



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



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

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AIMCAL (USA)



Batch Microwave+Convection Heat Treatment

for Drying of Carbon Brick

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

Customer :	M/s. Carborundum Universal
Process :	Batch Microwave + Convection Heat Treatment for Drying of Carbon Brick

TEST REPORT No: 47/KRDC/LAB/17 Mum 23/06/2021

Date Sample reception	: 23/06/2021
ID	: 47/LAB/168

SAMPLE DESCRIPTION:

Sampling	: As Requested
Sample Condition	: Acceptable
Quantity	: 10 Nos.
Sampling date	: 23/06/2021
Product	: Carbon Bricks
Requirement	: Final Product must be dried fully
Start Date test	: 23/06/2021
End Date test	: 24/06/2021

LABORATORY EXPERIMENTAL SET UP:



LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

Microwave Power	2 KW (CW)
Frequency	2450 MHz ± 50
Convective Power	3.5 KW (airflow 350 I/min
	at 20°C)
Microwave Exposure Zone	1 Cubic meter
(Cavity)	
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 (°C)	30°C (±5°C)	
Humidity (%)	≤74% 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.

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 Carbon brick to speed up the drying rate. For this experimental run, given sample has been placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of weight of the product and temperature on the product.

PICTURES DURING TREATMENT OF SPECIMEN SAMPLE:





BEFORE

AFTER

ANALYTICAL RESULTS:

Trial No. 1:

No. of Carbon Bricks under test: 1 Nos. Initial Wt. of brick: 3.611 Kg

Initial Temperature of Brick: 29.3°C

Cycles	Specifications of Microwave	Cycle Time	Product	Product
		(Hrs.)	Temperature	Temperature
C1	Magnetron Power: 1.6 kW;	1	(80-85) °C	3.60 Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
C2	Magnetron Power: 1.6 kW;	1	(90-95) °C	3.592 Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
С3	Magnetron Power: 1.6 kW;	1	(95-100) °C	3.584 Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
C4	Magnetron Power: 1.6 kW;	1	(95-100) °C	3.580 Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
C5	Magnetron Power: 1.6 kW;	1	(95-100) °C	3.569 Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
C6	Magnetron Power: 1.6 kW;	1	(95-100) °C	3.569Kg
	Temperature Limit : 80°C;			
	Fan speed: 100; Heater- 100%			
C7	Magnetron Power: 1.6 kW;	1	(95-100) °C	3.569Kg
	Temperature Limit: 80°C;			
	Fan speed: 100; Heater- 100%			

No. of Carbon Bricks under test: 2 Nos. Initial Wt. of brick 1 (B1) : 3.623 Kg Initial Wt. of brick 2 (B2) : 3.609 Kg Initial Temperature of Brick: 29.3°C Initial Temperature of Brick: 29.1°C

Cycles	Specifications of Microwave	Cycle Time	Product	Product	Product
			Temperature	Weight of B1	Weight of B2
C1	Magnetron Power: 1.7 kW;	1 Hrs	(80-85) °C	3.601 Kg	3.590 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C2	Magnetron Power: 1.7 kW;	1 Hrs	(90-95) °C	3.572 Kg	3.561 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C3	Magnetron Power: 1.7 kW;	1 Hrs	>100°C	3.570 Kg	3.558 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C4	Magnetron Power: 1.7 kW;	1 Hrs	>100°C	3.565 Kg	3.555 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C5	Magnetron Power: 1.7 kW;	30 min	>100°C	3.563 Kg	3.550 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C6	Magnetron Power: 1.7 kW;	30 min	>100°C	3.561Kg	3.548 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C7	Magnetron Power: 1.7 kW;	30 min	>100°C	3.560Kg	3.547 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
С8	Magnetron Power: 1.7 kW;	30 min	>100°C	3.559Kg	3.546 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
С9	Magnetron Power: 1.7 kW;	30 min	>100°C	3.558Kg	3.545 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				
C10	Magnetron Power: 1.7 kW;	30 min	>100°C	3.558Kg	3.545 Kg
	Temperature Limit : 90°C;				
	Fan speed: 100; Heater- 100%				

THERMAL IMAGES AFTER TREATMENT FOR SINGLE BRICK:

150.3°C

Measurements	
Sp1	150.2 °C
Sp2	150.2 °C
Sp3	150.2 °C
Parameters	

Emissivity	0.95
Refl. temp.	20 °C



34.1°C

THERMAL IMAGES AFTER TREATMENT FOR DOUBLE BRICK:

Measurement

Sp1	150.2 °C
Sp2	150.2 °C
Sp3	150.2 °C

Parameters

Emissivity	0.95
Refl. temp.	20°C



OBSERVATION:

The heating behavior of Carbon brick has been investigated under the Microwave+Convection heating system. The heating rate is found to be increasing with respect to increase in time and remains constant after certain point. 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 there is no degradation or no color change on product even after 6 hours of heating.

Ms. Komal Ingle (Tested by)