○ General overview

Target verification technology / verification applicant	IRUV CUT COAT・Hyper-SC/ Sketch.Co.,LTD
Verification organization	Japan Testing Center for Construction Materials
Verification test period	September 17, 2013 to February 17, 2014

1. Overview of the target verification technology

A technology for applying sunshade coating materials to existing windowpanes

*For information about the characteristics and other factors of the technology, see 4, "Reference information (overview version, on page 9)."

2. Overview of the verification test

2.1 Efficiency to reduce air conditioning and other loads

We measured the thermooptic efficiency of sunshade coating materials for glazing, and based on the findings, we numerically calculated the effects (such as the effect to reduce air conditioning load) achieved after applying a sunshade coating materials for glazing to all windows on the indoor side of the target building under the conditions specified below.

2.1.1 Set conditions in numerical calculations

(1) Target building

1) The living/dining (LD) space on the first floor of a housing (detached wooden) model
Target floor area: 20.49 m^2; window area: 6.62 m^2; floor height: 2.7 m; construction: wooden]

2) The southern part of the clerical office of the office model
[Target floor area: 115.29 m^2; window area: 37.44 m^2; floor height: 3.6 m; construction: RC construction]

Note: No consideration is given to the shelter of sunlight due to the effects of surrounding buildings or structures.

For details of the target building, see 4.2.2 (1) 1) “Target building” in the full version of main text. (See page 15 of the full version of main text.)

(2) Operating atmospheric data

Standard year for extended AMeDAS meteorological data (1991-2000) (Tokyo and Osaka Prefecture)

(3) Setting air-conditioning equipment

Building	Temperature setting (°C)		Operating hours	Cooling COP	Heating COP
	Cooling	Heating			
Housing	26.6	21.0	6:00-9:00, 12:00-14:00, 16:00-22:00	4.67	5.14
Office	28.0	20.0	7:00-21:00 on weekdays	3.55	3.90

(4) Setting the unit prices of electric energy charges

Region	Building	Standard contractual category	Unit price of electric energy charges (yen/kWh)	
			Summer	Other season
Tokyo	Housing	Meter rate lighting B	25.19	
	Office	Industrial power	16.65	15.55
Osaka	Housing	Meter rate lighting A	26.51	
	Office	High-voltage power AS	14.83	13.81

2.2 Efficiency of environmental load and maintenance

We performed a 1,000-hour accelerated weather resistance performance test using a weather resistance tester. After the test, we measured the thermooptic efficiency, and demonstrated the changes in measurements before and after the weather resistance test.

3. Verification test results

3.1 Efficiency to reduce air conditioning and other loads and efficiency of environmental load and maintenance

(1) Test results of thermooptic efficiency and efficiency of environmental load and maintenance (averages)*1

[Verification items]

Board thickness	Item		Before weather resistance test	After weather resistance test
3 mm	Sheltering coefficient	(–)	0.63	0.64
	Heat transmission coefficient	(W/m^2•K)	6.1	6.1

[Measurement items] (reference)

Board thickness	Item		Before weather resistance test	After weather resistance test
3 mm	Visible ray transmittivity	(%)	70.4	71.0
	Solar transmission factor	(%)	34.0	35.1
	Solar reflectance	(%)	5.3	5.0

[Reference items]

Board thickness	Item		Before weather resistance test	After weather resistance test
8 mm	Sheltering coefficient	(–)	0.64	-
	Heat transmission coefficient	(W/m^2•K)	5.9	-
	Visible ray transmittivity	(%)	71.0	-
	Solar transmission factor	(%)	35.2	-
	Solar reflectance	(%)	5.1	-

*1: Before the weather resistance test, we performed measurements on three samples (n = 3). Based on the findings, we selected two samples (i.e., those with the highest and lowest solar transmission factor where n = 2) and then performed a weather resistance test.

(2) Spectral transmission factor and spectral reflectance characteristics (wavelength range: 300 nm to 2,500 nm)

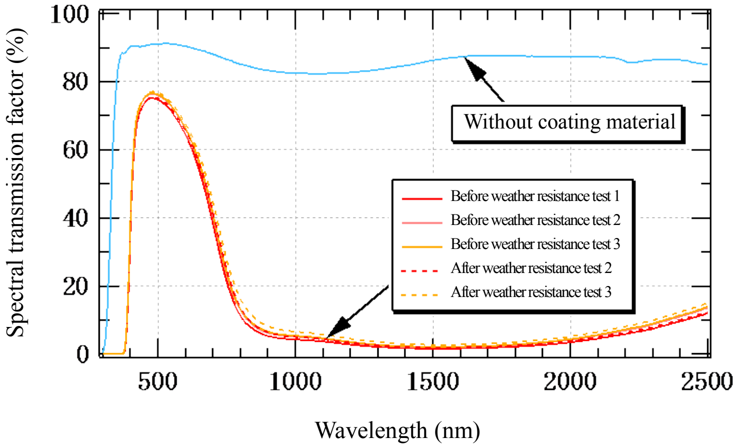

Figure 1 Measurement results of spectral transmission factor (board: float glass plate 3-mm thick)

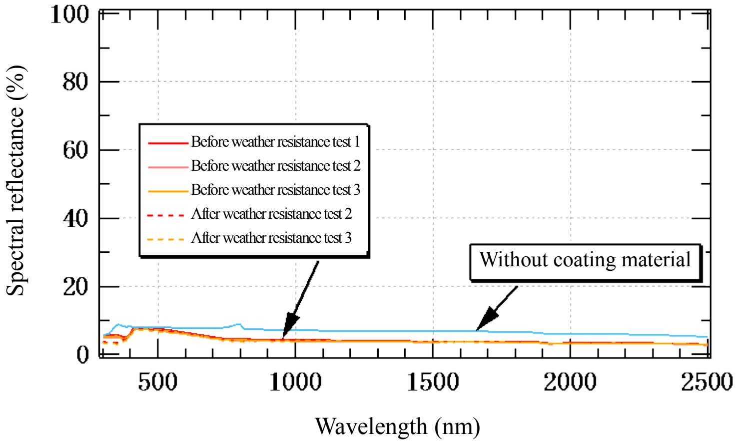

Figure 2 Measurement results of spectral reflectance (board: float glass plate 3-mm thick)

* Thermooptic efficiency was measured before the weather resistance test on three samples (n = 3) in view of the dispersions of the products. Among the samples measured, we selected two samples (n = 2), that is, those with the highest and lowest solar transmission factor, and then performed the weather resistance test. To monitor the deterioration in performance due to the weather resistance test, we performed another round of measurements on thermooptic efficiency after the weather resistance test.

[Reference information: wavelength range and definition*]
Ultraviolet region: 300-380 nm; visible light region: 380-780 nm; sunlight region: 300-2,500 nm
*Based on JIS A 5759

3.2 Verification items to be numerically calculated

(1) Calculation results of verification items

[Calculable region: Living/dining (LD) space (housing), southern part of the clerical office (office)]

Control: before applying coating material

		Tokyo		Osaka	
		Housing (detached wooden construction)	Office	Housing (detached wooden construction)	Office
Effect to reduce air conditioning load*1 (1 month in summer)	Calorific value	99 kWh/month (513 kWh/month → 414 kWh/month)	306 kWh/month (1,866 kWh/month → 1,560 kWh/month)	108 kWh/month (626 kWh/month → 518 kWh/month)	329 kWh/month (2,209 kWh/month → 1,880 kWh/month)
		Reduction of 19.3%	Reduction of 16.4%	Reduction of 17.3%	Reduction of 14.9%
	Power rate	Reduction of 534 yen	Reduction of 1,435 yen	Reduction of 613 yen	Reduction of 1,374 yen
Effect to reduce air conditioning load*1 (June to September in summer)	Calorific value	331 kWh/4 months (1,468 kWh/4 months → 1,137 kWh/4 months)	981 kWh/4 months (5,071 kWh/4 months → 4,090 kWh/4 months)	375 kWh/4 months (1,839 kWh/4 months → 1,464 kWh/4 months)	1,123 kWh/4 months (6,440 kWh/4 months → 5,317 kWh/4 months)
		Reduction of 22.5%	Reduction of 19.3%	Reduction of 20.4%	Reduction of 17.4%
	Power rate	Reduction of 1,786 yen	Reduction of 4,539 yen	Reduction of 2,129 yen	Reduction of 4,626 yen
Effect to control rising room temperature*2 (15:00 in summer)	Natural room temperature*3	3.0°C (42.1°C → 39.1°C)	3.0°C (49.2°C → 46.2°C)	3.1°C (40.6°C → 37.5°C)	3.2°C (50.2°C → 47.0°C)
	Effective temperature*4	3.5°C (42.6°C → 39.1°C)	3.0°C (49.2°C → 46.2°C)	3.7°C (41.3°C → 37.6°C)	3.2°C (50.3°C → 47.1°C)

*1: Effect to reduce air conditioning load after activating cooling when the indoor temperature rises above the cooling temperature setting in one summer month (August) and in summer (June to September)

*2: Effect of controlling rises in room temperature at the target region at 3 p.m. on a weekday in August when the total amount of direct solar radiation is highest (August 10 in Tokyo and August 18 in Osaka)

*3: Room temperature when no cooling is provided

*4: Temperature considering the surface temperature of indoor walls (average of air temperature and indoor wall surface temperature)

Note Numerical calculations are performed on the assumption of a model housing and office and under various preconditions, and thus differ from the actual environment where the technology is introduced.

(2) Calculation results of reference items

1) Calculation results in view of the effects of heating with regard to verification items

[Calculable region: Living/dining (LD) space (housing), southern part of the clerical office (office)]

Control: before applying coating material

		Tokyo		Osaka	
		Housing (detached wooden construction)	Office	Housing (detached wooden construction)	Office
Effect to reduce heating system load*1 (1 month in winter)	Calorific value	-91 kWh/month (293 kWh/month → 384 kWh/month)	-222 kWh/month (166 kWh/month → 388 kWh/month)	-86 kWh/month (398 kWh/month → 484 kWh/month)	-238 kWh/month (469 kWh/month → 707 kWh/month)
		Reduction of -31.1%	Reduction of -133.7%	Reduction of -21.6%	Reduction of -50.7%
	Power rate	Reduction of -446 yen	Reduction of -885 yen	Reduction of -443 yen	Reduction of -843 yen
Effect to reduce air conditioning and heating system load*2 (air-conditioning for a limited period)	Calorific value	-28 kWh/year (2,901 kWh/year → 2,929 kWh/year)	222 kWh/year (5,776 kWh/year → 5,554 kWh/year)	19 kWh/year (3,389 kWh/year → 3,370 kWh/year)	341 kWh/year (7,582 kWh/year → 7,241 kWh/year)
		Reduction of -1.0%	Reduction of 3.8%	Reduction of 0.6%	Reduction of 4.5%
	Power rate	Reduction of 28 yen	Reduction of 1,511 yen	Reduction of 293 yen	Reduction of 1,856 yen

*1: Effect to reduce heating system load after activating heating when the indoor temperature drops below the heating temperature setting in one winter month (February)

*2: Effect to reduce air conditioning and heating system load after activating cooling when the indoor temperature rises above the cooling temperature setting in summer (June to September), and after activating heating when the indoor temperature drops below the heating temperature setting in winter (November to April)

Note 1: Numerical calculations are performed on the assumption of a model housing and office and under various preconditions, and thus differ from the actual environment where the technology is introduced.

2) Calculation results in view of the effects of cooling and heating throughout the year
[Calculable region: Living/dining (LD) space (housing), southern part of the clerical office (office)]
Control: before applying coating material

		Tokyo		Osaka	
		Housing (detached wooden construction)	Office	Housing (detached wooden construction)	Office
Effect to reduce air conditioning load*1 (yearly air-conditioning)	Calorific value	610 kWh/year (1,933 kWh/year → 1,323 kWh/year)	1,699 kWh/year (6,616 kWh/year → 4,917 kWh/year)	621 kWh/year (2,256 kWh/year → 1,635 kWh/year)	1,778 kWh/year (7,796 kWh/year → 6,018 kWh/year)
		Reduction of 31.6%	Reduction of 25.7%	Reduction of 27.5%	Reduction of 22.8%
	Power rate	Reduction of 3,290 yen	Reduction of 7,686 yen	Reduction of 3,526 yen	Reduction of 7,174 yen
Effect to reduce heating system load*2 (yearly air-conditioning)	Calorific value	-370 kWh/year (1,461 kWh/year → 1,831 kWh/year)	-759 kWh/year (705 kWh/year → 1,464 kWh/year)	-364 kWh/year (1,571 kWh/year → 1,935 kWh/year)	-782 kWh/year (1,142 kWh/year → 1,924 kWh/year)
		Reduction of -25.3%	Reduction of -107.7%	Reduction of -23.2%	Reduction of -68.5%
	Power rate	Reduction of -1,813 yen	Reduction of -3,028 yen	Reduction of -1,876 yen	Reduction of -2,770 yen
Effect to reduce air conditioning and heating system load*3 (yearly air-conditioning)	Calorific value	240 kWh/year (3,394 kWh/year → 3,154 kWh/year)	940 kWh/year (7,321 kWh/year → 6,381 kWh/year)	257 kWh/year (3,827 kWh/year → 3,570 kWh/year)	996 kWh/year (8,938 kWh/year → 7,942 kWh/year)
		Reduction of 7.1%	Reduction of 12.8%	Reduction of 6.7%	Reduction of 11.1%
	Power rate	Reduction of 1,477 yen	Reduction of 4,658 yen	Reduction of 1,650 yen	Reduction of 4,404 yen

*1: Effect to reduce air conditioning load after activating cooling when the indoor temperature rises above the cooling temperature setting at any time of the year
*2: Effect to reduce heating system load after activating heating when the indoor temperature drops below the heating temperature setting at any time of the year
*3: Sum of the yearly cooling load and yearly heating load that decline due to applied sunshade coating materials for glazing
Note 1: Numerical calculations are performed on the assumption of a model housing and office and under various preconditions, and thus differ from the actual environment where the technology is introduced.

3) Calculation results in view of the effects of cooling and heating throughout the year in an entire building or entire clerical office

[Calculable region: Entire building (housing), entire clerical office on the reference floor (office)]

Control: before applying coating material

		Tokyo		Osaka	
		Housing (detached wooden construction)	Office	Housing (detached wooden construction)	Office
Effect to reduce air conditioning load*1 (yearly air-conditioning)	Calorific value	755 kWh/year (2,550 kWh/year → 1,795 kWh/year)	6,690 kWh/year (30,583 kWh/year → 23,893 kWh/year)	795 kWh/year (3,078 kWh/year → 2,283 kWh/year)	7,222 kWh/year (36,782 kWh/year → 29,560 kWh/year)
		Reduction of 29.6%	Reduction of 21.9%	Reduction of 25.8%	Reduction of 19.6%
	Power rate	Reduction of 4,072 yen	Reduction of 30,337 yen	Reduction of 4,513 yen	Reduction of 29,180 yen
Effect to reduce heating system load*2 (yearly air-conditioning)	Calorific value	-665 kWh/year (2,535 kWh/year → 3,200 kWh/year)	-4,003 kWh/year (7,583 kWh/year → 11,586 kWh/year)	-615 kWh/year (2,690 kWh/year → 3,305 kWh/year)	-3,407 kWh/year (8,647 kWh/year → 12,054 kWh/year)
		Reduction of -26.2%	Reduction of -52.8%	Reduction of -22.9%	Reduction of -39.4%
	Power rate	Reduction of -3,258 yen	Reduction of -15,961yen	Reduction of -3,172 yen	Reduction of -12,064 yen
Effect to reduce air conditioning and heating system load*3 (yearly air-conditioning)	Calorific value	90 kWh/year (5,085 kWh/year → 4,995 kWh/year)	2,687 kWh/year (38,166 kWh/year → 35,479 kWh/year)	180 kWh/year (5,768 kWh/year → 5,588 kWh/year)	3,815 kWh/year (45,429 kWh/year → 41,614 kWh/year)
		Reduction of 1.8%	Reduction of 7.0%	Reduction of 3.1%	Reduction of 8.4%
	Power rate	Reduction of 814 yen	Reduction of 14,376 yen	Reduction of 1,341 yen	Reduction of 17,116 yen

*1: Effect to reduce air conditioning load after activating cooling when the indoor temperature rises above the cooling temperature setting at any time of the year

*2: Effect to reduce heating system load after activating heating when the indoor temperature drops below the heating temperature setting at any time of the year

*3: Sum of the yearly cooling load and yearly heating load that decline due to applied sunshade coating materials for glazing

Note 1: Numerical calculations are performed on the assumption of a model housing and office and under various preconditions, and thus differ from the actual environment where the technology is introduced.

(3) Cautions on (1) "calculation results of verification items" and (2) "calculation results of reference items"

1) Numerical calculations are performed under various preconditions on the assumption of a model housing and office. The preconditions may differ from the actual environment where the technology is introduced.
2) To represent the reduction effects of heat loads not only in calorific value units (kWh) but also in terms of the reduction effects (in yen) of power rates, we set COP and energy charge unit prices that represent the cooling and heating capacities (in kW) per kW of power consumption during a rated output run.
3) The operating periods of cooling and heating set in the numerical calculations were as follows:
   - 15:00 in summer: Tokyo: 15:00 on August 10; Osaka: 15:00 on August 18
   - One summer month: August 1-31
   - Summer (June to September): June 1 to September 30
   - One winter month: February 1 to 28
   - Air-conditioning for a limited period: Cooling from June to September and heating from November to April
   - Yearly air-conditioning: One year of cooling and heating*1
4) No consideration is given to the rise in heat load arising from the amount of illumination and time stemming from the sunlight sheltered and resulting darkening of the indoor space.
5) The fields of the calorific values of effect to reduce air conditioning and heating system load represent the difference in heat load before and after use of the target verification technology, and the sum of heat load before and after said use, respectively (before use → after use).
6) For power rates, these calculations consider the difference in indoor heat load depending on the presence or absence of sunshade coating materials for glazing. Therefore, we do not estimate a total amount that entails various assumptions, but only indicate the difference in air-conditioning power rates due to changes in heat load. (For the concepts of calculating power rates, see page 28 of the full version of main text in [Concepts on calculating power rates]).

*1: Cooling will be performed when room temperature is higher than the temperature setting. Heating will be performed when room temperature is lower than the temperature setting.

4. Reference information

The verification applicant has submitted the information specified in (1) "overview of the target technology (reference information)" and (2) "other information from the manufacturer (reference information)" on his or her own responsibility. Therefore, MoE and the verification organization assume no responsibility whatsoever for the contents thereof.

(1) Overview of the target technology (reference information)

<table>
<tr><th colspan="2">Item</th><th colspan="3">To be filled out by the verification applicant</th></tr>
<tr><td colspan="2">Verification applicant</td><td colspan="3">Sketch. Co.,Ltd.</td></tr>
<tr><td colspan="2">Name of the technology-developing company</td><td colspan="3"></td></tr>
<tr><td colspan="2">Name of the target product</td><td colspan="3">IRUV CUT COAT</td></tr>
<tr><td colspan="2">Model of the target product</td><td colspan="3">Hyper-SC</td></tr>
<tr><td rowspan="4">Contact information</td><td>Phone</td><td colspan="3">03-5825-6503</td></tr>
<tr><td>Fax</td><td colspan="3">03-5825-6504</td></tr>
<tr><td>Web address</td><td colspan="3">http://www.sketch.co.jp/english/index.html</td></tr>
<tr><td>E-mail</td><td colspan="3">info@sketch.co.jp</td></tr>
<tr><td colspan="2">Characteristics of the technology</td><td colspan="3">Technology to enhance the near-infrared shielding effect in the window glass by coating.</td></tr>
<tr><td rowspan="3">Conditions for installation</td><td>Corresponding building and its region</td><td colspan="3">The possible application on the window glass in general. There is a case of application are not allowed on the metal coating film and insulated film.</td></tr>
<tr><td>Considerations on installation</td><td colspan="3">Environment of window glass is needed Humidity of 70% or less, Glass surface temperature 30 ℃ or less.</td></tr>
<tr><td>Other constraints on the installation location, etc.</td><td colspan="3"></td></tr>
<tr><td colspan="2">Need for maintenance, weather resistance, product service life, etc.</td><td colspan="3">10years durability , Cleaning is only to use water or neutral detergent</td></tr>
<tr><td colspan="2">Rough estimate of the cost</td><td>Design and installation price
(with materials and installation)</td><td>10,000 yen</td><td>per 1 m^2</td></tr>
</table>

(2) Other information from the manufacturer (reference information)
