

A CRISIL-NSIC RATED COMPANY ISO-9001-2008 COMPANY Member Of

A.M.P.E.R.E (EUROPE)



In Association With

ELECTRO MAGNETIC innevative technologies

Kerone Research & Development Centre (KRDC), B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46 Email-info@kerone.com www.kerone.com



Conveyorized Microwave + Infra-red Drying of Ceramic Boards

> ISO 9001-2008 | ISO 9001-2015 | EMS 14001 | OHSAS 18001 In Association with SVCH-Technologii, Moscow (Russia)

IN ASSOCIATION WITH EMitech, ITALY



ΙSO-9001-2008 COMPANY



Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Customer:	M/s. Murugappa Morgan Thermal Ceramic Limited
Process:	Conveyorized Microwave + Infra-red Drying of Ceramic Boards

TEST REPORT No: 47/KRDC/LAB/17 Mum 26/06/2021

Date Sample reception	: 26/06/2021		
ID	<mark>: 47/LAB/96</mark>		

SAMPLE DESCRIPTION:

: As Requested
: Corners of wet board were bent but sample is acceptable
: 2 boxes (14 Bricks)
: 26/06/2021
: Ceramic Boards
: Must be totally dried
: 06/07/2021
: 06/07/2021

LABORATORY EXPERIMENTAL SET UP:



IN ASSOCIATION WITH EMitech, ITALY





ΙςΩ_9ΩΩ1_2ΩΩΛ COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

LAB CONTINUOUS INFRARED HEATING SYSTEM SPECIFICATIONS:

IR Medium Wave Emitters	6 Nos (-each having 0.5 kW, 445 mm heating			
	length)			
Short Wave IR Emitter with	6 Nos (-each having 1 kW, 406 mm heating			
special reflectors	length)			
IR Emitter to Object Distance	120 mm (- in medium wave zone)			
IR Emitter to Object Distance	100 mm (- in short wave zone)			
Overall IR Heating Zone	1400 mm			
length				
Web width	400 mm			
IR wavelength range	0.7 to 10 microns			
Direct Exposure of MW IR	500 mm			
Direct Exposure of SW IR	750mm			
Temperature Range	0-400°C			

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	27.5°C (±5°C)
Humidity (%)	≤65% RH
Pressure (kN/m2 or kPa)	Not recorded

Note for recommendation: Environmental conditions have a direct impact on test results. Accuracy and consistency of test data are affected by the laboratory conditions

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





ΙSIL HOIC INTED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

EQUIPMENTS USED:

SAMPLE PREPARATION AND METHOD/PROCEDURE:

Name of Equipment	Picture of Equipment	Specifications	
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160x 120IR Thermalsensitivityof 0.10°C	
Moisture Analyzer		Make: Axis Balance Description: Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g)	
Thermo Hygrometer		Model No: HTC-2 Temperature accuracy: ± (1.8°F) Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: ±5% RH Humidity resolution: 1% RH	

The experiment has been performed on ceramic boards to speed up the heating rate. For experimental run, given sample ceramic boards have been placed on conveyor first, under infrared heating system to pre-heat the boards and later passed under MW heating chamber for different setting parameters and observations are made accordingly.

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

ANALYTICAL RESULTS:

IR Temperature- Set at 120°C

Microwave Power- Set at 80%

SAMPLE A UNDER TREATMENT:

Length*Width*Thickness- 2900*1850*280

Initial weight – 880 g

Initial temperature - 27.6°C

Initial moisture- 39.5%

Sr.	No. of	Cycle	Process	Product	Weight of	Moisture	Remarks, if any
No.	cycles	Time	Temp.	Temp.	Board	Content	
		(seconds)	(°C)	(°C)	(grams)	(%)	
1.	1st	20	126	53	837	-	Drying process started
2.	2nd	40	126	54	763	25.7%	Drying continues
3.	3rd	80	126	54	710	-	Drying continues
4.	4 th	100	126	57	641	9%	Drying continues
5.	5th	120	126	62	593	-	Drying continues
6.	6th	140	126	62.6	556	2.3%	Drying continues
7.	7th	160	126	73.5	549	-	Drying continues
8.	8th	180	126	83.5	547	1.7%	Almost dried
9.	9th	200	126	93	546	-	Almost dried
10.	10th	220	126	96.8	543	0.7%	Drying complete

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Final weight – 543 g

Final moisture- 0.7%

SAMPLE B UNDER TREATMENT:

Length*Width*Thickness- 2900*1950*300

Initial weight – 931 g

Initial temperature - 27.6°C

Initial moisture- 42.1%

Sr.	No. of	Cycle	Process	Product	Weight of	Moisture	Remarks, if any
No.	cycles	Time	Temp.	Temp.	Board	Content	
		(seconds)	(°C)	(°C)	(grams)	(%)	
1.	1st	20	126	53.6	884	-	Drying process started
2.	2nd	40	126	54	806	25.4%	Drying continues
3.	3rd	80	126	54	719	-	Drying continues
4.	4 th	100	126	57	644	8.50%	Drying continues
5.	5th	120	126	57.3	581	-	Drying continues
6.	6th	140	126	62.4	545	1.9%	Drying continues
7.	7th	160	126	72.5	532	-	Drying continues
8.	8th	180	126	83.6	531	1.6%	Almost dried
9.	9th	200	126	95	528	-	Almost dried
10.	10th	220	126	96.8	526	1.1%	Drying complete

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





A CRISIL-NSIC RATED COMPANY ΙςΟ-9ΛΛΙ-2ΛΛΧ ΓΟΜΡΔΝΥ

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Final weight - 526 g

Final moisture- 1.1%

THERMAL IMAGE SHOWING TEMPERATURE PROFILE:

SAMPLE-A

06-07-2021

150.2°C

Measurements		
Sp1	96.8 °C	-0- -0-
Sp2	107.6 °C	
Sp3	101.4 °C	
Parameters		
Emissivity	0.95	A STATE OF A
Refl. temp.	20 °C	
1227 Decision Alexa. 		



Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

SAMPLE-B

06-07-2021



61.1

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

Sample A:





BEFORE HEAT TREATMENT

AFTER HEAT TREATMENT

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Sample B:





BEFORE HEAT TREATMENT

AFTER HEAT TREATMENT

Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





Α CRISIL-NSIC RATED COMPANY

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

MOISTURE ANALYSIS REPORTS:





Format: F/R&D/01

IN ASSOCIATION WITH EMitech, ITALY





ΙϚΛ-9ΛΛ1_2ΛΛΧ (ΟΜΡΔΝΥ

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

OBSERVATIONS:

The heating behavior of Ceramic Boards has been investigated under the Conveyorized Microwave + Infrared heating system. As per physical investigation, it has been observed that it becomes hard and moisture of board reduces to lowest with increase in cycle time. Also, there is slight shrinkage of Ceramic Board.

Ms. *Komal Ingle* Tested By

Format: F/R&D/01