chirucoat HSG

Colorless and Highly Transparent Heat Shielding Glass Paint

CHIRUCOAT,INC.
株式会社チルコート

How does the sun's heat travel to the earth?

Despite the vast distance of 150 million km between the sun and Earth, Sunlight reaches us in about 8 minutes. This is possible because sunlight consists of photons that travel through the vacuum of outer space, unaffected by its lack of atmosphere and extreme temperatures.

◆How Heat is transmitted ...??

There are three types of heat transfer :

Conduction,

Convection

Radiation

" Conduction" is the direct transfer of heat through materials in contact, without the materials moving. When one end of a metal rod is heated, the heat travels to the other end. It's a process where heat spreads through a substance by molecular interaction, showcasing thermal conductivity in stationary materials..

Next, "Convection" is the process of heat transfer through the movement of substances. In liquids and gases, like water or air, convection occurs, seen in warming water in a kettle or cooling it with ice. Air conditioners also use convection to cool rooms. Unlike solids, which use conduction for heat transfer, convection relies on fluid motion.

"Radiation" is the transmission of heat through electromagnetic waves. Despite concerns, various waves like radio, infrared, visible light, ultraviolet, X-rays, and gamma rays are part of the electromagnetic family. Radiation transfers heat when absorbed by an object, evident in experiences like feeling warmth near a bonfire. Thermography utilizes this phenomenon to measure surface temperatures.

◆Mechanism for transmitting the sun's heat

The sun's heat travels to Earth through radiation since outer space is a vacuum without a substance for conduction or convection. Solar energy, including visible light, infrared, and ultraviolet rays, reaches Earth as "sunlight." Despite a potential of 1.37kW/sq meter/second, atmospheric reflection, absorption, and scattering reduce the effective energy reaching Earth's surface to about 60-70%. The vacuum between the sun and Earth remains unheated by sunlight due to the selective absorption characteristic of radiation.

◆Why you feel warm when exposed to light ?

Sunlight contains infrared rays, making up half of its electromagnetic waves. When these rays touch a material, like the human body, molecules vibrate, producing heat and the sensation of warmth. This principle is akin to how a microwave oven works, using microwaves to vibrate water molecules in objects, generating heat.

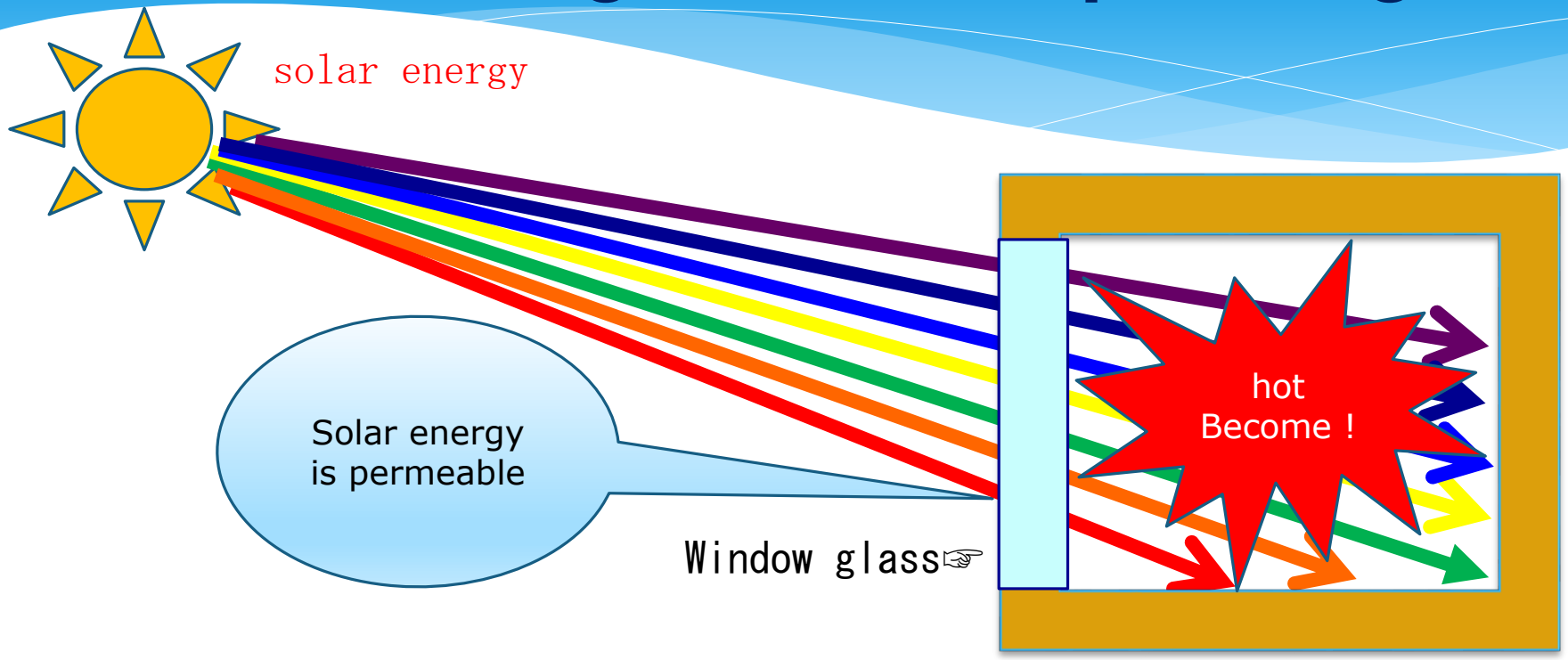
◆ Is Condensation likely to form on window glass ?

Condensation forms on window glass when warm indoor air with water vapor meets the cooled glass due to outside air. The greater the temperature difference, the more condensation occurs. Windows are prone to it as they are highly affected by the indoor-outdoor temperature contrast, leading to moisture buildup.

◆ Need for Heat Shielding

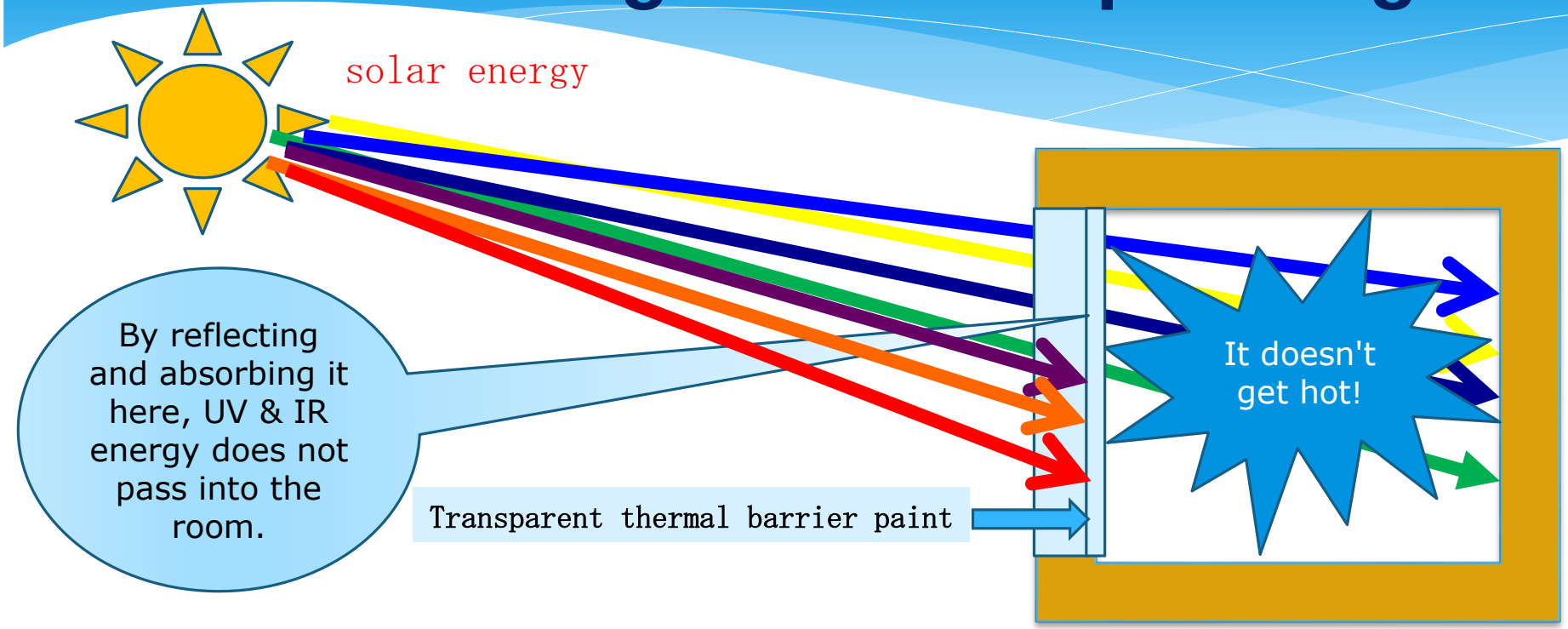
Earth thrives on solar energy from a distance of 150 million kilometers. To combat indoor heat and conserve electricity, controlling indoor temperatures is crucial. Excessive heat can result in UV damage, necessitating heat-shielding for window glass. Understanding the mechanism of blocking sunlight through appropriate glass is essential for a sustainable living environment.

Heat shielding from transparent glass



Indoor temperature rises not only due to heat transfer from the roof and walls, but also due to the action of infrared radiation (electromagnetic waves) on floors , walls , ceilings, etc. indoors due to sunlight passing through window glass . It generates heat and radiates heat, making the room hotter .

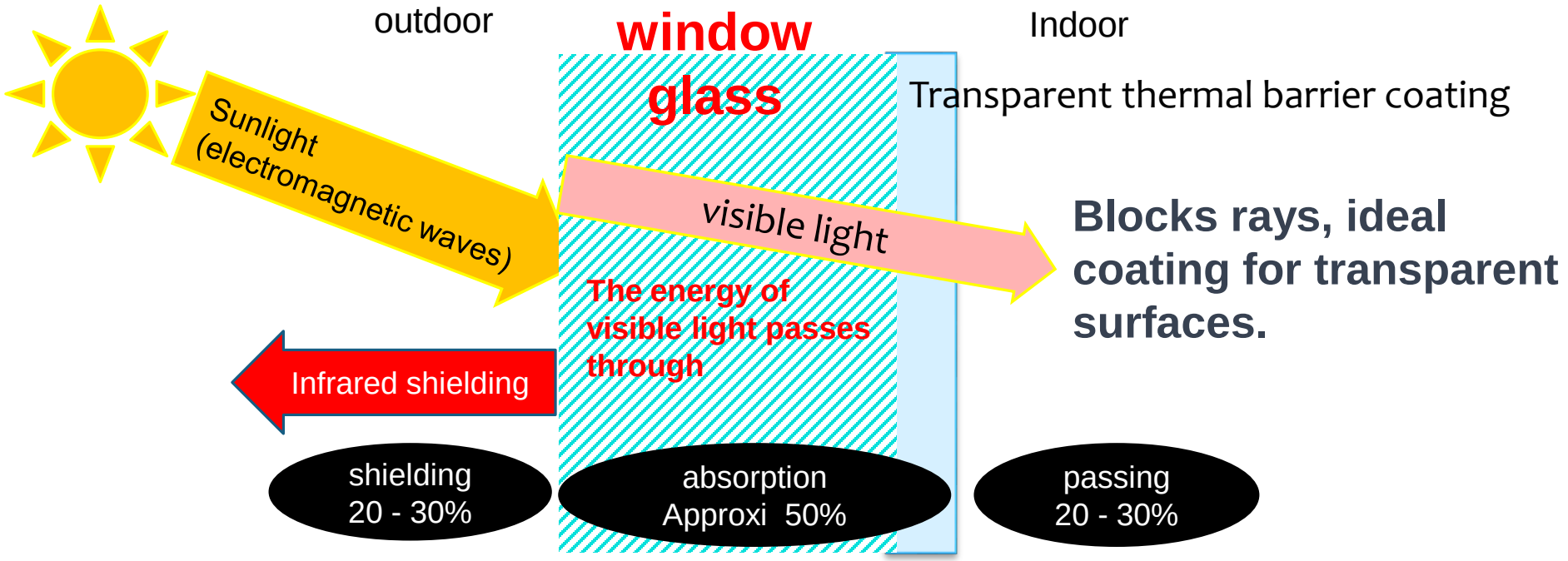
Heat shielding from transparent glass



A transparent heat-shielding paint has been developed that prevents infrared and ultraviolet rays from entering through window glass .
The mechanism is that by painting the glass, it suppresses infrared and ultraviolet rays it cannot be denied that
However , even if the temperature of the glass surface rises , the indoor space temperature will certainly fall .

Heat Shielding with Transparent Glass

The colorless and highly transparent heat shielding paint for glass reduces solar radiation by reflecting 20-30% of infrared rays, with 50% absorbed by surfaces. This targeted heating minimizes energy consumption, making it an efficient solution for maintaining room temperature without raising it uniformly.



chirucoat HSG

Colorless & Highly Clear Heat Shielding Glass paint

What is

chirucoat HSG **:**

Clear thermal barrier coating cuts UV rays, reduces heat, prevents heatstroke, & saves energy, potentially lowering CO2 emissions.

1 Features

This coating offers a 70% reduction in infrared rays, preventing indoor temperature rise, and an 80% blockage of UV rays, safeguarding against fading. Highly transparent, it doesn't compromise views or brightness. Additionally, it retains indoor heat in winter, resists scratches and chemicals, and lasts around 10 years for cost-effectiveness.

2 Product Summary

This thermal barrier paint is a colorless and highly transparent solution made with special heat shielding materials and hybrid silicone resin. It's designed for heat insulation on surfaces like glass and polycarbonate. Caution is advised with wired glass. The paint is initially slightly dark blue and transparent but dries colorless. Application tools include roller brushes and spray guns, with a recommended single coat of 10-20g/㎡. No dilution is needed, and it dries in 60 minutes (24 hours for complete curing). It falls under Class 4, 1st petroleum, and is classified as Dangerous goods, Class II, with storage recommendations in a cool, dark place, preferably a refrigerator.

3 HSG coating performance

Test items	Test condition	Test results
Hardness	Pencil hardness (using Mitsubishi Uni)	3H
Adhesion	Peeling cellophane tape (2mm width)	100/100
Alcohol resistance	Ethanol rubbing 100 times, 500g load	No abnormality
Detergent resistance	5% Glass My Pet (Kao) Spot, 24hr	No abnormality
Acid resistance	5% sulfuric acid spot, 24hr	No abnormality
Alkali resistance	Calcium hydroxide saturated aqueous solution immersion, 24 hours	No abnormality
Hot water resistance	45℃ warm water immersion, 100hr	No abnormality
Pollution resistance	Water-based ink, oil-based ink, creon stain ethanol wiping	No abnormality
Cold and heat resistant cycle	60℃×3hr ⇔ -20℃×3hr (10 cycles)	No abnormality
accelerated weather resistance	Kisenonuezaomator 1000hr	No abnormality

* Base: Glass plate Surface preparation: Lacquer thinner wipe Drying conditions: RT × 7 days
* The above data are reference values and are not standard values.

4 Transmittance

Apply Chill Coat HSG to glass and measure
Measuring equipment: Shimadzu UV- 3100 PC

Measurement result

region		Glass 2mm No coating		HSG Applied	
		TR (%)	Cut rate (%)	TR (%)	Cut rate (%)
all waves	300-2500	84.1	15.9	35.7	643
UV light	300-400	59.7	40.3	15.1	**84.9**
Vsible light	400-780	88.6	11.4	**79.2**	20.8
Near IR	780-2500	84.6	15.4	27.4	**72.6**

Table 1 : Average values of transmittance and cut rate in each area

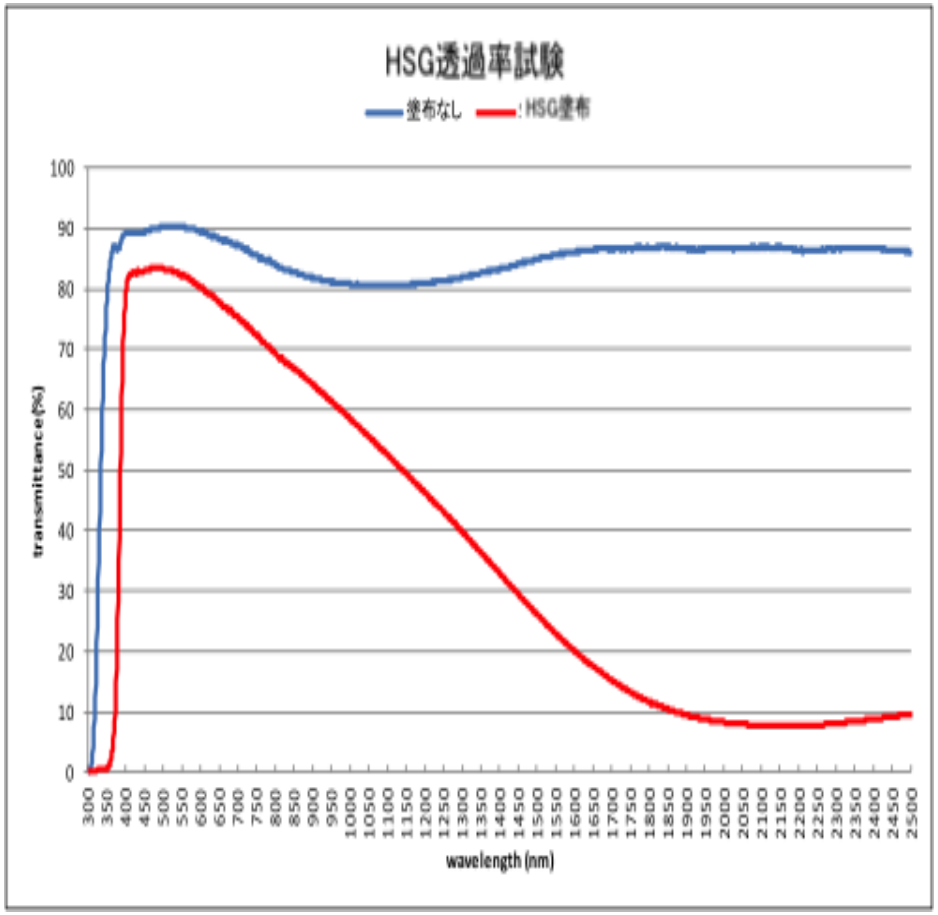


Figure 1 : Transmittance test graph

5 Temperature change on the coated surface (glass)

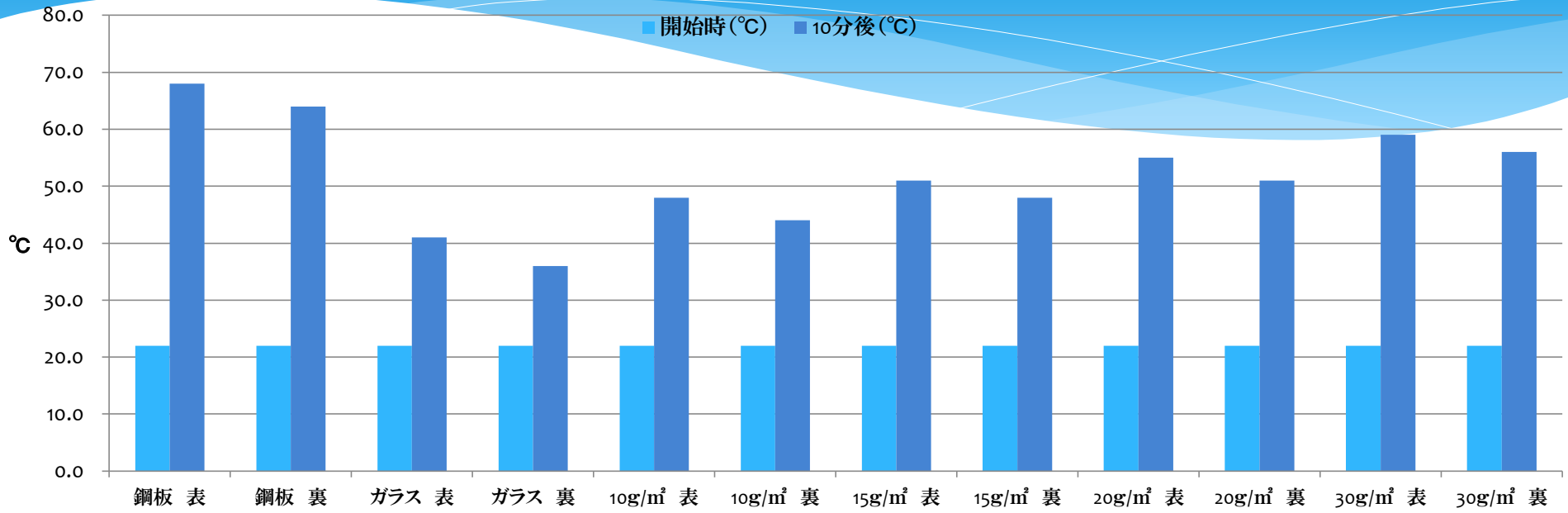
Glass was coated with different amounts of HSG, and temp changes were monitored using an IR light bulb as a heat source. Testing was conducted at a 35cm distance to simulate summer sunlight on a steel plate, maintaining a reference temperature of about 70℃, the previous measurement value, to determine the installation position of the piece.

Ambient Temp
: 23 ℃

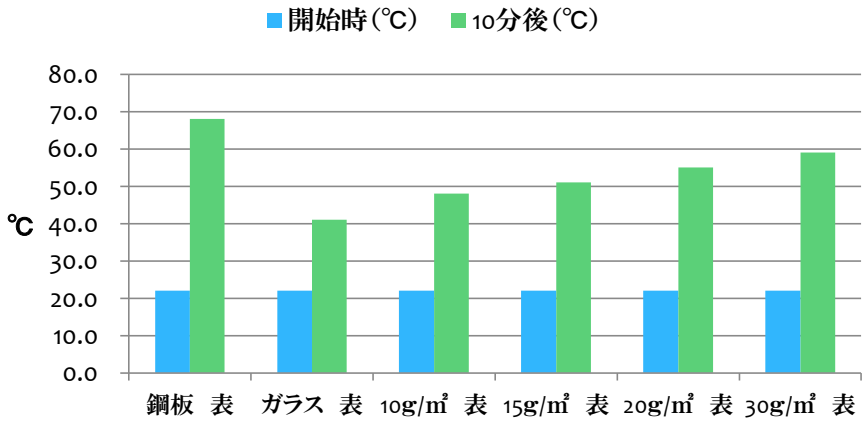
Test equipment: light fixture
IR bulb (TOSHIBA
H100v 250WR)
steel plate (70 x 150 x 1.6)
glass (70 x 150 x 2.0)

Test pieces		At the start (℃)	10 minutes (℃)
steel plate	surface	22.0	68.0
	Back side	22.0	64.0
glass	surface	22.0	41.0
	Back side	22.0	36.0
HSG 10g / ㎡	surface	22.0	48.0
	Back side	22.0	44.0
HSG 15g / ㎡	surface	22.0	51.0
	Back side	22.0	48.0
HSG 20g / ㎡	surface	22.0	55.0
	Back side	22.0	51.0
HSG 30g / ㎡	surface	22.0	59.0
	Back side	22.0	56.0

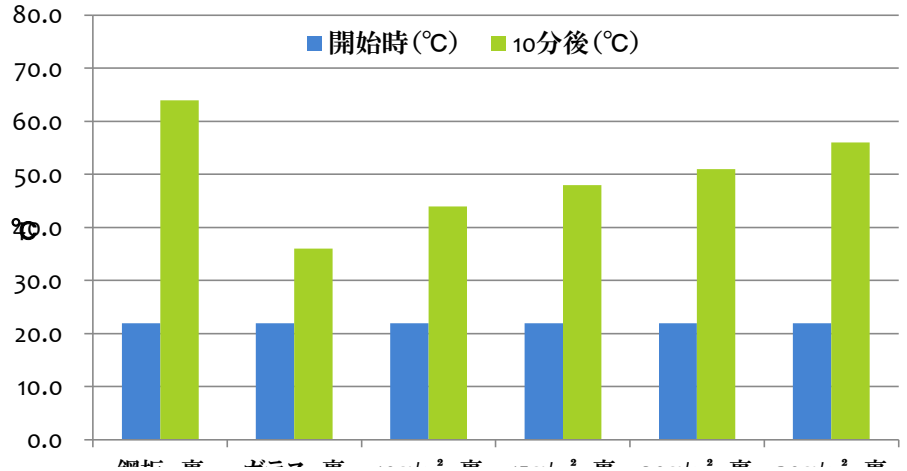
Application amount and temperature change



Usage and temp change (surface)



Usage and temp (back side)



6 Temperature after transmission

Glass was subjected to varying heat-absorbing coatings (HSG), and post-transmission temperatures were measured. Positioned 35 cm from an infrared light bulb simulating a steel plate's 70℃ temperature in sunlight, the experiment aimed to mimic summer conditions. An aluminum plate placed 3 cm behind the test piece measured temperatures post-transmission.

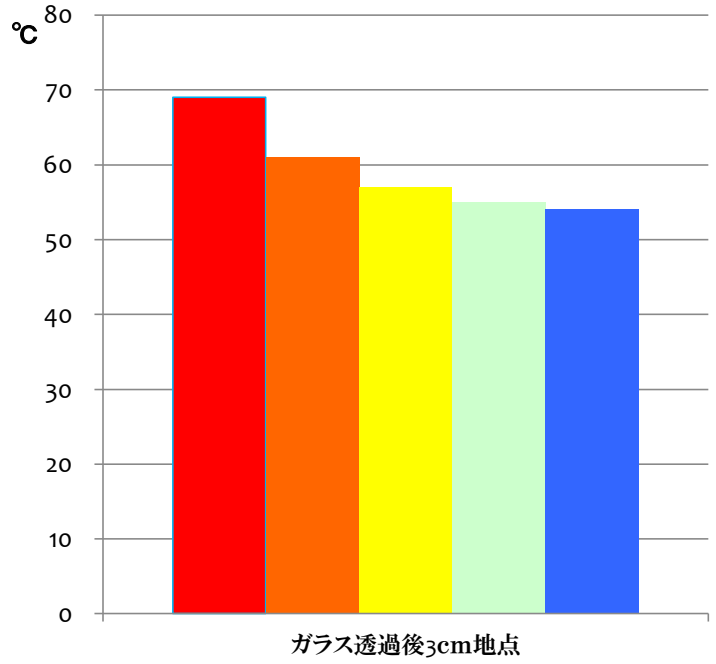
Test piece (glass)	3 cm after passing through the glass
Glass (no coating)	69℃
HSG coating (10 g /m2)	61℃
HSG coating (15 g /m2)	57℃
HSG coating (20 g /m2)	55℃
HSG coating (30 g /m2)	54℃

Temp at time of measurement : 27℃

Distance: lamp to glass 10 cm

Distance: Glass to aluminum plate 3 cm

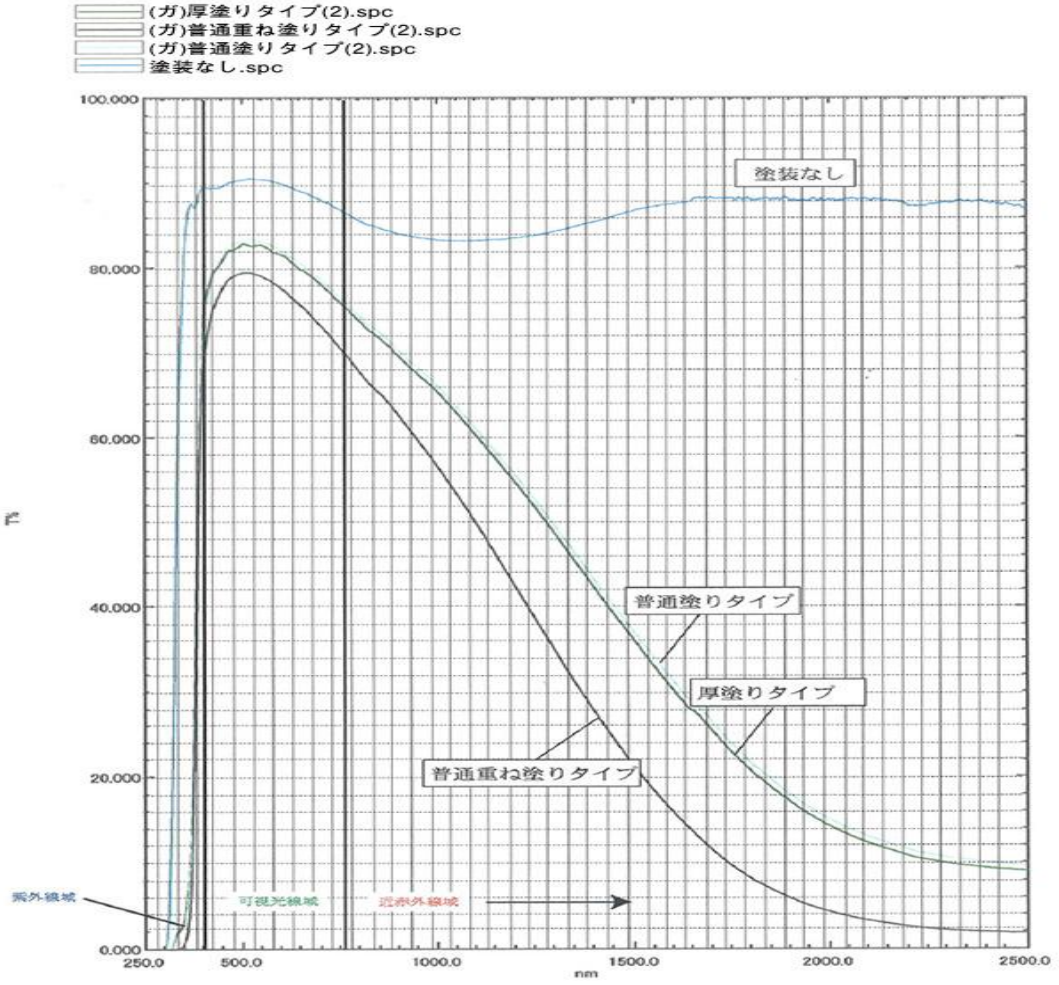
Measurement time is after 10 minutes



7 Differences by application

Standard HSG coating is 10 g /m2 .

when applying more than 10 g/m2 ,
it is better to apply thick coats at once.
We recommend applying the product in multiple layers.
Also , if you apply thick coats at once, the drying time (curing period) will be longer, so be careful! !



chirumon **chirucoat ®** *chirumon*

CHIRUCOAT,INC.

株式会社チルコート

Email: info@chirucoat.com
URL https://chirucoat.com