Comparison of Nano-Coat Plaster Insulation Boards

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Abstract— In the construction industry and architecture could rise new opportunities with research in nanotechnology and nanomaterials. For example, through the development of durable, long-lived and extremely lightweight construction materials and plasters. New insulation materials with better insulation values are already available on the market, enable a thermal rehabilitation of buildings in which traditional insulation is not possible, and can help to improve energy consumption and efficiency. A lot of methods for the surfaces treatment is also available, including glass, masonry, wood or metal. The main goal is to improve functionalities as well as extend the lifetime of the building constructions. This article discusses about nano-coat home plaster boards and comparison between them.

Keywords— nano-coat plaster, interior thermal insulation, heat flow, thermal conductivity

I. INTRODUCTION

One of the greatest challenges in the construction sector is the thermal renovation of existing residential and industrial buildings. Here, applying novel insulation materials based on nanotechnology could make an important contribution [1].

Innovations attributable to nanotechnology also enable thermally insulating buildings in which a conventional, approximately 20cm-thick exterior insulation is not possible (for example in older buildings with structured facade) and thereby achieve very good insulation values [2].

II. DESCRIPTION OF MEASUREMENT TEST

Testing measurements were about determination of thermal transmittance and thermal resistance by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance. Duration of testing was 15 minutes and repeated 3 times. Samples were prepared at PK10A Laboratory of Excellent Research, Civil Engineering Faculty, Technical university of Košice in reusable formwork. Prepared nano-coat plaster boards were oven dried to constant mass at 70 C ±1°C and open-air conditioned in laboratory environment for 30+ days. The specimen is 300 x 300 mm and approximately 10 mm thick.

TABLE I. INSTRUMENTS AND SENSORS USED

Evidence No.	Name	Range	Unit	Decimal
C-4660/13	Lm.305 Heat Flow Meter (single specimen apparatus)	-5+50	° C	0,01
		n/a	(W/m.K)	0,00001
1337/07	Verneer scale	0 - 300	mm	0,01
V073-06	Laboratory scale	0 - 60	kg	0,1
N414/01	Feeder gauges	0.05 - 1	mm	0,05
249/03	Straight edge	-	-	-

Fig. 1. *Single specimen heat flow meter*

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A. *Plaster insulation board – pure*

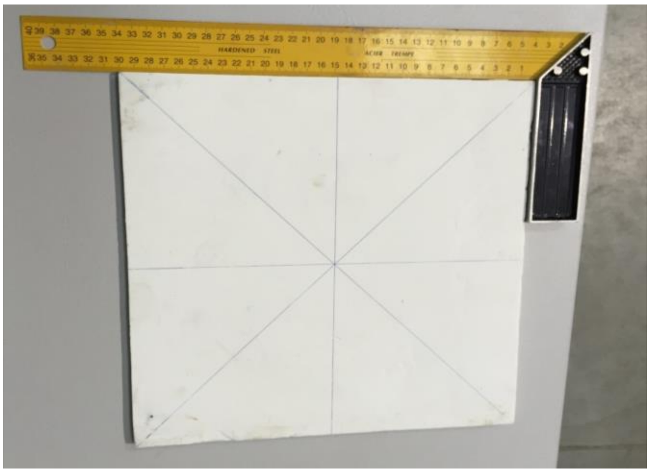

Fig. 2. *View of 9mm thick Nano-Coat Home Pure specimen Table Styles*

TABLE II. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.009	135	-	167.22	23.88	-0.82	24.70	122.01	0.045	0.20
2	0.009	-	-	-	23.88	-0.83	24.71	121.90	0.044	
3	0.009	-	137	169.70	23.89	-0.77	24.66	121.43	0.044	

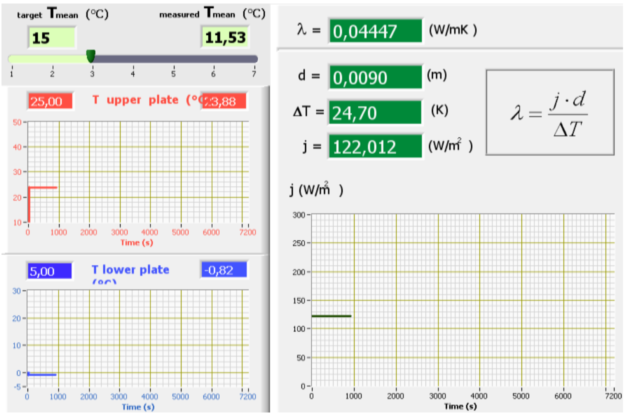

Fig. 3. *Graphical representation of T1 (T2 T3 similar)*

1) *Closing statement:*

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance conform to declared values.

B. *Plaster insulation board – honeycomb 10 mm*

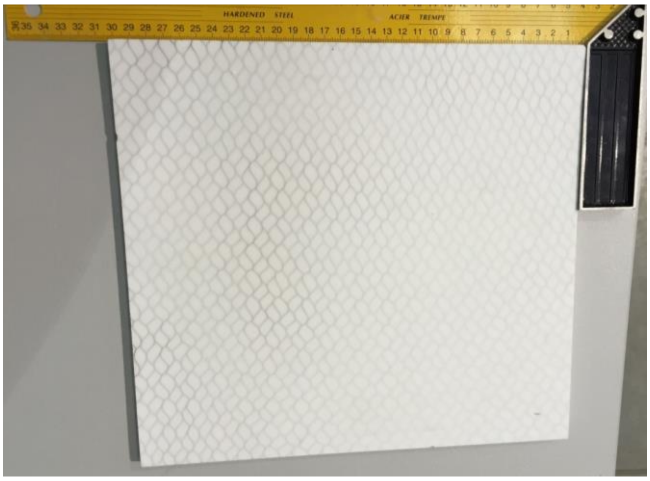

Fig. 4. *View of Nano-Coat Honeycomb 10 mm specimen*

TABLE III. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.0098	197	-	223.40	23.74	-1.05	24.78	136.35	0.054	0.18
2	0.0098	-	-	223.40	23.88	-1.27	25.15	137.40	0.054	
3	0.0098	-	197	223.40	23.88	-1.23	25.10	137.04	0.054	

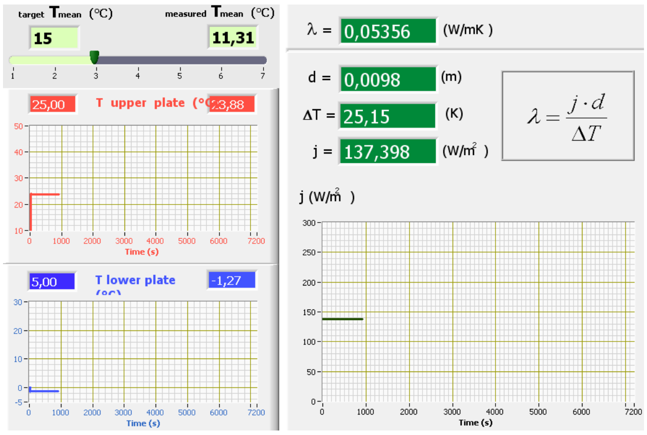

Fig. 5. *Graphical representation of T1 (T2 T3 very similar)*

2) *Closing statement:*

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.054 W/m.K thermal transmissivity value.

C. Plaster insulation board – honeycomb foil 10 mm

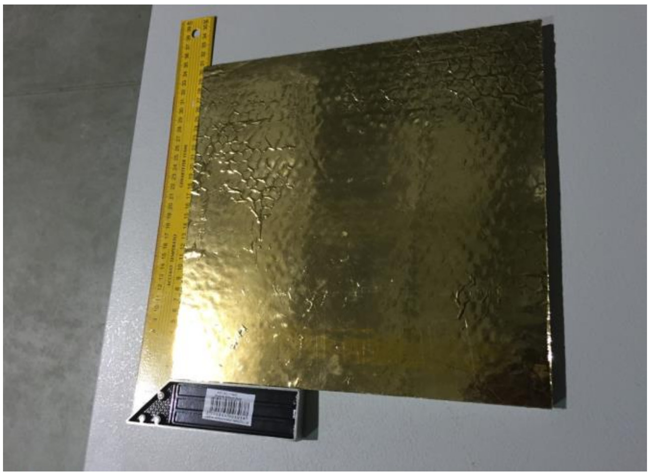

Fig. 6. *View of Nano-Coat Honeycomb foil 10 mm specimen*

TABLE IV. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.0113	178	-	176.20	23.94	-1.14	25.08	122.60	0.056	0.21
2	0.0113	-	-	176.20	23.96	-1.00	24.96	121.42	0.055	
3	0.0113	-	178	176.20	23.94	-0.99	24.93	121.27	0.055	

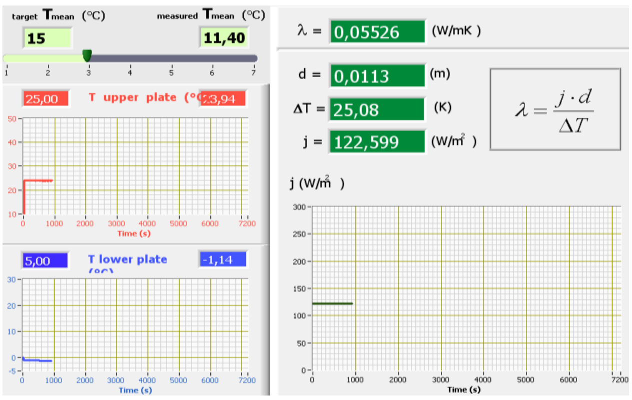

Fig. 7. *Graphical representation of T1 (T2 T3 very similar)*

1) *Closing statement:*

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.055 W/m.K thermal transmissivity value.

D. Plaster insulation board – honeycomb foil 18 mm

Fig. 8. View of Nano-Coat Honeycomb 18 mm specimen

TABLE V. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.0178	283	-	177.00	24.15	-1.12	25.08	75.386	0.053	0.34
2	0.0178	-	-	177.00	24.15	-1.66	24.96	76.035	0.052	
3	0.0178	-	283	177.00	24.11	-0.82	24.93	75.900	0.052	

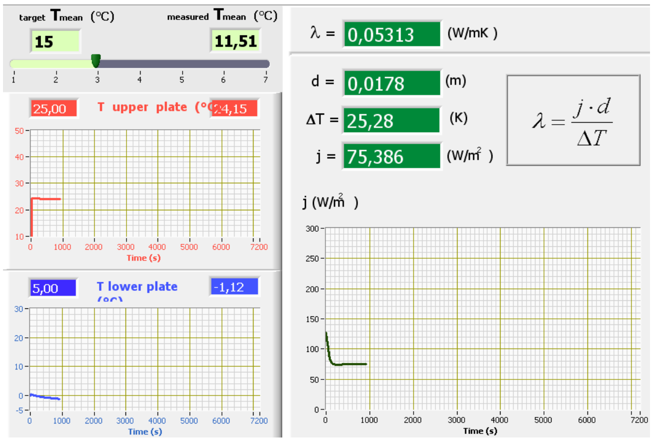

Fig. 9. Graphical representation of T1 (T2 T3 very similar)

1) *Closing statement:*

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.053 W/m.K thermal transmissivity value.

E. Plaster insulation board – Nidaplast 50/50

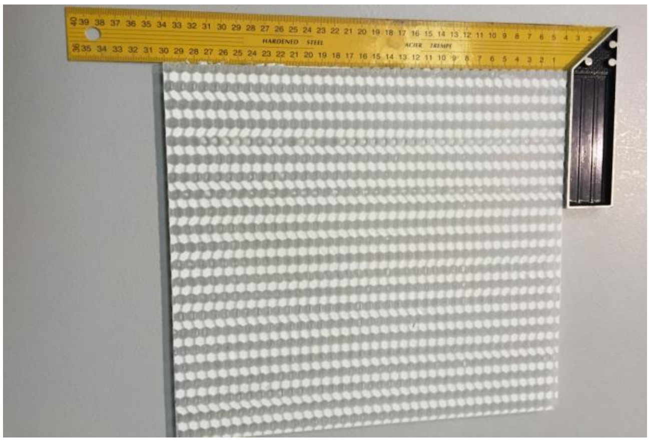

Fig. 10. View of Nano-Coat Nidaplast 50/50 specimen

TABLE VI. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.0099	160	-	180.20	23.80	-0.81	22.99	162.39	0.070	0.14
2	0.0099	-	-	-	23.75	-0.04	23.79	166.75	0.069	
3	0.0099	-	162	182.43	23.79	-0.21	24.00	168.02	0.069	

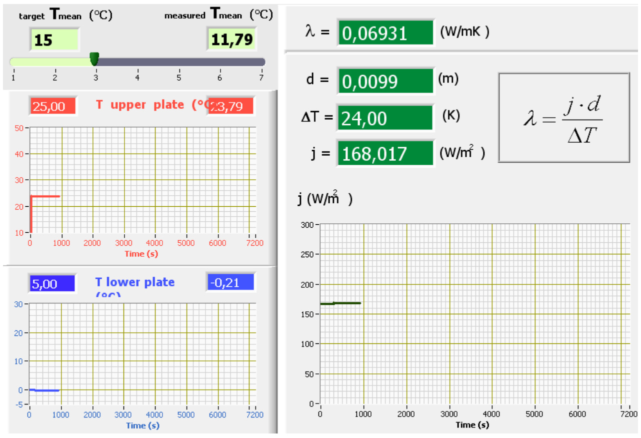

Fig. 11. Graphical representation of T1 (T2 T3 very similar)

1) Closing statement:

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.070 W/m.K thermal transmissivity value.

F. Plaster insulation board – Nidaplast half plastered

Fig. 12. View of Nano-Coat Nidaplast half plastered specimen

TABLE VII. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.0109	118	-	119.7	23.88	-0.08	23.96	145.88	0.067	0.16
2	0.0109	-	-	-	23.88	-0.46	24.34	147.62	0.067	
3	0.0109	-	120	121.71	23.85	-0.54	24.39	147.91	0.067	

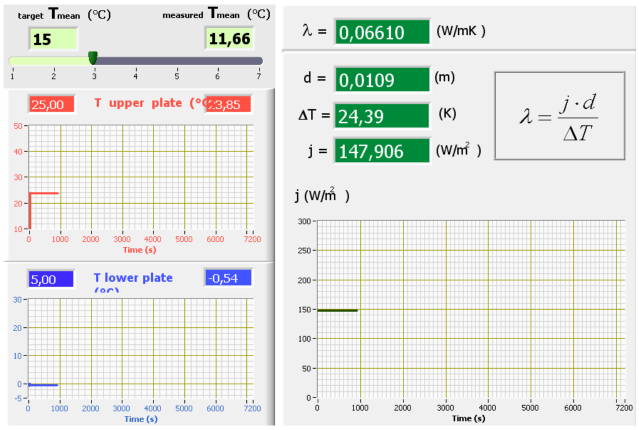

Fig. 13. Graphical representation of T3 (T1 T2 very similar)

6) Closing statement:

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.067 W/m.K thermal transmissivity value.

G. *Plaster insulation board – Nidaplast plastered*

Fig. 14. View of Nano-Coat Nidaplast plastered specimen

TABLE VIII. THERMAL CONDUCTIVITY, THERMAL RESISTANCE AND HEAT FLOW FOR 300 X 300 MM SPECIMEN

TEST	PHYSICAL PROPERTIES				THERMAL PROPERTIES					
	d	Mass start	Mass end	ρ	Top Plate	Bottom Plate	ΔT	J	λ	R
	m	g	g	kg/m³	° C	° C	° C	W/m²	W/m.K	m².K/W
1	0.012	141	-	129.90	23.69	-0.58	24.27	129.76	0.064	0.19
2	0.012	-	-	129.90	23.79	-0.97	24.76	131.30	0.064	
3	0.012	-	141	129.90	23.81	-0.96	24.77	131.30	0.064	

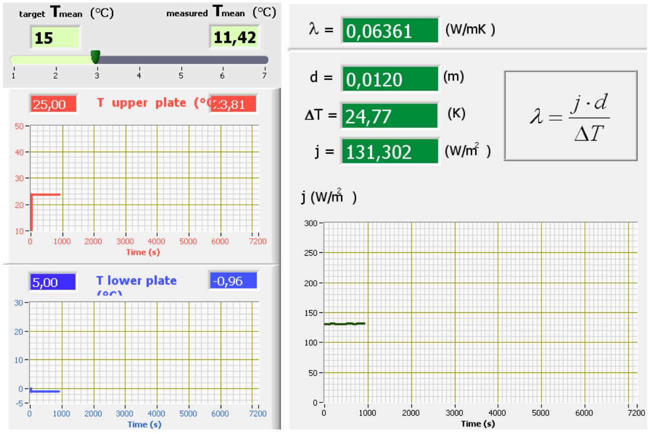

Fig. 15. Graphical representation of T3 (T1 T2 very similar)

7) *Closing statement:*

Test specimens for the assessment of thermal conductivity by means of heat flow method in accordance with STN EN 12667 – Products of high and medium thermal resistance can declare a 0.067 W/m.K thermal transmissivity value.

H. *Conclusion*

In a comparison of different tested samples of nano-coat plaster boards only one sample fulfilled its declared thermal conductivity. This is the first sample, which is clear without various stiffening elements. All samples meet the assessed values for thermo plaster, since the thermal conductivity values are ranging from 0,044 to 0,069 W/m.K. Commercially available thermo plasters on the market have thermal conductivity values at the level of 0,09 to 0,13 W/m.K.

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[1] Internet: http://www.nanowerk.com/spotlight/spotid=26700.php

[2] W. Luther, “Einsatz von Nanotechnologien in Architektur und Bauwesen“, commissioned by: Hessisches Ministerium für Wirtschaft Verkehr und Landesentwicklung, Nr. Band 7 der Schriftreihe der Aktionlinie Hessen Nanotech: HA Hessen Agentur, 2008