



Homeasy Services Ltd.

日本隔熱塗料 (Protuvalu)

---太空船技術應用---

有效降低室內溫度，減少能源消耗

JAXA – Environmental Friendly Coating

- ▶ 日本宇宙航空研究開發機構
Japan Aerospace Exploration Agency (JAXA)
- ▶ 證實Protuval有效抑制室內溫度的變化，從而減少能源消耗。

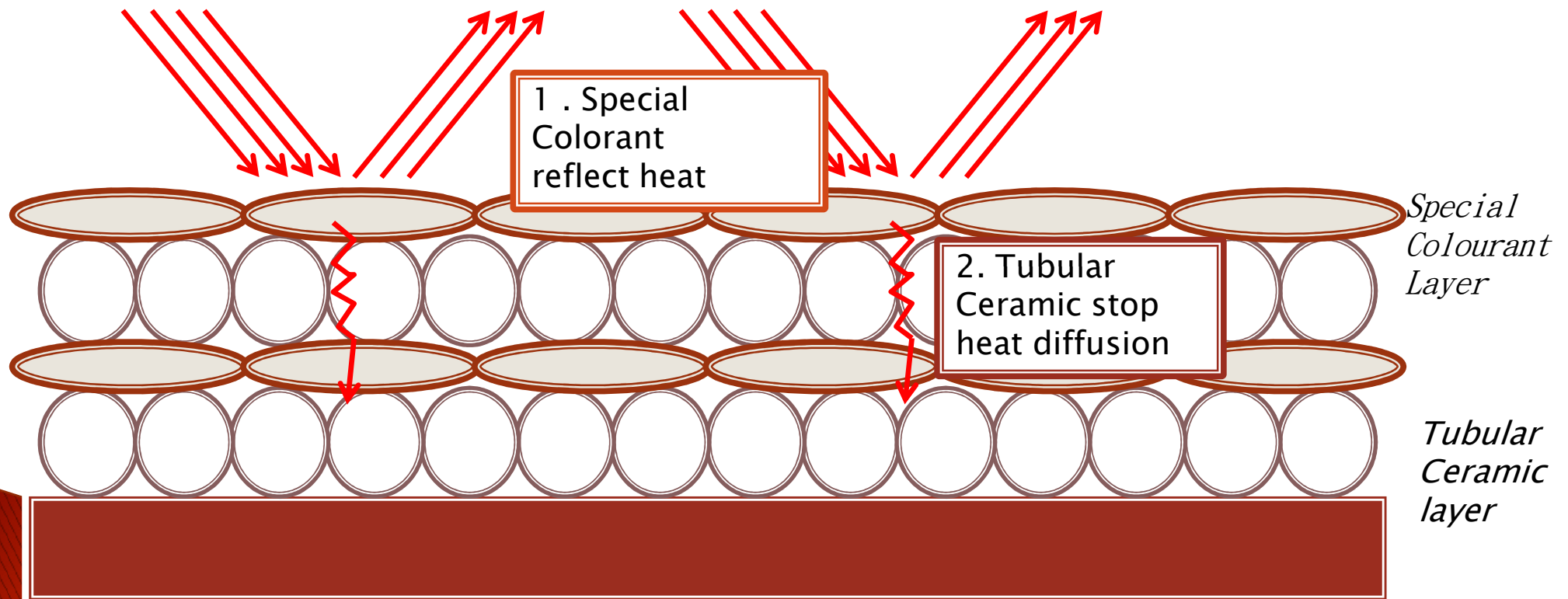


Insulation Mechanism of Protuvalu Coating

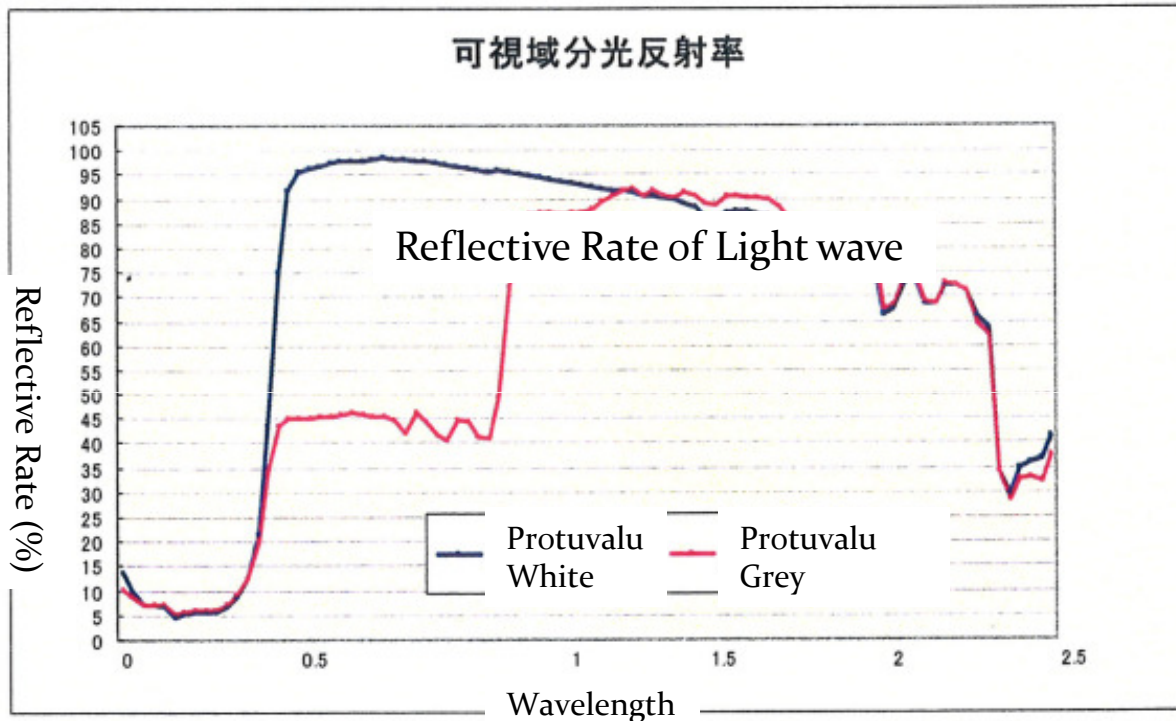


Protuvalu隔熱原理

1. 反射熱力
2. 阻止熱力滲透



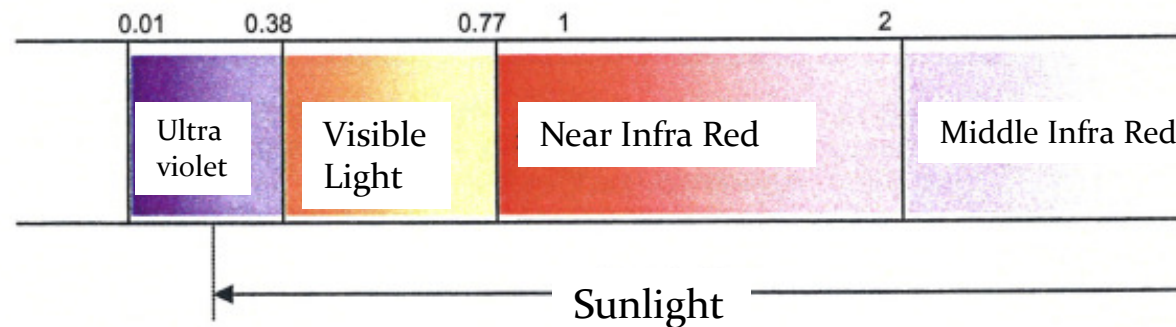
Heat Insulation Efficiency of Protuvalu



Human body
feels hot at
 $0.38 \mu\text{m} \sim 2.1 \mu\text{m}$

Average Reflective
Rate of Protuvalu
(White) = **85.8%**

Average Reflective
Rate of Protuvalu
(Grey) = **69.2%**

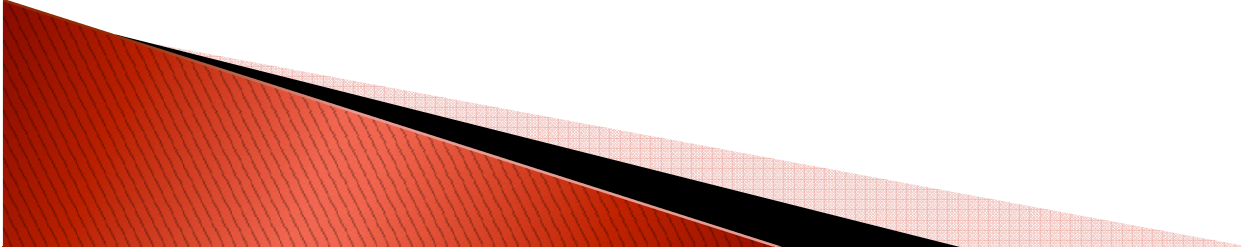


Wavelength of Heat Wave ($0.38 \sim 2.1 \mu\text{m}$)

Protuvalu(白色)的
平均反射率

= **85.8%**

Features of Protuvalu

- **雙重隔熱**
 - Protuvalu 以“反射熱力”及“阻止熱力”滲透兩種方法來隔熱
 - **保持室內溫度**
 - 優秀的隔熱性能有效抑制室內溫度變化
 - **改善外觀**
 - 塗層表面光滑,多種顏色可供選擇
 - **環保**
 - 水性，揮發性有機化合物(VOC)含量低
- 

Specification of Protuvalu

| Test Item | Result | Methodology |
|-----------------------------------|-----------|---|
| Glossy(60°C) | 83 | Cure for 7 days |
| Pencil Hardness | B | Cure for 7 days |
| Adhesive | 25/25 | 25pc X 2mm adhesive tape |
| Water Resistance | No Change | Immerse in Tap water for 7 days |
| Alkali Resistance | No Change | Immerse in saturated lime water for 7 days |
| Acid Resistance | No Change | Immerse in 3% sulphuric acid for 7 days |
| Warm Water Resistance | No Change | Immerse in 50°C warm water for 4 days |
| High Humidity Cold and Heat Cycle | No Change | 10 cycles |
| Mould Resistance | No Change | Based on JIS Z 2911 |
| Fungi Resistance | No Change | Based on Agar medium method |
| Formaldehyde Emission (mg/L) | 0.00 | Desiccating Method (0.12 = F☆☆☆☆) |
| VOC Content | 45.5g/L | US EPA Method 24 and SCAQMD Method 303 (Limited = 250g/L) |

Experiment on Protuvalu VII

Period : 2007-Jun-20 ~ Jul-1

Location:

Tokonosawa City, Saitama, Japan

Thermometer Model :

KN Laboratories Thermomanager



Thermometer Position

Outer Roof

Inner Roof

Indoor 150cm
from floor

Indoor 50cm
from floor



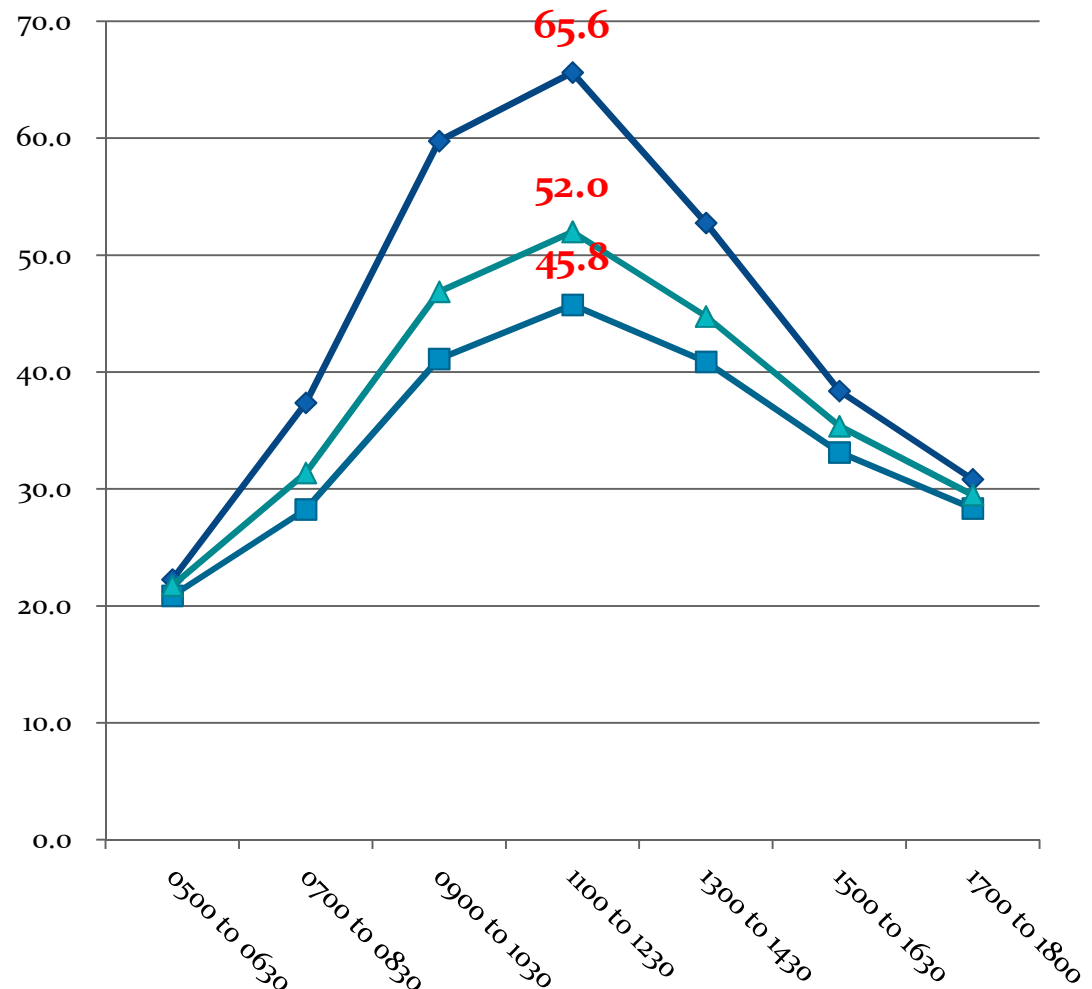
Data Sheet (2007-Jun-21)

| Time | Outer Roof | | |
|----------------|-------------|-----------------|----------------|
| | Non coating | Protuvalu white | Protuvalu Grey |
| 05:00 to 06:30 | 22.3 | 20.9 | 21.8 |
| 07:00 to 08:30 | 37.4 | 28.3 | 31.4 |
| 09:00 to 10:30 | 59.8 | 41.1 | 46.9 |
| 11:00 to 12:30 | 65.6 | 45.8 | 52.0 |
| 13:00 to 14:30 | 52.8 | 40.9 | 44.8 |
| 15:00 to 16:30 | 38.4 | 33.1 | 35.4 |
| 17:00 to 18:00 | 30.8 | 28.3 | 29.5 |

Protuvalu VII White :
20°C lower than non-coated

Protuvalu VII Grey :
13 °C lower than non-coated

Temperature Change on Outer Roof



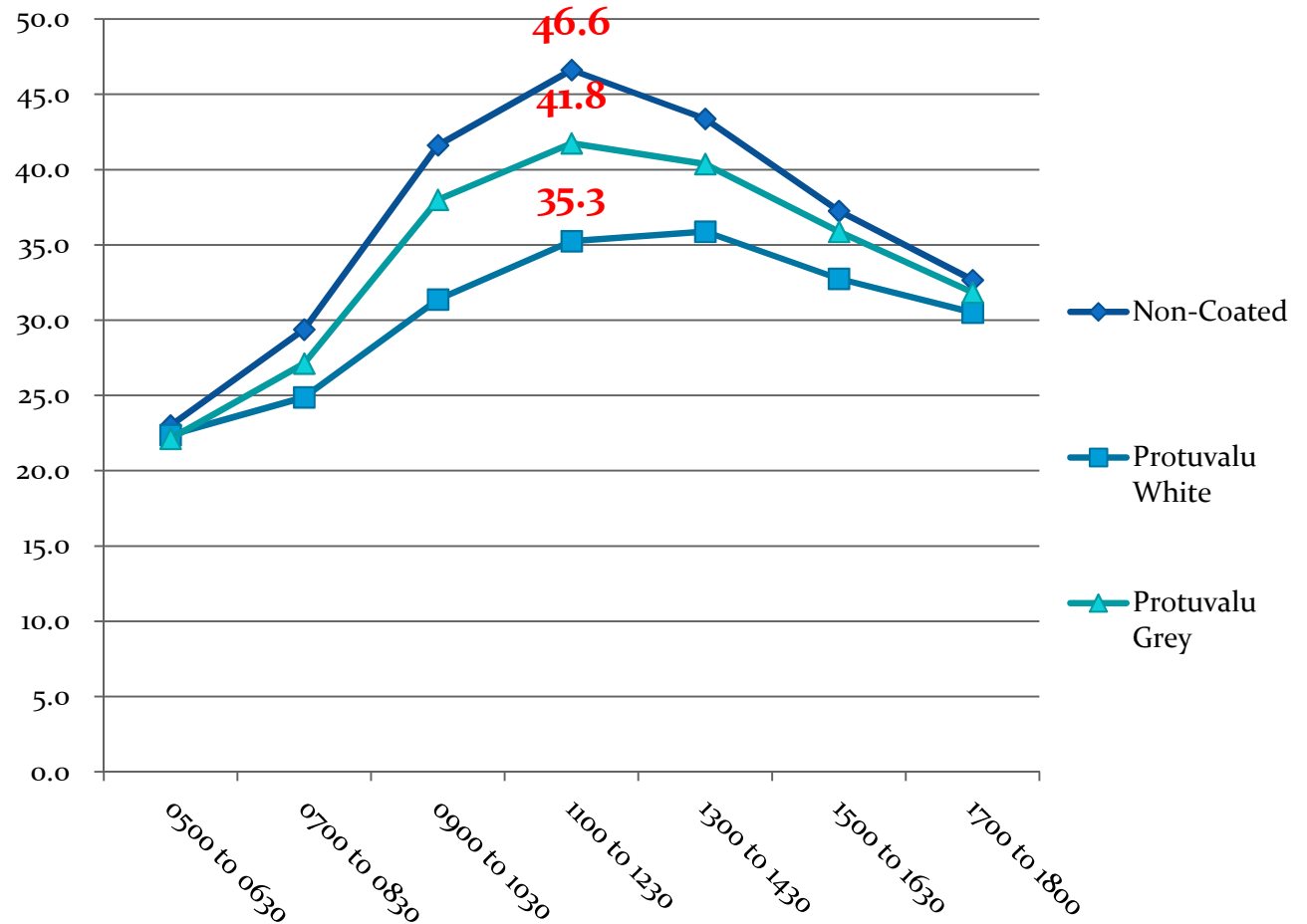
Data Sheet (2007-Jun-21)

| Time | Inner Roof | | |
|----------------|------------|-----------------|----------------|
| | Non-Coated | Protuvalu White | Protuvalu Grey |
| 05:00 to 06:30 | 23.0 | 22.4 | 22.1 |
| 07:00 to 08:30 | 29.4 | 24.9 | 27.1 |
| 09:00 to 10:30 | 41.6 | 31.4 | 38.0 |
| 11:00 to 12:30 | 46.6 | 35.3 | 41.8 |
| 13:00 to 14:30 | 43.4 | 35.9 | 40.4 |
| 15:00 to 16:30 | 37.3 | 32.8 | 35.9 |
| 17:00 to 18:00 | 32.7 | 30.5 | 31.8 |

Protuvalu VII White :
10°C lower than non-coated

Protuvalu VII Grey :
5 °C lower than non-coated

Temperature Change on Inner Roof



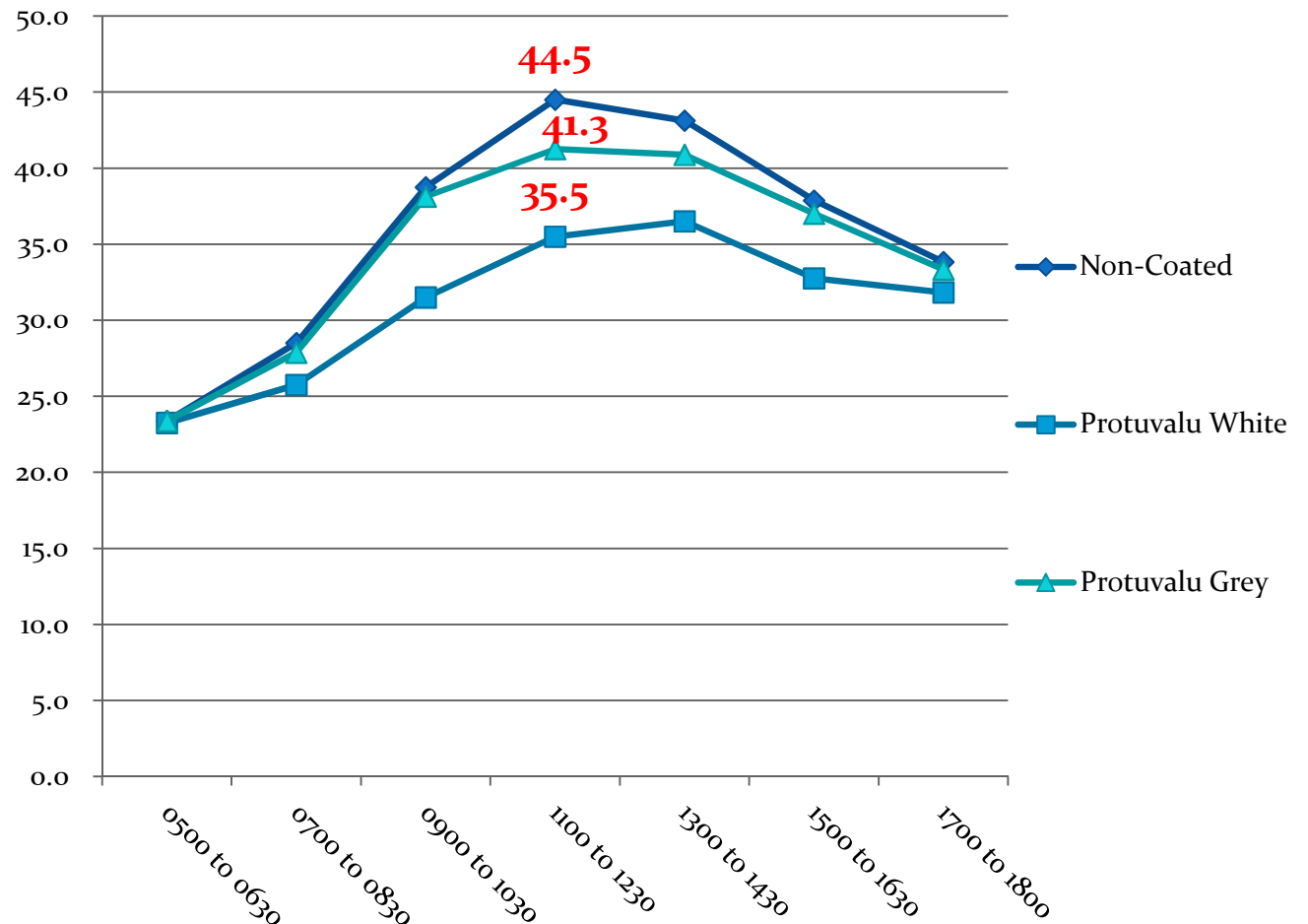
Data Sheet (2007-Jun-21)

| Time | Indoor 150cm from floor | | |
|----------------|-------------------------|-----------------|----------------|
| | Non-coated | Protuvalu White | Protuvalu Grey |
| 05:00 to 06:30 | 23.4 | 23.3 | 23.4 |
| 07:00 to 08:30 | 28.5 | 25.8 | 27.9 |
| 09:00 to 10:30 | 38.8 | 31.5 | 38.1 |
| 11:00 to 12:30 | 44.5 | 35.5 | 41.3 |
| 13:00 to 14:30 | 43.1 | 36.5 | 40.9 |
| 15:00 to 16:30 | 37.9 | 32.8 | 37.0 |
| 17:00 to 18:00 | 33.8 | 31.8 | 33.3 |

Protuvalu VII White :
10°C lower than non-coated

Protuvalu VII Grey :
3 °C lower than non-coated

Temperature Change in indoor 150cm from floor

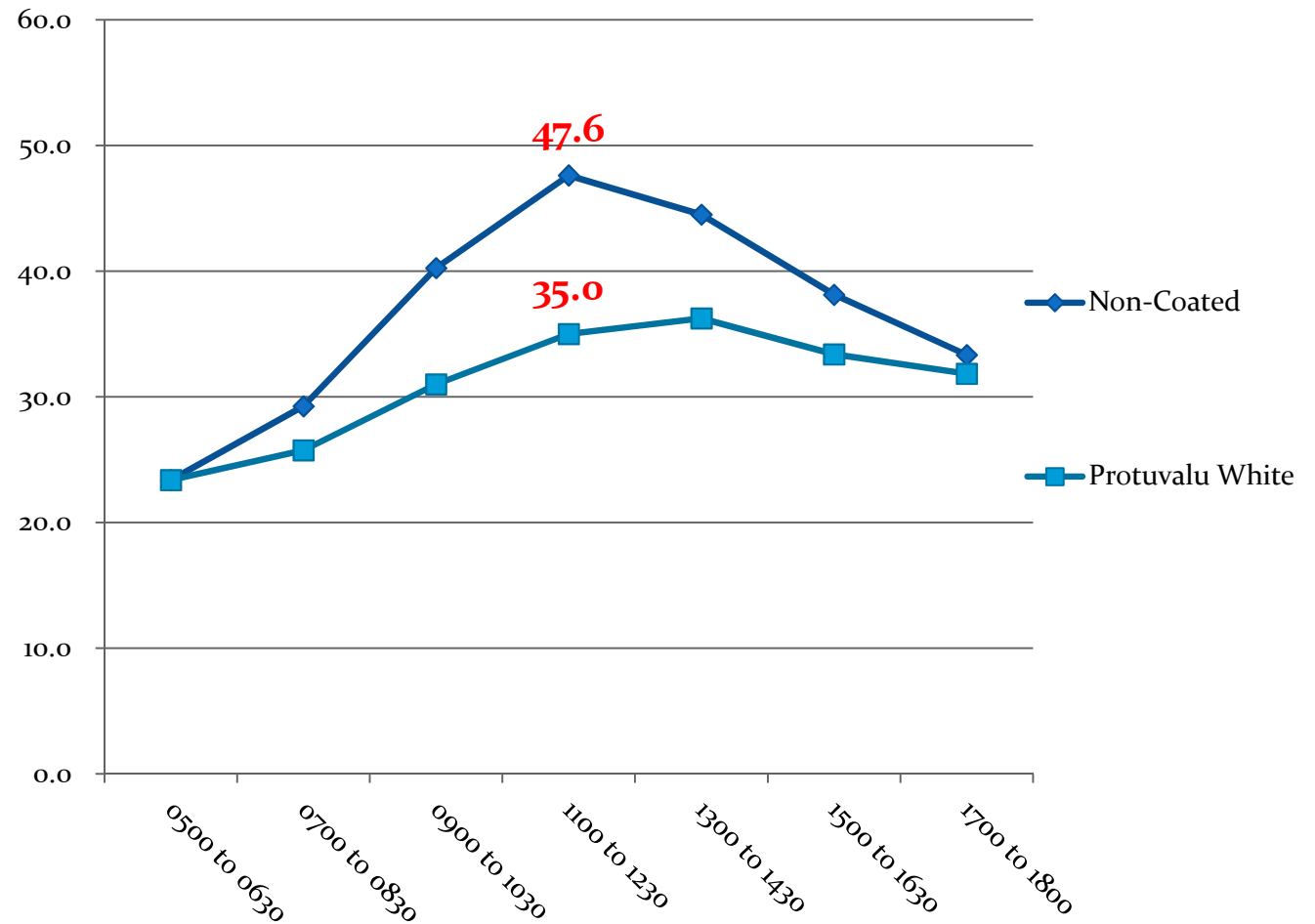


Data Sheet (2007-Jun-21)

| Time | Indoor 50cm from Floor | |
|----------------|------------------------|-----------------|
| | Non-Coated | Protuvalu White |
| 05:00 to 06:30 | 23.4 | 23.4 |
| 07:00 to 08:30 | 29.3 | 25.8 |
| 09:00 to 10:30 | 40.3 | 31.0 |
| 11:00 to 12:30 | 47.6 | 35.0 |
| 13:00 to 14:30 | 44.5 | 36.3 |
| 15:00 to 16:30 | 38.1 | 33.4 |
| 17:00 to 18:00 | 33.3 | 31.8 |

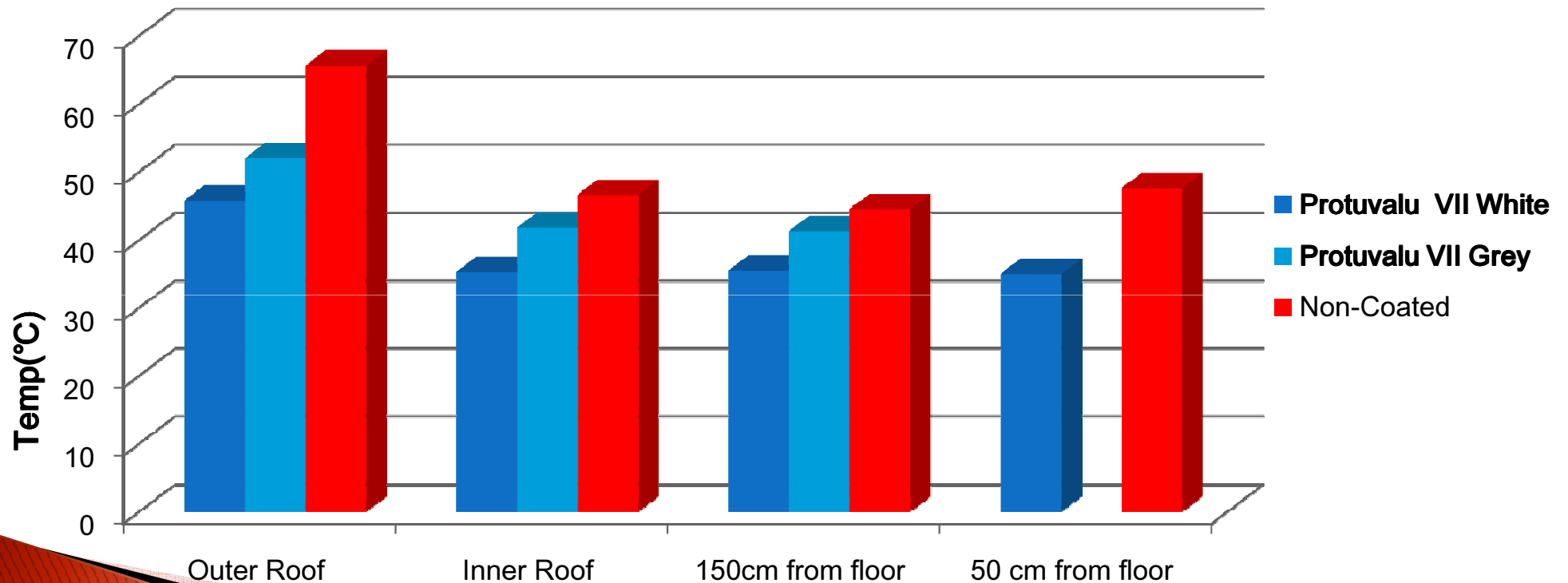
Protuvalu VII White :
12°C lower than non-coated

Temperature Change in indoor 50cm from floor



Result Analysis

| Max. Temp | Protualu VII White | Protualu VII Grey | Non-Coated |
|------------------|--------------------|-------------------|------------|
| Outer Roof | 45.8 | 52 | 65.6 |
| Inner Roof | 35.3 | 41.8 | 46.6 |
| 150cm from floor | 35.5 | 41.3 | 44.5 |
| 50 cm from floor | 35 | | 47.6 |

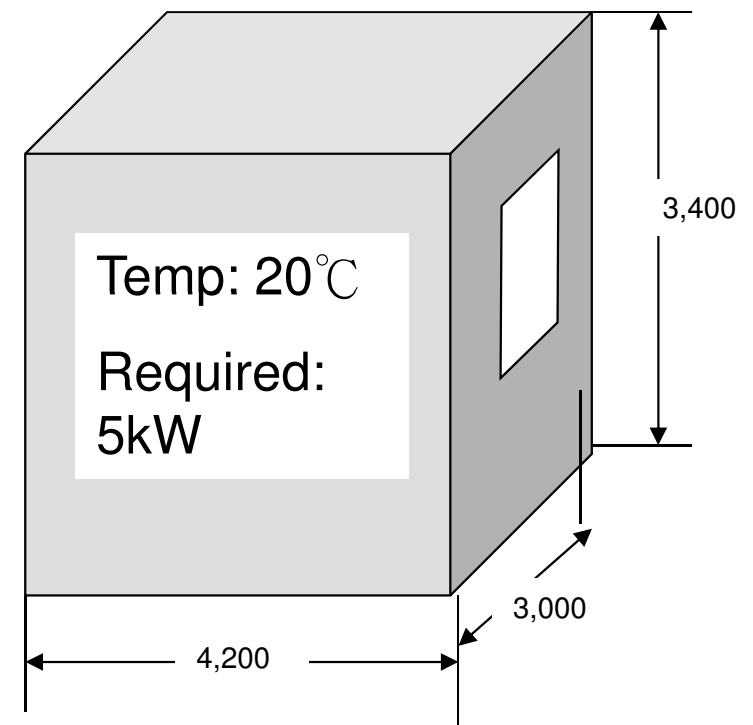


Reduction of Energy Consumption

- ▶ R Value : 12.99 m²K/W
- ▶ Sunlight Reflection : Estimate to 80%
- ▶ Actual Energy of sunlight is 11.6kW
 - Required of Energy to keep at 20 °C
From 5kW reduced to 2.5kW
after Protuvalu is applied

能源消耗減少50% !

Diagram of testing environment



Compare with other building materials

| Material/Substrate | R-Value (m ² K/W) | Sunlight Absorbance |
|--------------------|------------------------------|---------------------|
| Protuvalu III | 12.98 | 13% |
| Concrete | 0.625 | 65% |
| Slate | 2.85 | 89% |
| Galvanized Zinc | 0.226 | 89% |

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