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المركز القومى لبحوث الإسكان والبناء
مكتب نائب رئيس مجلس الإدارة
لشئون أعضاء هيئة البحوث والوظائف المعاونة

المركز القومى لبحوث الأسكان والبناء
إدارة السكرتارية والمحفوظات
التاريخ ٢٠٢٠/١٢/٢ المرفقات : لا يوجد
رقم الصادر : ٦٧٠٢

مرجعنا : ٢٠٢٠/١٢/٢١٣

مرجعكم: ٢٠٢٠/١١/١١

الموضوع: أعمال تقييم أداء (حراري – ضوئي) لمنتج دهان عازل للحرارة
GAINA THERMAL INSULATION COATING

الجهة الطالبة: **GAINA PRO JAPAN/ MIDDLE EAST**

تحية طيبة وبعد،،

إيماءً الى خطاب سيادتكم بتاريخ ٢٠٢٠/١١/١١ بخصوص الموضوع عاليه، مرفق طيه التقرير النهائي بالنتائج ، هذا وقد سددت الرسوم المقررة بالقسيمة رقم ٠٢٣٨٢٥٩ بتاريخ ٢٠٢٠/١١/١١ .

وتفضلوا بقبول فائق الاحترام،،

مدير المعهد

أستاذ دكتور /

محمود علي حسن

نائب رئيس مجلس

الإدارة لشئون الأعضاء

٢٠٢٠/١٢/٢

أ.د/ محمد مسعود السعداوي

وزارة الإسكان والمرافق
المركز القومى لبحوث الإسكان والبناء
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٨٧ شارع التحرير الدقى - جيزة
ص.ب. : ١٧٧٠ القاهرة

Client Name: GAINA PRO JAPAN/ MIDDLE EAST **Delivery Date:** 11/11/2020
Supplier Code: BPI/H/CO.213 **Subject:** Technical study
Sample Description: Thermal insulation coating (**GAINA**)

Technical Study for Evaluating:

Thermal performance and solar reflection of white solar reflective paint

1. Objective of the study

The objective of this study is to evaluate the solar reflection and the thermal performance of white thermal insulation paint (Manufactured by: **GAINA**).

2. Experimental details

This work was divided into three main procedures:

- **Spectral and solar reflectance measurements for white solar-reflective paints.**

Reflectance measurements were performed for the received paint using shimadzu double-beam spectrophotometer, considering both specular and diffuse radiation according to the ASTM E1980-11 standard. The reflectance was determined from 300 to 2500 nm, which is the solar spectrum range with the highest concentration of solar energy.

- **The heat insulation performance of the coating is assessed by guarded hot box method (discussed hereinafter).**

The paint to be tested is applied on a metal plate by the client with dry film thickness of about 600 μm. The thermal insulation has been assessed using the Guarded Hot Box method. The test setup consists of a guard hot box (source chamber) and a cold box (receiving). The dimensions of the both chambers are 40 × 40 × 40 cm as shown in fig.1. The specimen to be tested is located in an aperture between the cold box and the guarded hot box. A 100 W infrared lamp is used to heat the source chamber to reach the set point. T-type thermocouples are used to monitor the temperature variation of the hot and cold chambers.

- **The solar reflection performance is confirmed by solar simulator.**

The two guarded boxes one containing uncoated steel plate and the other containing the coated plate were subjected to solar spectrum by using solar simulator as shown in fig.2. The enclosure temperatures for both boxes were recorded through an hour.

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المركز القومى لبحوث الإسكان والبناء
معهد بحوث فيزيقيا المنشآت والعوامل البيئية المحيطة

Client Name: GAINA PRO JAPAN/ MIDDLE EAST
Testing Name: SRI **Testing Date: 1/12/2020**
Supplier Code: BPI/H/CO.213 **Delivery Date: 11/11/2020**
Sample Description: Gaina Thermal insulation Coating

Solar Reflectance Index (SRI)

Test Result:

Sample No	Optical properties	result
Gaina Thermal insulation Coating	Reflectance	90 %

h_c	5	12	30
SRI	94	90	88

h_c is the outdoor heat transfer coefficient W/(m²•K)

Remarks:

- In this test the solar properties of the sample delivered to the laboratory is determined using Scanning Thermometer – Photo Cell – Air Velocity – Spectrophotometer - Reflect meter – Hygrometer.
- The test was conducted in accordance with the standard specification ASTM E1980 – 11.
- This results are only valid for the samples delivered to the thermal laboratory.
- This results are only valid for one year.

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Ass.Rec. M. Mahmoud

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02/12/2020
Fahmy

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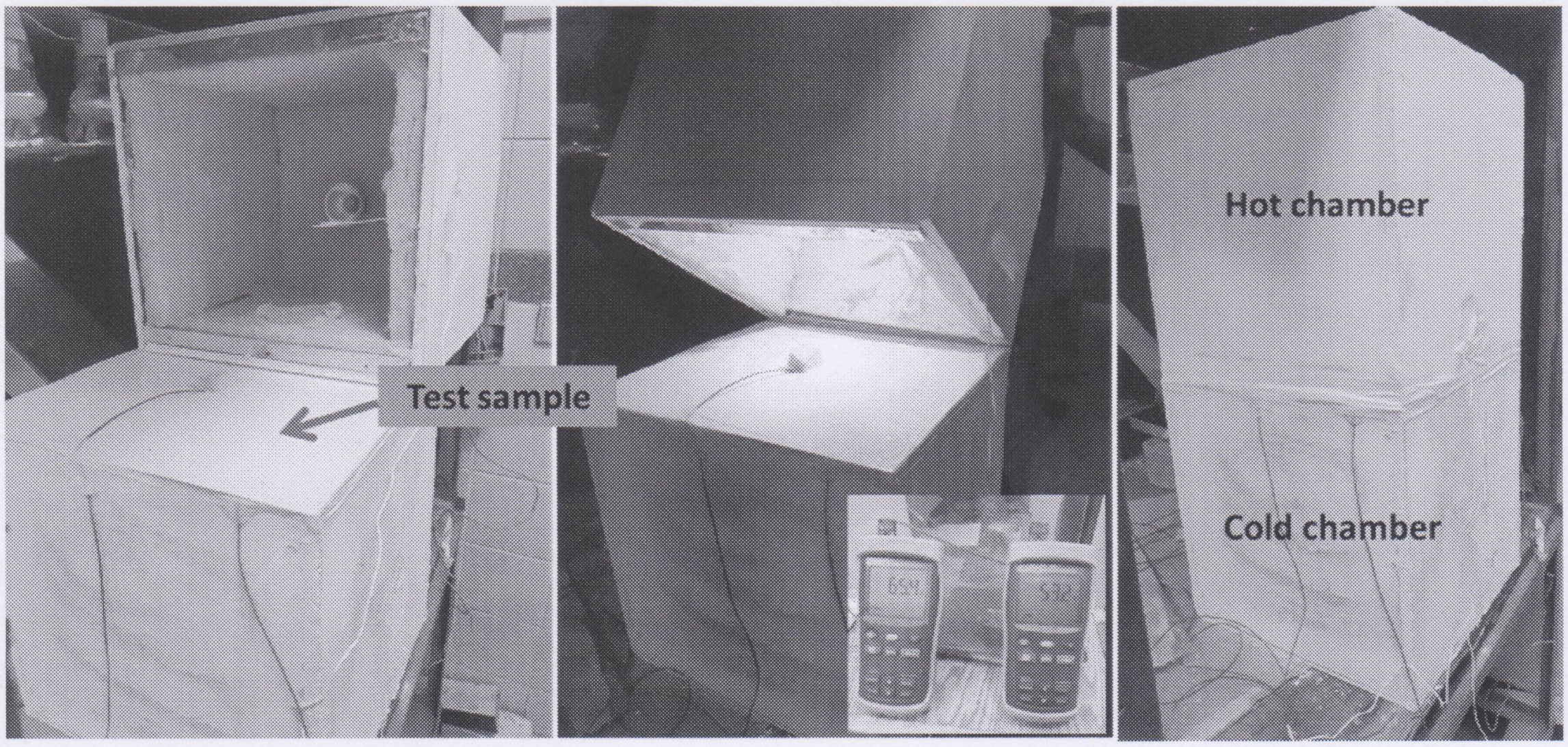

Fig.1. Guarded Hot Box Test Setup

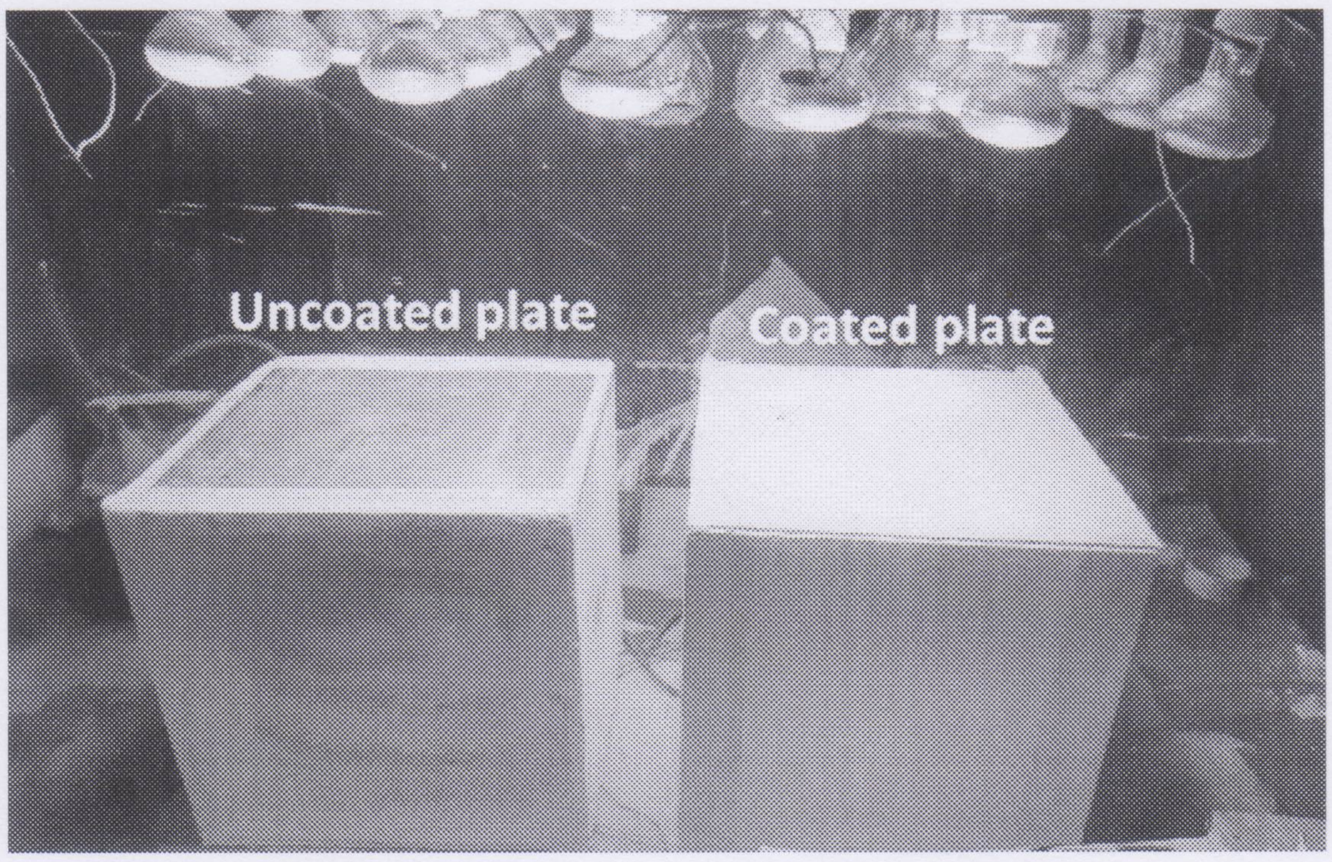

Fig.2. Evaluating solar reflection of paint by solar simulator

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3. Test results

3.1. Thermal insulation performance

Figures 3 and 4 show the variations in air temperatures with time for the source and receiving chambers in case of uncoated and coated plates respectively.

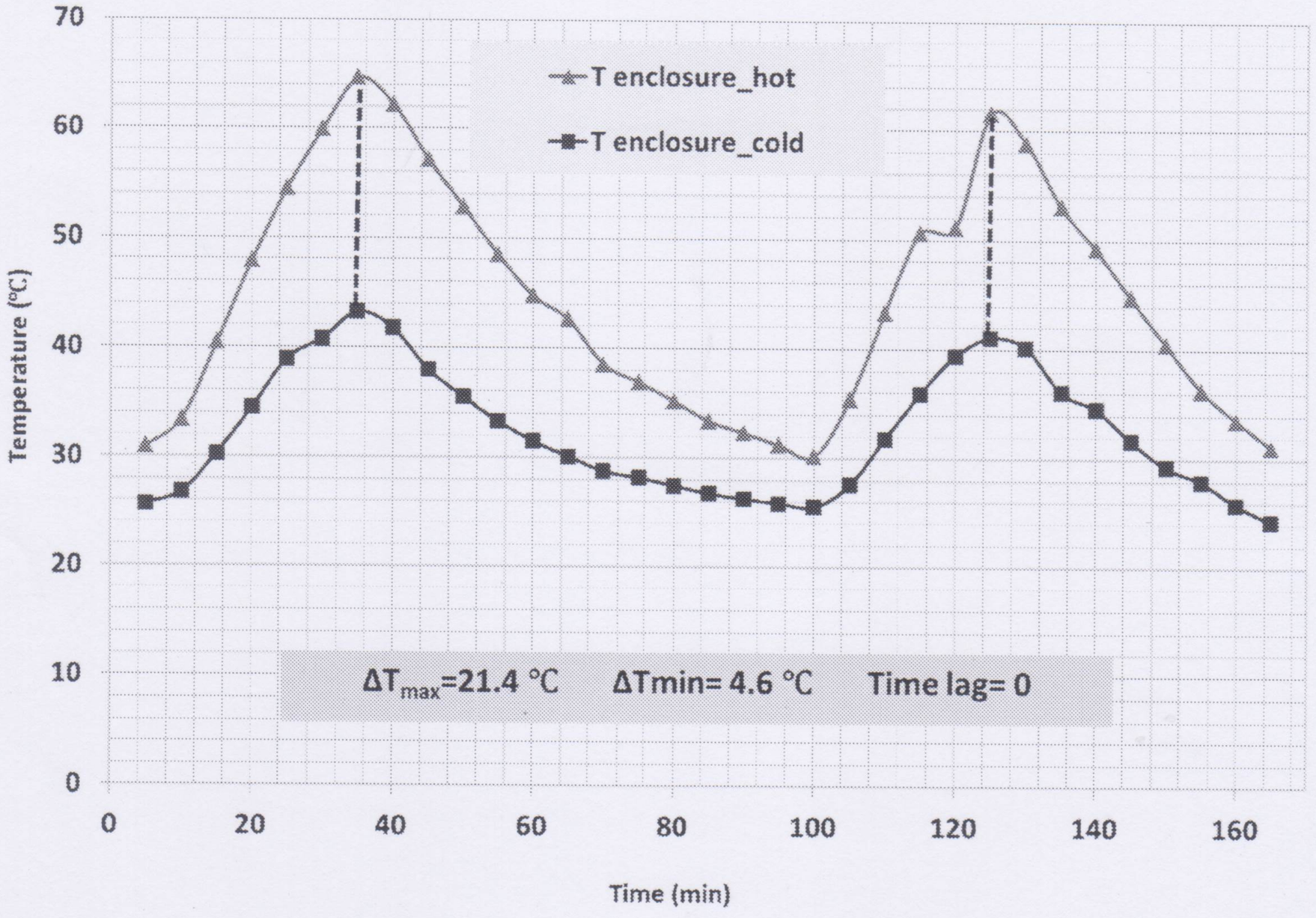

Fig.3. Time –temperature graph for uncoated plate

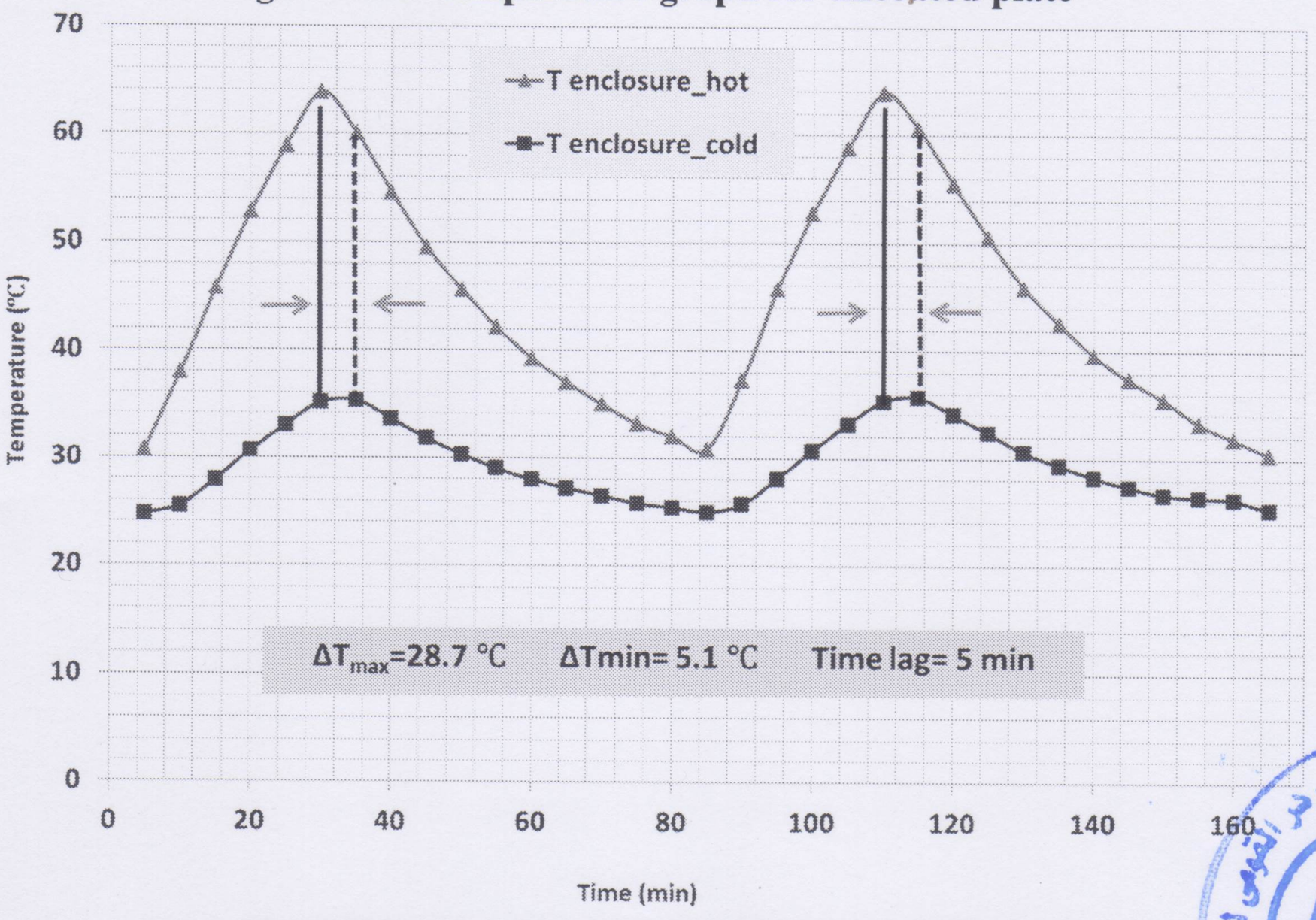

Fig.4. Time –temperature graph for coated plate

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Table (1): summarizes the maximum and minimum temperature difference between hot and cold enclosures for uncoated and coated samples.

Table (1): Temperature difference between hot and cold enclosures for uncoated and coated samples

Sample	Temperature difference, ΔT [°C]		Time lag, min
	Maximum	Minimum	
Reference (Uncoated)	21.4	4.6	0
Coated	28.7	5.1	5

The maximum temperature difference achieved by the coated plate is 7.3 ℃ less than that of the uncoated reference plate. This is attributed to the considerable thermal resistance afforded by GAINA coating.

3.2. Solar reflection performance

Fig.5. presents the variations in air temperatures for enclosures of two guarded boxes one with uncoated steel plate and the other with coated plate. The two boxes are subjected to direct solar rays for 1h.

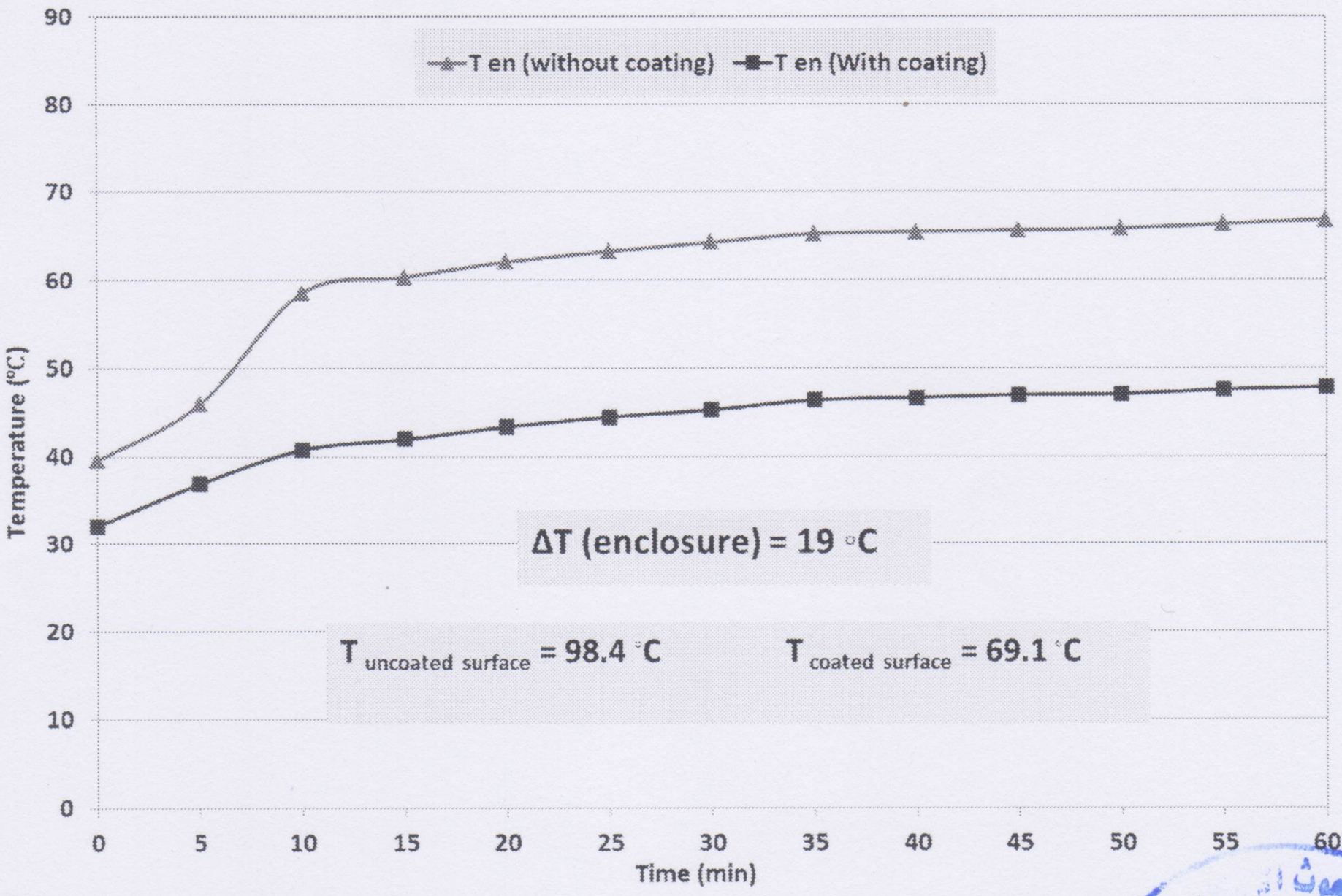

Fig.4. Time –temperature graph for uncoated and coated samples exposed to solar rays

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The air temperature inside the chamber containing coated plate is 19 ˚C less than that of reference (uncoated).

The surface temperature of the coated plate is 29.3 ˚C less than that of reference uncoated plate; this is due to the superior reflectivity of the coating.

5. Conclusions

- **The results make evident that the tested GAINA white coat considerably contribute to thermal insulation.**
- **The recorded time lag (5 minutes) points out the intrinsic thermal resistance of the tested coat.**
- **Reflection coefficient of GAINA WHITECOAT is very high, and most of the solar radiation is reflected back into the atmosphere. Relatively speaking, the heat into the painting room is less than the non-painting room.**
- **The great potential use of these paints in order to reduce surface temperatures for surfaces exposed to the sun is due to the superior solar reflectance and the considerable thermal resistance of this paint, as it can be observed from the data presented in attached reflectivity report.**

Test and Report by:

Dr. Hamada Shoukry

Supervised by:

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