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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

Batch Microwave + Convection Heat Treatment For Curing of Composite Material

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

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IN ASSOCIATION WITH EMitech, ITALY

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Customer :	**M/s. ACME, Hadapsar, Pune**
Process :	**Batch Microwave + Convection Heat Treatment for Curing of Composite Material**

TEST REPORT No: 47/KRDC/LAB/61 Mum 02/11/2021

Date Sample reception : 27/08/2021
ID : 47/LAB/61

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 1 Kg
Samples opening date : 28/10/2021
Product : Composite Material
Requirement : Final moisture must be 0.4%
Start Date test : 01/11/2021
End Date test : 03/11/2021

LABORATORY EXPERIMENTAL SET UP:

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LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

Microwave Power	2 KW (CW)
Frequency	2450 MHz ± 50
Convective Power	3.5 KW (airflow 350 l/min at 20°C)
Microwave Exposure Zone (Cavity)	1 Cubic meter
Mode Stirrer	One
Thermal Monitoring System	Single Channel Fiber Optic: Range -40 to 250°C
Exhaust Power	1 HP
Tray size (width*height*depth)	450*950*50 mm

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (^oC)	26^oC (±5^oC)
Humidity (%)	≤70% 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.

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EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160 x 120 IR Thermal sensitivity of 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: ±°C (1.8°F) Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: ±5% RH Humidity resolution: 1% RH

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Composite material to speed up the curing rate. For this experimental run, given sample has been filled in a plastic mould and later over turned on a crucible to form a cake. It is then placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of Product temperature, Texture, change in Weight & moisture of the product.

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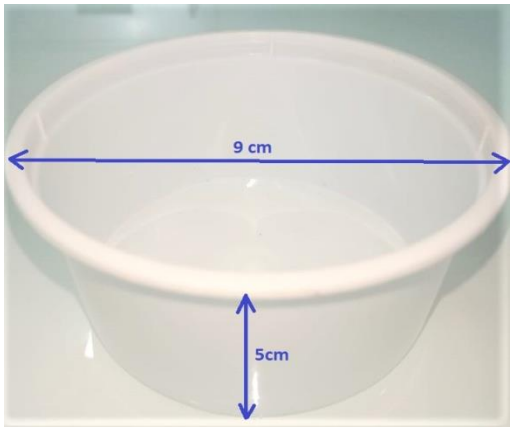
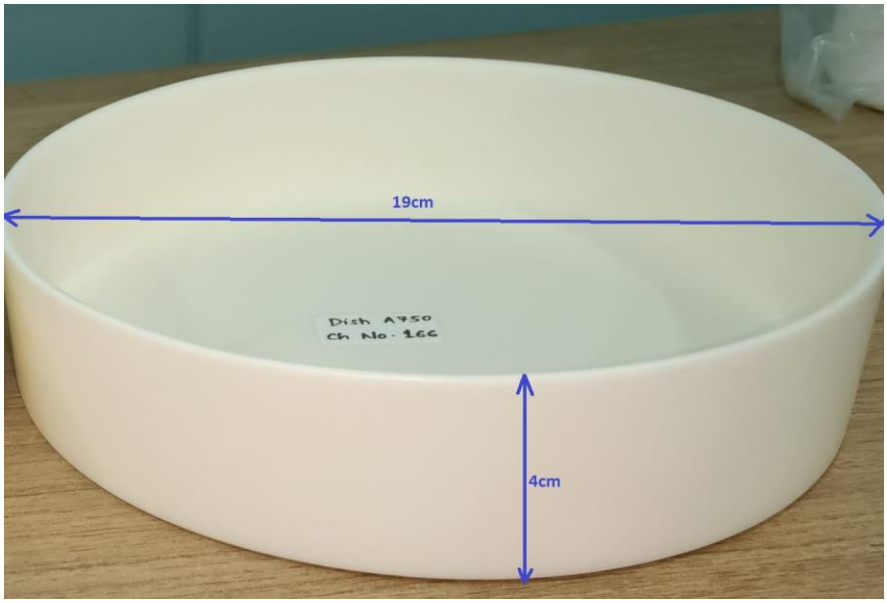
PLASTIC MOULD-



CRUCIBLE-



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ANALYTICAL RESULTS:

TRIAL-1:

Initial Wt. of Product: 345g
Initial moisture of Product: 9.6 %
Magnetron Power: 1.8 KW
Convection Heater- 180°C
Fan speed: 70%

Cycles	Cycle Time (min)	Product Temperature	Product Weight (g)	Product Weight Loss (%)
C1	4 min	(170-180) °C	307g	11.01%

Total cycle time: 4 min
Final Wt. of Product: 307 g
Final moisture of Product: 0.4%

TRIAL-2:

Initial Wt. of Product: 332g
Initial moisture of Product: 9.6 %
Magnetron Power: 1.8 KW
Convection Heater- 190°C
Fan speed: 70%

Cycles	Cycle Time (min)	Product Temperature	Product Weight (g)	Product Weight Loss (%)
C1	7 min	(180-195) °C	294g	11.44%

Total cycle time: 7 min
Final Wt. of Product: 294 g
Final moisture of Product: 0.3%

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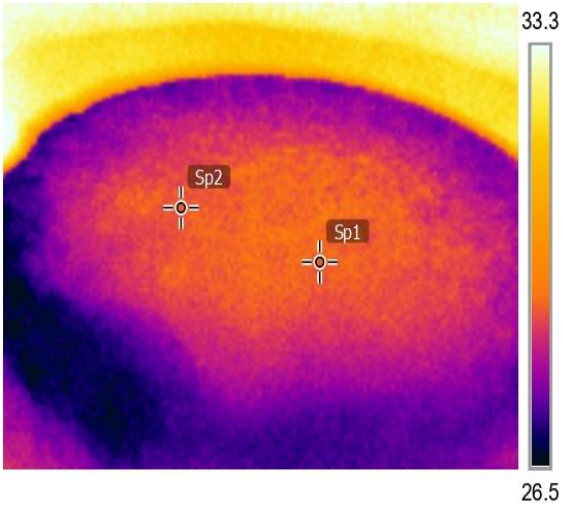
BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

THERMAL ANALYSIS REPORTS :

BEFORE TREATMENT-

Measurements	
Sp1	29.0 °C
Sp2	29.2 °C

Parameters	
Emissivity	0.95
Refl. temp.	20 °C



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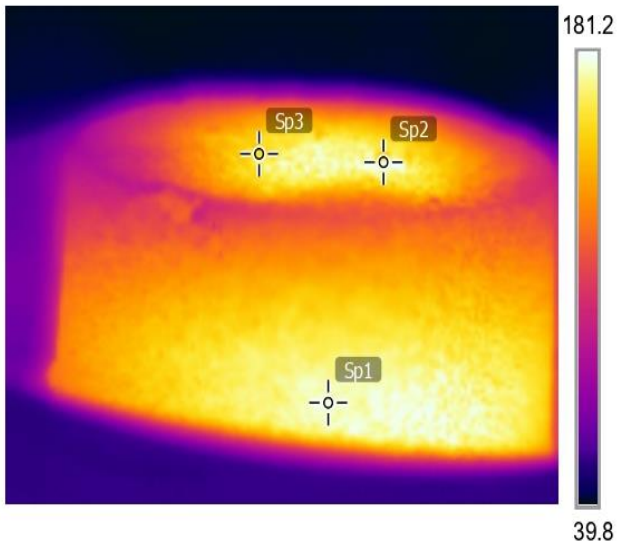
During Trial -1:

Measurements	
Sp1	178.8 °C
Sp2	179.6 °C
Sp3	164.2 °C

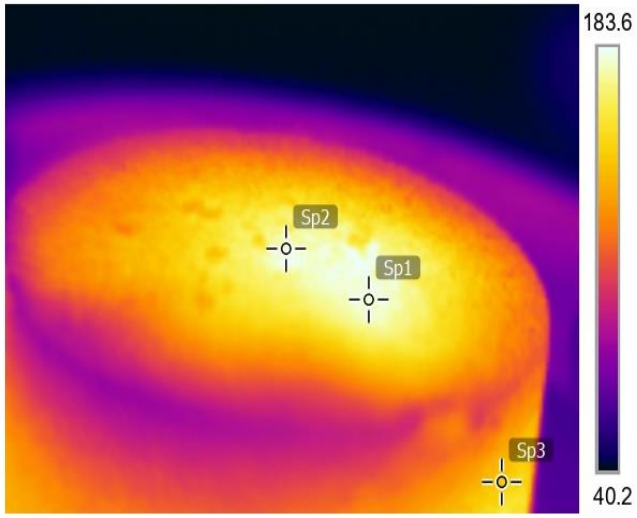
Parameters	
Emissivity	0.95
Refl. temp.	20 °C



During Trial -2:

Measurements	
Sp1	180.0 °C
Sp2	182.0 °C
Sp3	152.7 °C

Parameters	
Emissivity	0.95
Refl. temp.	20 °C



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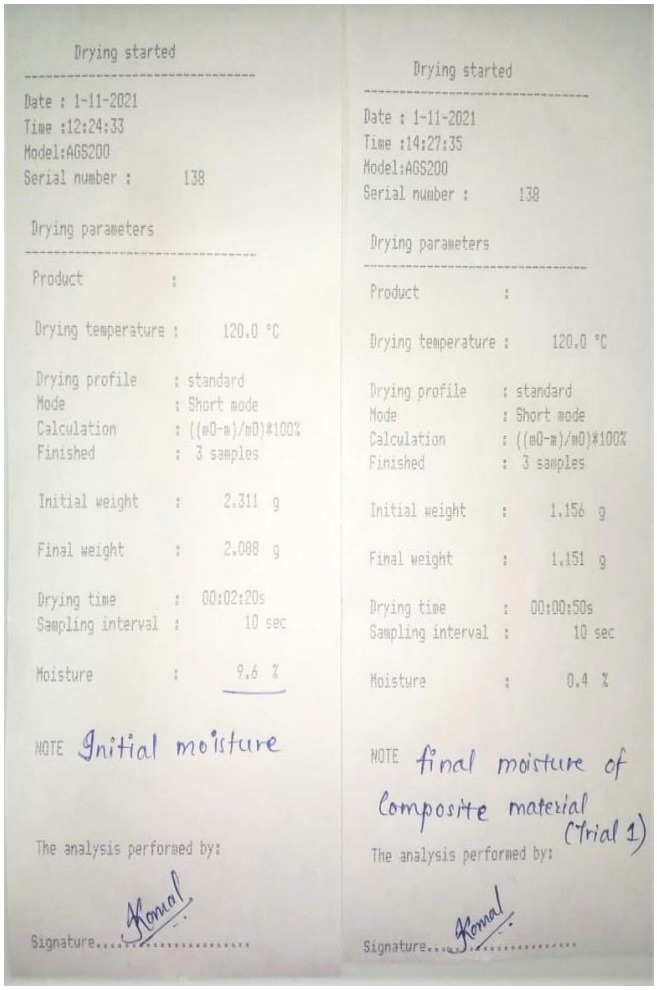
MOISTURE ANALYSIS REPORTS:



Drying started
Date : 1-11-2021
Time :12:24:33
Model:AGS200
Serial number : 138

Drying parameters
Product :
Drying temperature : 120.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 2.311 g
Final weight : 2.088 g
Drying time : 00:02:20s
Sampling interval : 10 sec
Moisture : 9.6 %

NOTE Initial moisture

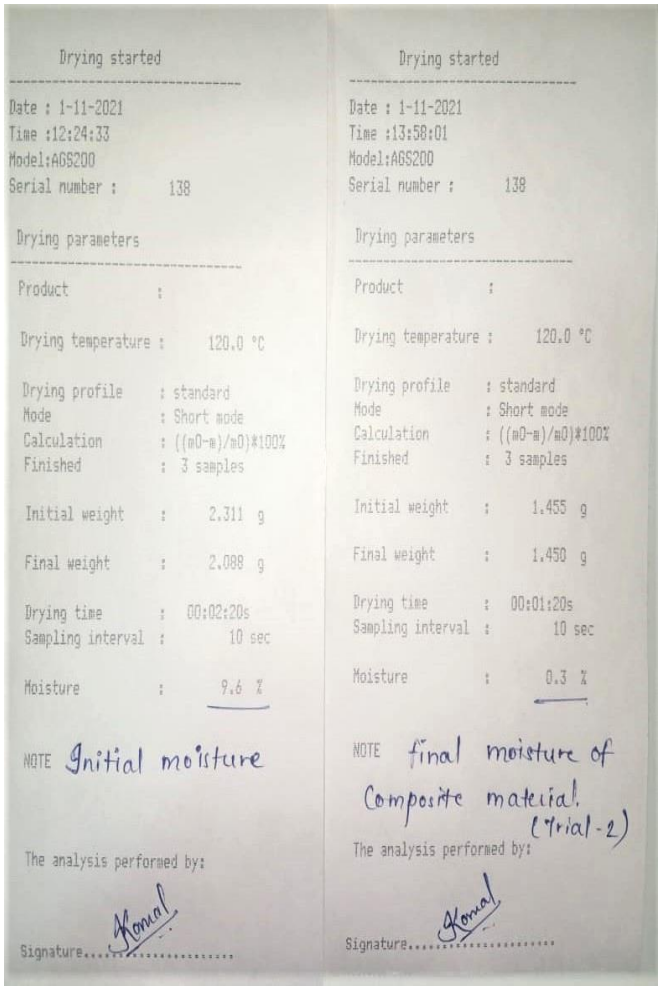
The analysis performed by:
Signature.....

Drying started
Date : 1-11-2021
Time :14:27:35
Model:AGS200
Serial number : 138

Drying parameters
Product :
Drying temperature : 120.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 1.156 g
Final weight : 1.151 g
Drying time : 00:00:50s
Sampling interval : 10 sec
Moisture : 0.4 %

NOTE final moisture of Composite material (Trial 1)

The analysis performed by:
Signature.....



Drying started
Date : 1-11-2021
Time :12:24:33
Model:AGS200
Serial number : 138

Drying parameters
Product :
Drying temperature : 120.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 2.311 g
Final weight : 2.088 g
Drying time : 00:02:20s
Sampling interval : 10 sec
Moisture : 9.6 %

NOTE Initial moisture

The analysis performed by:
Signature.....

Drying started
Date : 1-11-2021
Time :13:58:01
Model:AGS200
Serial number : 138

Drying parameters
Product :
Drying temperature : 120.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 1.455 g
Final weight : 1.450 g
Drying time : 00:01:20s
Sampling interval : 10 sec
Moisture : 0.3 %

NOTE final moisture of Composite material (Trial-2)

The analysis performed by:
Signature.....

TRIAL-1 **TRIAL-2**

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OBSERVATION:

The Composite material containing metallic aluminium, alcohol and moisture has been treated under the Microwave + Convection heating system with the aim of curing it. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation, it has been observed that the product becomes harder on drying.

Ms. Komal Ingle
(Tested By)