibilized with **molecular level**.

Structure of SIFCLEAR.

Hydrophobic units
- Vinylidene fluoride polymer (**F Series**)
- Siloxane polymer (**S series**)

Hydrophilic units
-Cross linked modified poly-aclylate.

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1. Weather resistance of SIFCLEAR

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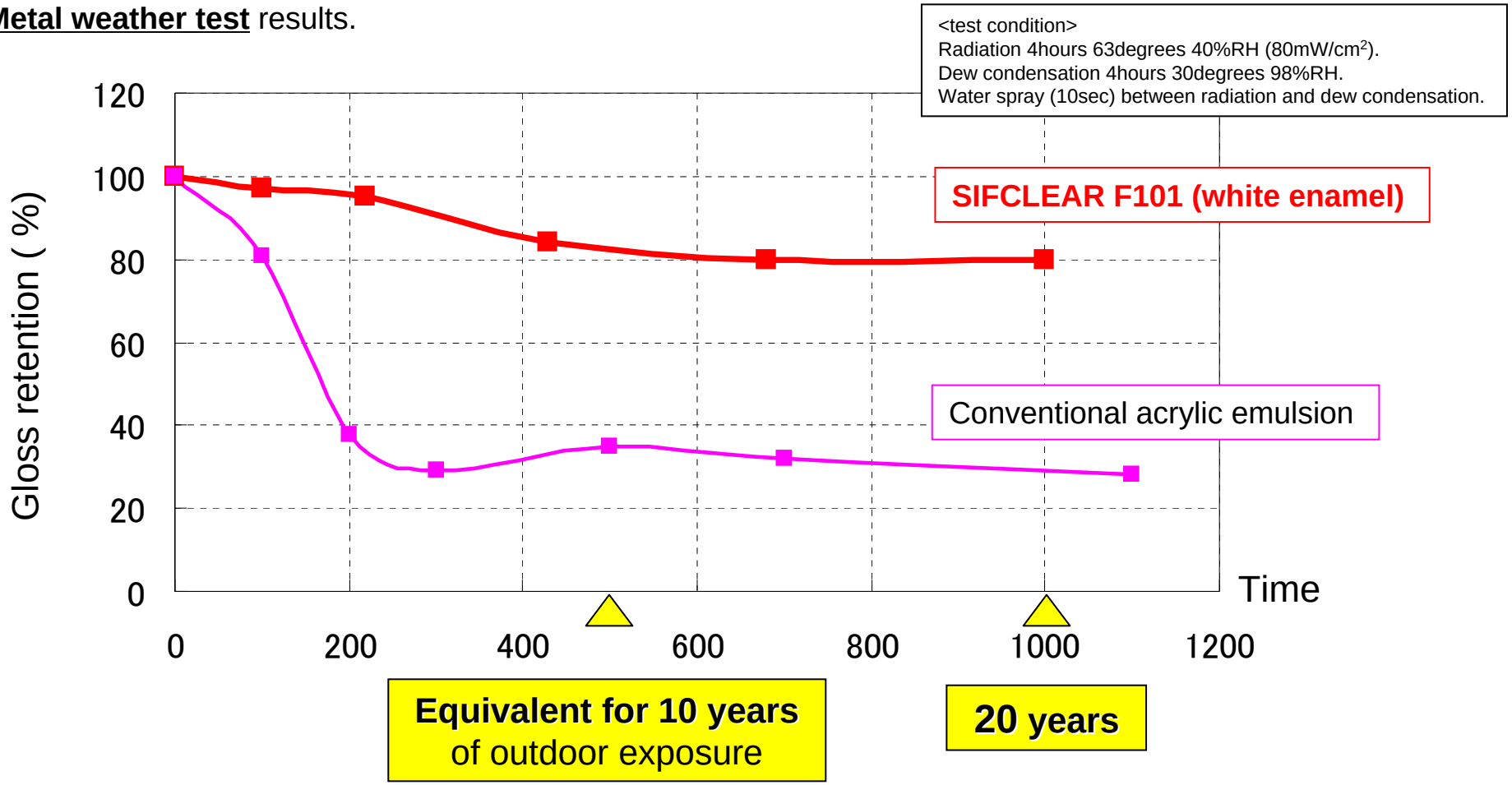
Metal weather test results.



SIFCLEAR has **high weather resistance** enough to withstand **20 years of outdoor use**.

* This data does not guarantee quality.

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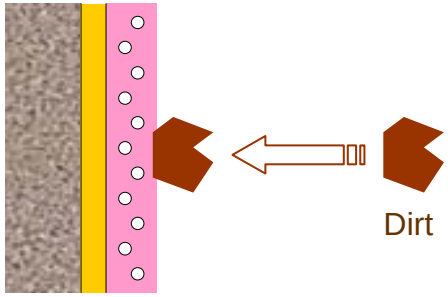
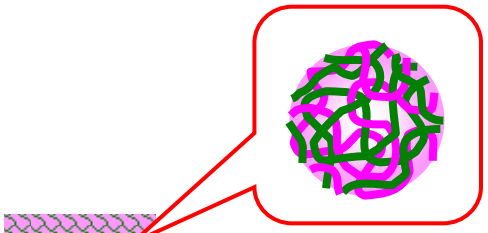
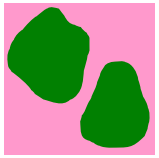
2. Stain resistance of SIFCLEAR -Mechanism-

2011.Nov

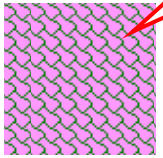


The coatings outermost layer is in the state where **the hydrophobic portion** and **the hydrophilic property portion** were intermingled with the molecular levels, by **SIFCLEAR**.



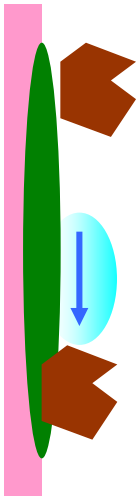


Case of conventional fluorinated resin



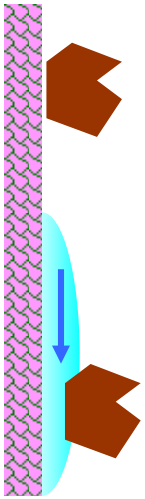
Case of **SIFCLEAR**

Case of conventional acrylic resin



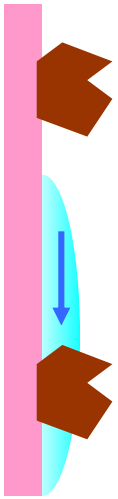
Dirt is difficult to stick…

Once dirt sticks,
It does not easily
washed away by water.



Dirt is difficult to stick.
Even if it sticks…

Dirt is washed away
easily due to the balance
of hydrophobic/hydrophilic.



Dirt sticks easily.

Dirt is not washed away
Easily.

By **controlling hydrophobic/hydrophilic balance at molecular level**, SIFCLEAR realizes **high stain resistance**.

2. Stain resistance of SIFCLEAR -Surface Wetting-

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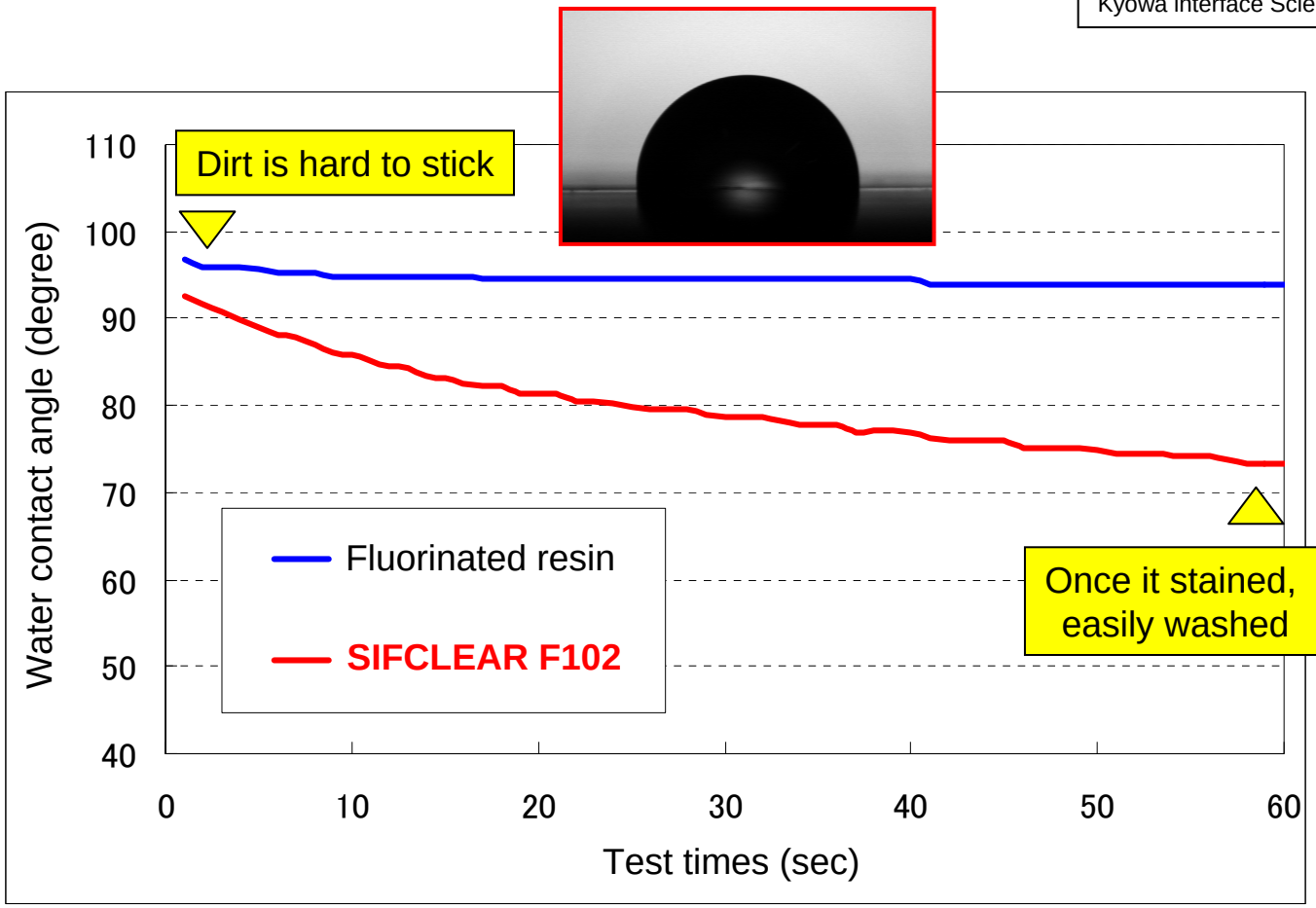
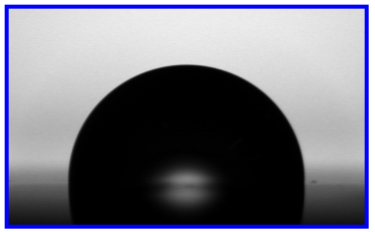
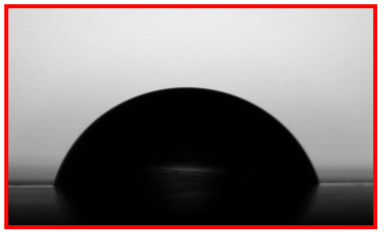
Surface Wetting changes over time.

<measurement device>
Kyowa interface Science Co., Ltd. “Drop Master 500”





Fluorinated resin
Stable contact angle
(96° ～94°)



SIFCLEAR F102
contact angle decreases
(93° →**73°**)

Gradual change in surface wetting leads **High stain resistance** of SIFCLEAR.

* This data does not guarantee quality.

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2. Stain resistance of SIFCLEAR -Field test-

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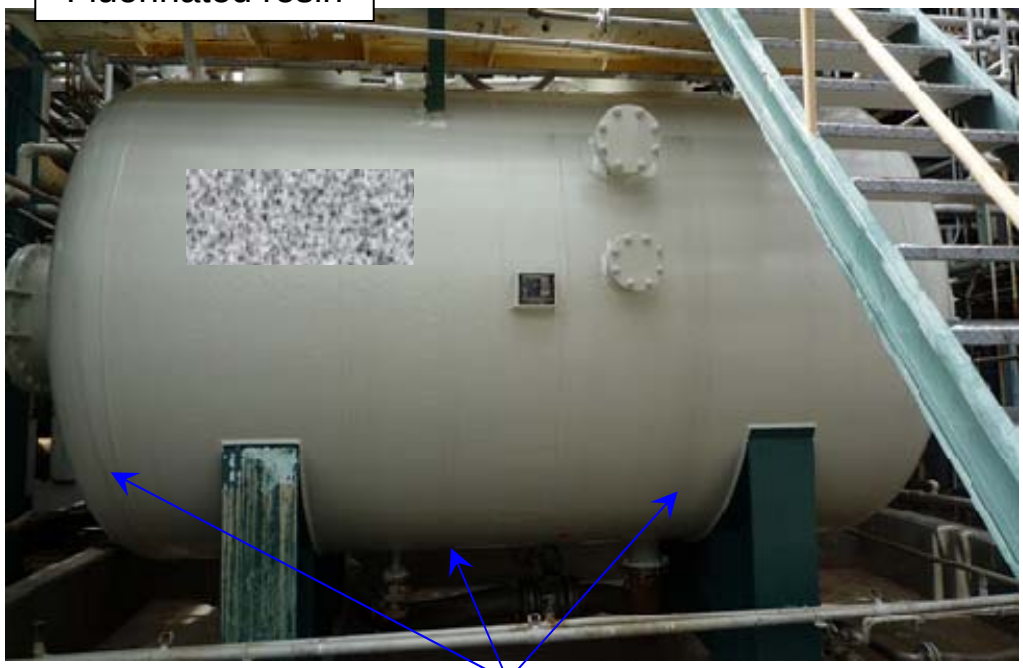
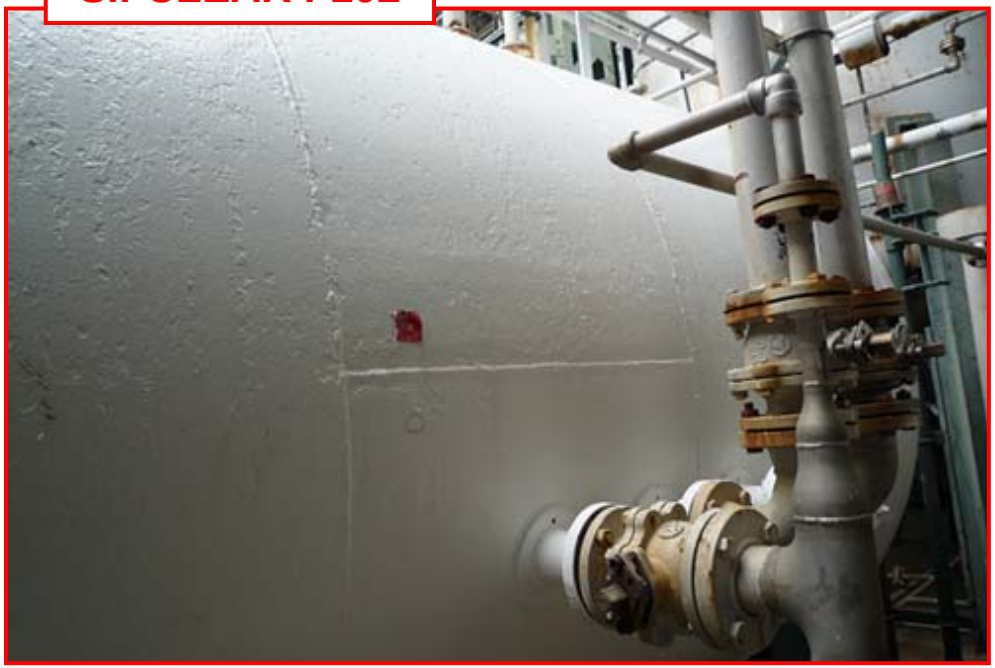
Field test on reservoir tank in JSR (since Aug. 2011).

Fluorinated resin



Stain of rain flow

SIFCLEAR F102



No stain

Field test demonstrated **superior stain resistance** of SIFCLEAR.

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3. Application of SIFCLEAR : Heat reflection paint

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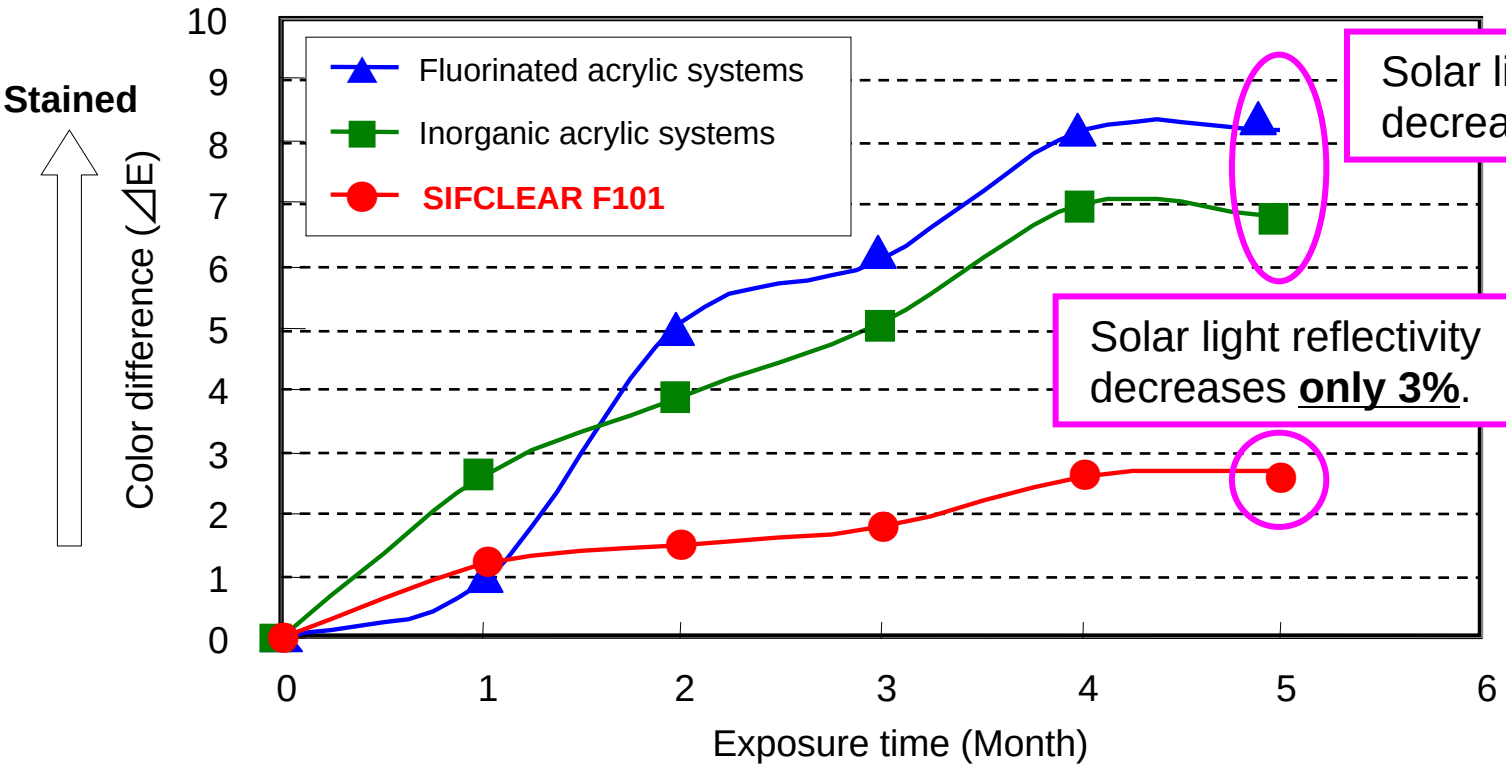
Heat reflection paint with SIFCLEAR maintains it **performance longtime**.

Stained surface decreases heat reflection performance.



Solar light reflectivity decreases **15% or more**.

Solar light reflectivity decreases **only 3%**.

(reference)
Relation between color difference (⊿E) and solar light reflectance

780 to 2000 nm Solar reflectance (%)	
⊿E=10	67.7
⊿E=5	75.4
⊿E=2	85.1
⊿E=0	87.3

Heat reflection performance improves by the **high stain resistance** of SIFCLEAR.

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3. Improved Heat Reflection performance by SIFCLEAR

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Temperature inside hut was **monitored for 1year** @ JSR Yokkaichi plant.

Heat reflection coating only on the roof.

	Freshly painted		One year later	
Condition	Unpainted	**SIFCLEAR**	Unpainted	**SIFCLEAR**
Max temperature (inside)	**39.3℃**(basis)	**33.8℃**（⊿5.5） **-14.0%**	**43.7℃**(basis)	**37.3℃**（⊿6.4） **-14.6%**

High stain resistance of SIFCLEAR **keeps heat reflection performance** for long time.

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4. Physical Properties of SIFCLEAR

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		SIFCLEAR™		
		Vinylidene fluorides (F) series		Siloxane (Si) series
		F101	**F102**	**S101**
Depositions conditions	Drying methods	**Baking**	**Air drying**	**Baking**
	Minimum filming temperatures (MFT) [℃]	**47**	**<20**	**45**
Water-borne emulsion properties	Solids contents (TSC) [%]	**47**	**47**	**40**
	Viscosity [mPa-s]	**1000**	**200**	**70**
	Particle size [nm]	**150**	**150**	**100**
	Ionics	**Anions**	**Anions**	**Anions**
	PH	**8.0**	**8.0**	**7.0**

SIFCLEAR : **environment-friendly** (water-borne), **easy drying** (air or bake).

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