Heat disspation coating paint

ECOMILE2 ®

Multi-functional heat dissipation coating agent made using polysilicon materials.

- High Radiation Performance (About 97 %)
- Heat dissipation effect in wide temperature range

  Low temperature (About 35℃) ~ High temperature (About 1200℃)
- Reflect radiation heat (Radiant heat)
- Simple coating construction

- ECOMILE 2 is just liquid coating, primer is not necessary
- If there are places where baking is not possible, natural drying is also possible
- The most effective film thickness is 10μ.

Eco Mile 2, the heat dissipation coating paint is a coating agent containing polysilicon with high thermal conductivity which accelerates heat energy transfer that is also effective in low

■Component

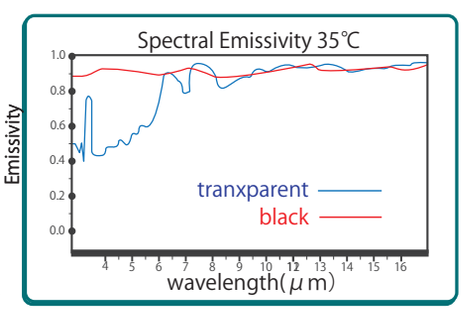
Colloidal silica mixture
Isopropanol
Silicate Polyester Water, etc.

■Specification

Specific gravity: 0.85~1
Package: 500g / can
*Other container is also available
(However will be treated as special order)

Colour: Black, Transparent
* Other colours are available for production as well
(However will be treated as special order)
Example of painting area: For 10 - 15μ thickness painting (Loss rate about 40%) using 1kg paint, painting a 22m^{2}area is possible.

Measurement of wavelength and wmissivity
Room temperature emmissivity measurement
Specimen SUS306 (10.8mm)
Coating film 10-15 μ (Both black and transparent)
Test temperature 35℃. 40℃.50℃



Temp \ Emissivity	ECOMILE2(Transparent) 4~7μm	ECOMILE2(Transparent) 7~16μm	ECOMILE2(Blank) 4~7μm	ECOMILE2(Blank) 7~16μm
35℃	0.44	0.89	0.93	0.92
	(4~16μm) ε=0.665		(4~16μm) ε=0.925	
40℃	0.57	0.92	0.96	0.91
	(4~16μm) ε=0.745		(4~16μm) ε=0.975	
51℃	0.72	0.98	0.96	0.98
	(4~16μm) ε=0.85		(4~16μm) ε=0.97	

Emissivity (Average during 51℃)
Transparent Sample 85%
Black Sample 97%

1. Test environment: Temp 20° C RH% 70% 2. Test Wavelength 4 – 16μm
3. Test Instrument Bomen MR104 4. Normative Basis ASTM E1933-99a

Advantages: You will gain the following effect when the coating is applied

Heat will be transmitted well
Improving the Heat Conduction (Diffusion)

Heat will be discharged well
Improving the Heat Emissivity

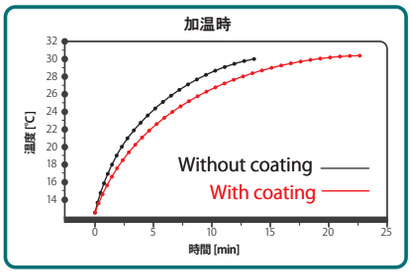
- **Heat resistant to about 850 – 1200℃**
- **Heat dissipation effect can also be seen even in low temperature range (about 35℃)**

Heat will be discharged well
Improving the Heat Emissivity

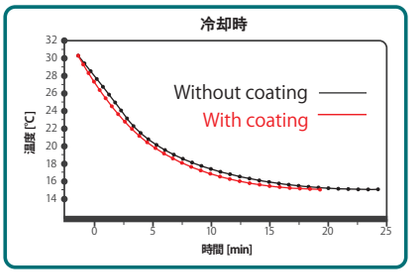
Liquid/air will be fragmented/minimized
By fragmenting/ minimizing at molecule level, allowing the improvement of the liquid/air state

There is effect that reflects heat emission (radiation).
*General heat dissipation products does not show the heat dissipation effect until after a certain amount of high temperature is accumulated, but this product is able to show the heat dissipation effect even in low saturation state as well as room temperature.

Measurement of Heat dissipation function
Cube Test
2 metal plates, one with coating and the other without a coating, are put on a 25x25x25 box, and is heated until 30 ° C, and then the temperature rise and fall of the experiment box is measured.



When heated Temperature



When cooling doen Temperature

According to the test result
During heating, the coated metal plate were able to reach 30° C in a long time period.
And during cooling down, the coated metal plate was able to cool down to 15° C in an early time.
In other words, the sample which uses the Eco Mile 2 has a higher heat dissipation effect which means its takes a longer time to raise the temperature, but cools

About Secondary Effect

Improving the heat source performance
Extending the life-span of machinery
Improving fuel economy

Weight reduction for radiators, allowing cost savings,
Easy to execute, application place and execution place is not required.

- Only the Eco Mile 2 coating solution is needed, primer is not necessary.
- If you have no place to bake, the coating can also be dried naturally.
- Only 10μ of coating is needed to achieve the result, so it is an easy and economical coating .
- A thermal emissivity of an alumite coating can be achieved in a simple way.

The following is the only 3 ways to transfer heat

Principle: Heat will always travel from high place to

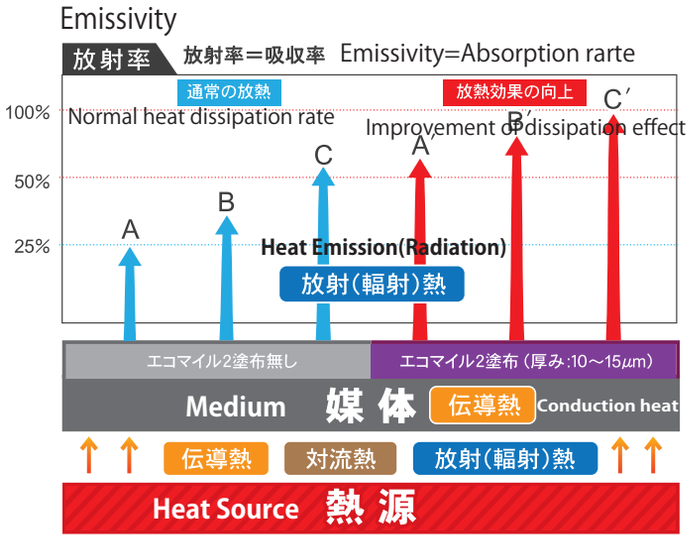
①Conductive heat: Heat transmitted within the material
Within objects there are atoms (molecules) uses covalent binding to strongly bind them to each other.
Heat transmitted within an object means the molecules are vibrating. And “Large vibrations = High Thermal Energy” .
Which means objects with low thermal conductivity, the vibration that happens when heat energy is given is small,and objects with good thermal conductivity, means large vibrations occur that allow effective heat conduction.
②Convective heat: Gas/liquid that is accumulated within gas/liquid is transferred to other materials by moving.
③Heat emission (radiation): Directly transmitted by the ray of the far-infrared radiation
Heat energy is emitted from outside of the object in the form the electromagnetic waves (infra-red, etc.)
[High Temp] Strong >> Heat Emission (Radiation) >> Weak [Low Temperature]

About Eco Mile 2 Heat Dissipation Action

Polysilicon, the component that can be found with Eco Mile 2, the material itself has an extremely large vibration, which means it has a high heat conductivity (diffusion)

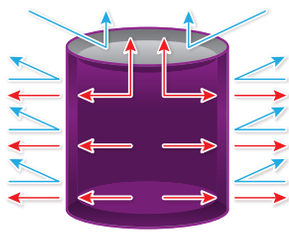
The unique terahertz electromagnetic wave (a type of intra-red) which has excellent permeable emission is created, and the action causes a high thermal emissivity.

*And for that reason, a high thermal emissivity as well a wide range of wavelength can be held even if it is white or pale colour, and produce Heat Emission (Radiation) easily.



*Metal medium' s example emissivity -> Aluminum: 0.05/ Steel: 0.59/ Copper: 0.05, etc.

Eco Mile 2 also works to reflect Heat Emission (Radiation), so you can also achieve effects such as prevention of temperature rise that is caused by heat emission (radiation) from the sunlight for the outdoors.



1. From the heat inside -> Infrared is radiated through the Eco Mile 2 -> Heat is dissipated to the air
2. The heat emission (radiation) -> Is reflected using the Eco Mile 2 -> Heat is dissipated to the air
3. The coating is thin (About 10 μm), making material cost more economic. And it is hard to peel off.

Action example
C Without coating 100° C x 0.59 = 59° C
C With coating 100° C x 0.97 = 97° C
For steel, supposing the emissivity is 59% (0.59), 100 ° C will only produce a 59° C radiation, but by coating with Eco Mile 2, will cause a rise to 97° C

Other Advantages

The terahertz wave that is transmitted at all times by the polysilicon activates the rotational motion and vibrations within the molecules which activates mutual movements between the molecules. The action further fragmenting/ minimizing the state of the air and liquid.

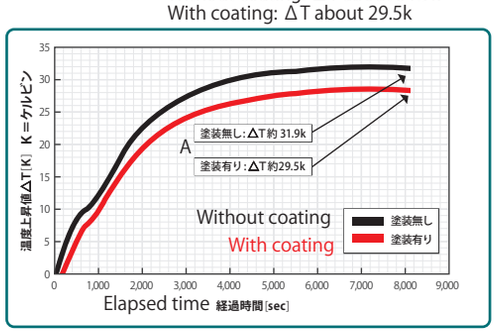
And as a result, the density air and liquid will be raised, and the flow rate will be improved as well as getting a better and improved state.

*Terahertz wavelength is electromagnetic wave between the light and electronic waves, and has wavelength 10 - 1000 μm, which is longer when compared to the infrared(Wavelength 3 – 12 μm)

1.Het Sink Natural Air Cooling Test

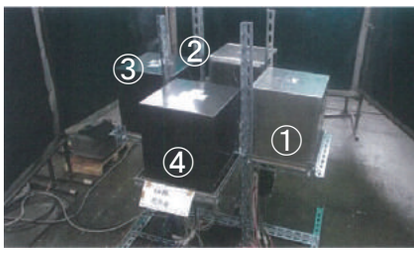
▼Test Condition
Heat burden: 300W (150W x 2)
Measurement point: Heater installation
Outside air temperature: About 25° C

Without coating: ΔT about 31.9k
With coating: ΔT about 29.5k



According to the test result
Change in the temperature rise value
With coating (about 29.5K) – Without coating (about 31.9K)
= About -2.4K (Temperature rise value: Average value of a
1 minute before the end of the test)
With coating, the result of 7.5% of the temperature rise is reduced and the improvement of thermal emissivity is confirmed.
*However, external factors are strong under forced cooling, so the effect could not be demonstrated.

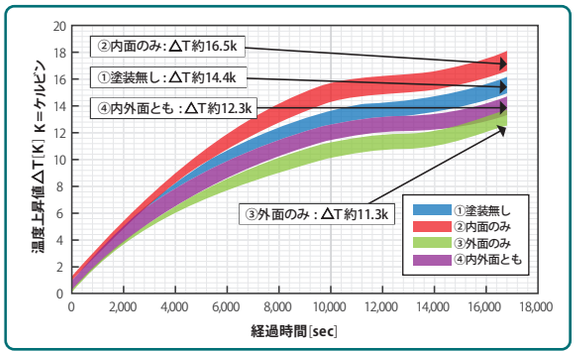
2.Cube (Housing) Test



▼Housing test
①Without coating
②Coating only on the inside surface
③Coating only on the outside surface
④Coating on the inside and

▼Test Condition
Heat burden: 50W, outside air temperature: About 23° C
Measurement point:
A Air within the housing.
B Ceiling surface of the housing
C Right under the heater

A Temperature distribution of air within the housing



Coating conditions	Temp rise value	Temp rise value compared to	Temp rise ratio compared to
1) Without coating	14.4		
2) only ins side surface coating	16.5	2.1	14.6
3) only outside surface coating	11.3	−3.1	−21.5
4) Both surface coating	12.3	−2.1	−14.6

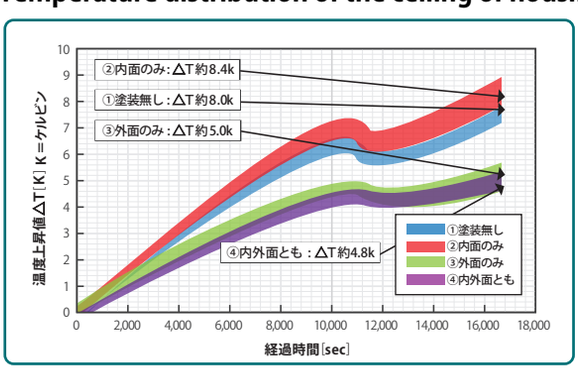
According to the result

▼ The outside surface coating ③ is confirmed to have improved thermal emissivity due to the temperature drop of the ambient temperature inside the housing

▼ The inside surface coating ② temperature equalization due to the improvised thermal conduction of the ambient temperature inside the housing, and the warm air accumulated on the top part of the housing is balanced inside the housing, and the heat radiation reflected due to the process of confinement of heat, and it is presumed that the temperature has risen.

▼ The inside and outside coating ④, is showed as numerical value of the effect of process ②③.

B Temperature distribution of the ceiling of housing



Coating conditions	Temp rise value	Temp rise value compared to	Temp rise ratio compared to
1) Without coating	8.0		
2) only ins side surface coating	8.4	0.4	5.0
3) only outside surface coating	5.0	−3.0	−37.5
4) Both surface coating	4.8	−3.2	−40.0

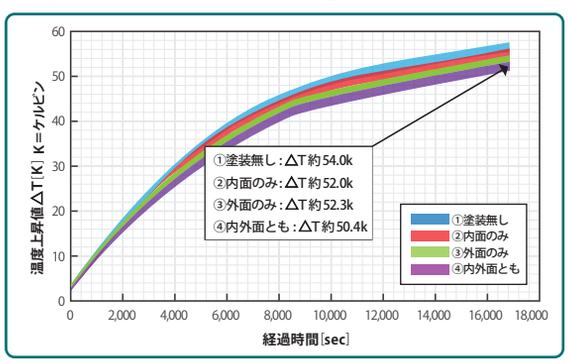
According to the result

▶ The outside surface coating ③ is confirmed to have improved thermal emissivity caused by the temperature drop of the painted surface.

▶The inside surface coating ②, in a state where radiation could not happen, the improved heat conductivity was the only temperature raise that can be seen

▶The inside and outside coating ④, is assumed to have a better heat dissipation effect due to the improved heat conductivity on the inside and outside surface ②&③, as well as the improved thermal emissivity of ③.

C Temperature distribution right under the heater



Coating conditions	Temp rise value	Temp rise value compared to	Temp rise ratio compared to
1) Without coating	54.0		
2) only ins side surface coating	52.3	−2.7	−5.0
3) only outside surface coating	52.4	−2.6	−4.8
4) Both surface coating	50.4	−3.6	−6.7

According to the result

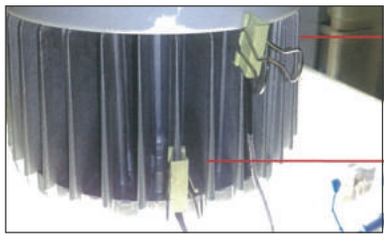
▶Because the measuring point is near the heat source, the heat difference between each measurement is little.

▶The outside surface coating ③, due to the improvement of thermal emissivity and the inside surface coating ② has temperature equalization due to the improvement of heat conductivity, causing the ambient temperature of the housing to drop.

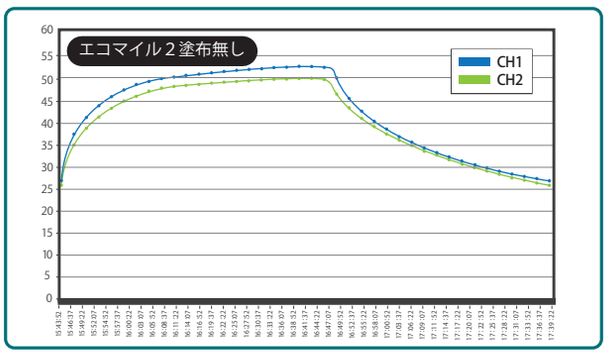
▶The inside and outside coating ④, is presumed to have the most heat dissipation effect due to the combined

3.LED Light Test

▼Test condition
Measurement time: Time start 15:43:52, Finish 17:38:42
Measurement interval: 5 seconds/time
Measurement position: Bottom of CH1 Fin ,Top of CH2 Fin
Measuring method: Thermocouple Thermomete

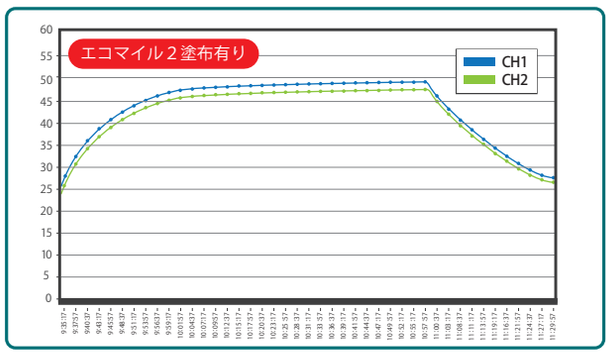


Without Eco Mile 2 coating



A	B	C	D	E	F	G	H	I
CH1	27.3℃	16:46:15	55.9℃	1:02:23	16:47:27	17:35:37	00:48:10	27.00℃
CH2	26.6℃	16:42:17	51.2℃	0:58:25	16:47:27	17:36:17	00:48:40	26.60℃

With Eco Mile 2 coating



A	B	C	D	E	F	G	H	I
CH1	27.3℃	10:49:07	47.9℃	01:10:50	10:56:07	11:23:07	00:27:00	27.00℃
CH2	26.6℃	10:27:57	46.3℃	00:49:40	10:56:07	11:24:17	00:28:10	26.60℃

A：Measuring Position
B：Starting Temperature
C：Average heat temperature recoading time
D：Average heat temperature A
E：Time required for the Average heat temperature
F：Power off time
G: Cooling temperature recoading end time
H: Time required for cooling B
I :Temperature at the end of cooling

According to the result

▶The difference of the each average heat temperature taken at the measurement position (CH1, CH2) with and without Eco Mile 2 coating, A' , which is coated has a lower temperature than A, which is not coated, confirming that there is an improvement of thermal emissivity.

CH1:A(55.9° C)-A'(47.9° C)=temperature difference(8° C)[Thermal radiation improved 14.3%]

CH1:A(51.2° C)-A'(46.3° C)=temperature difference(4.9° C) [Thermal radiation improved 9.6%]

▶The difference of the average heat temperature between the measuring positions CH1 and CH2, the coated A' has a smaller difference than A, which is no coated, confirming that there are temperature equalization that is cause by the improvement of heat conductivity.

A: CH1(55.9° C)-CH2(51.2° C) = temperature difference (4.7° C)

A: CH1(47.9° C)-CH2(46.3° C) = temperature difference (1.6° C)

The difference of average heat temperature: A(4.7° C)- A'(1.6° C) = (3.1° C) [Temperature equalization improved 66%]

▶After turning off, the time taken to cool the heat sink down to a complete cool down temperature, B' that was coated has a shorter time compared to the B which was not coated, and it is confirmed that cooling functions of the heat source can be raised by improving the thermal emissivity.

CH1: B(48:10)-B'(27:00)=time difference(21:00)[Cooling down time is shrunk by 43.8%]

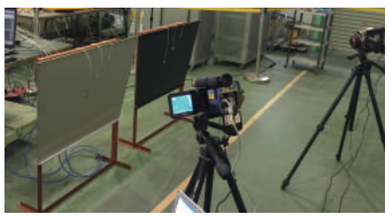
CH2:B(48:40)-B'(28:10)=time difference(20:30)[Cooling down time is shrunk by 42.2%]

4.Snow melting plate

Increasing heat source performance and heat dissipation effect test

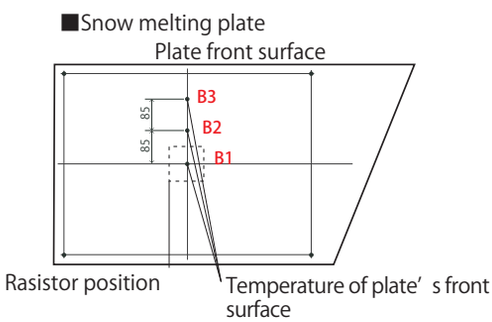
▼Test conditions

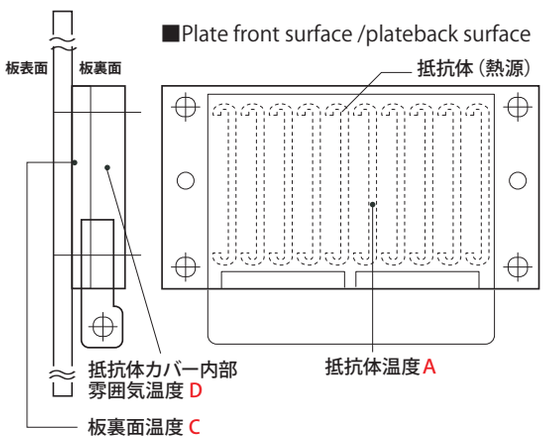
A heat source (resistor) is installed at the back surface of the snow melting plate, and the snow is melted by raising the temperature of the front surface. To increase the now melting effect, an experiment using show melting plate that is coated and not coated with Eco Mile 2.



Time(sec)	Temperature difference on the cover front surface B1	Temperature difference on the cover front surface B2	Temperature difference on the cover front surface B3	Temperature difference on the cover back surface C	Temperature difference on the cover back surface C	Temperature difference for resistor A
0	0.9	1.1	1.2	2.6	1.4	0.3
120	-1.7	0.9	1.1	-1.9	-6.7	5.7
240	-2.7	0.2	1.4	-1.7	-6.1	14.7
360	-2.6	-2.0	0.2	-3.9	-4.0	18.6
480	-2.3	-3.2	0.0	-3.3	-3.3	20.7
600	-2.9	-4.5	-0.8	-4.3	-1.7	22.0
720	-4.2	-6.2	-2.2	-5.9	-0.2	23.0

Thermometer (thermocouple) Mounting Position (A - D)





According to the result

▶At the same power consumption (W), the snow melting plate that is coated a, the heat source (resistor) temperature is higher compared to the snow melting plate that is not coated b, which shows improvement in the heat source performance, each temperature taken from the snow melting plate, C & D as well as the temperature taken from the resistor’ s cover, B1 – 3, are low, confirming improvement in heat conductivity and thermal emissivity.

Because of that, the coated plate release more energy to the outside of the snow melting machine at the same power can also be confirmed. In other words, the snow melting effect has been improved.

Specification

Item	Value Data
Solid content	25% min
Specific gavity	0.85–1
Viscosity	<50
PH	3–6
Coating amount	10–15 μm
Adhesion	SB

Item	Value Data
Paint hardness	4～7H
Sslt Watr resistance	Pass 168H
Asid resistance	Pass 5%24h
Alkali resistance	Pass 5%24h
Humidity and cool-heat cycling	Pass 100℃/30minutes Pass-30℃/30 minutes
Accelerated weathring	Pass 168h

Execution Method

- Roughen execution surface thoroughly with sand paper (No.320-400).
- Apply the coating as thin as possible (10μ is the most effective. Note: The effectiveness does not change even when the thickness is increased), and repeating the application and drying process a few times will improve the adhesion. When drying naturally, leave about 30 minutes between coatings.
- After drying the last coating naturally, followed by baking finish will further improve the adhesion. (Baking from normal temperature and raising the temperature little by little until 180℃ for about 40 minutes will improve the adhesion even further.)

Caution

- Before use, there is a possibility of sedimentation of the heat radiation paint inside the container, so please stir properly to make it uniform.
- After opening and using the ECOMILE 2 container, seal the container tightly, please keep in a cool and dark place far from direct sunlight.
- Please ensure that the paint and film is not exposed to fine dust from outside.

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ISO9001:2015 CERTIFICATE

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