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Kerone Research & Development Centre (KRDC)
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Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Batch Microwave Heat Treatment for Rubber Preheating

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

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Customer :	**M/s. Premier Seals (I) Pvt. Ltd., Pune**
Process :	**Batch Microwave Heat Treatment for Rubber Preheating**

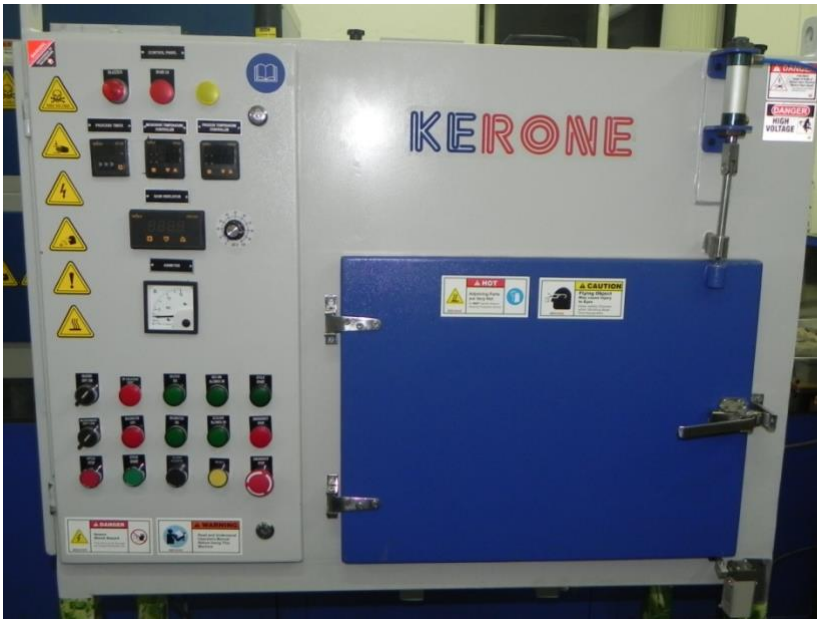
TEST REPORT No: 47/KRDC/LAB/17 Mum 01/10/2018

Date Sample reception : 01/10/2018
ID : 47/LAB/61

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 3 bags
Sampling date : 15/11/2018
Product : Natural Rubber
Requirement : Rubber Preheating (Temperature of core of product after treatment must be range between 60-70°C)
Start Date test : 15/11/2018
End Date test : 15/11/2018

EXPERIMENTAL SET UP:



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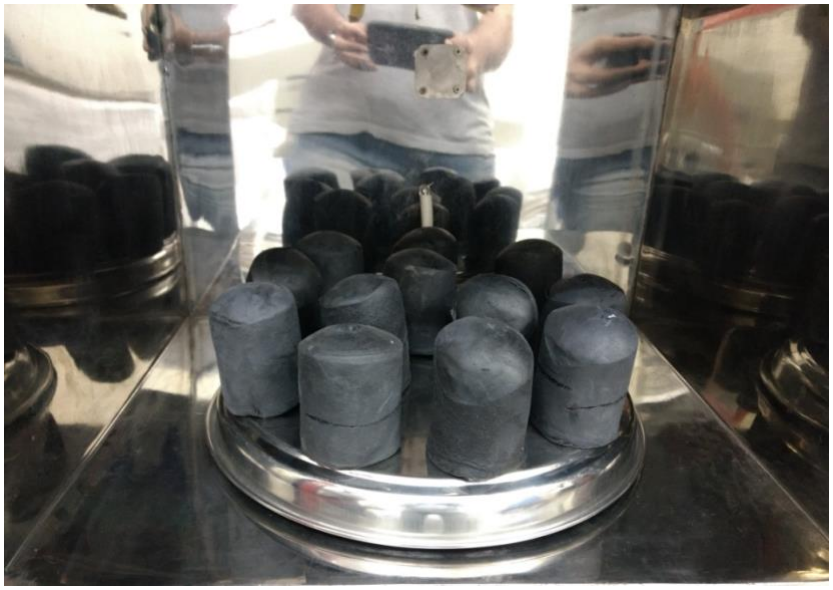

BATCH MICROWAVE HEATING SYSTEM SPECIFICATIONS:

Microwave Power	1.45 kW
Frequency	2450 MHz ± 50
Convective Power	1.5 kW
Microwave Exposure Zone (cavity)	500*350*350 mm^3
Exhaust Power	0.5 HP

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	27.8°C (±5°C)
Humidity (%)	≤63% 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
Digital Thermometer with sensor		**Model No: TM-902C** **Temperature range: -50~750°C** **Temperature accuracy: ±1°C**
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 given of rubber slabs having same shape and size in batch microwave heating system for rubber preheating. For this, rubber slabs has been placed on turntable in microwave system and heating treatment has been given for various parameters. The inner core temperature of samples has been noted.

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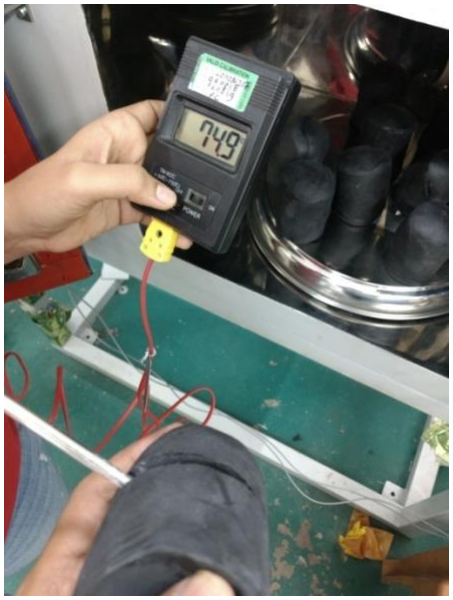
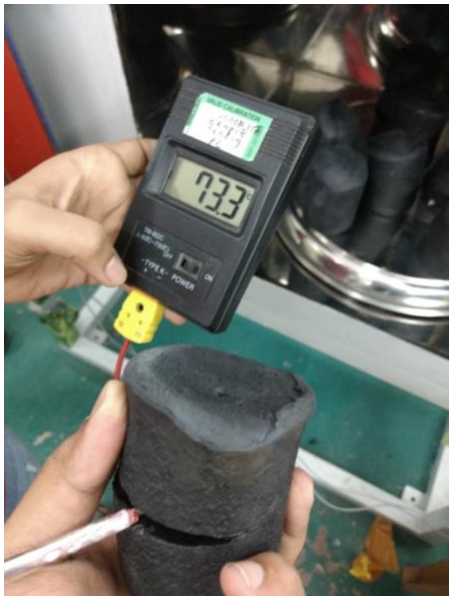
ANALYTICAL RESULTS:

	Trial (samples placed vertically)
No. of samples	12
Microwave Power Gain (%)	84
Chamber Temperature (°C)	70
Hot Air Temperature (°C)	60
Heating Cycle Time (minutes)	3
Microwave Current (A)	7
Surface Temperature (°C)	45-50
Core Temperature (°C)	60-75

PICTURES DURING TRIALS:





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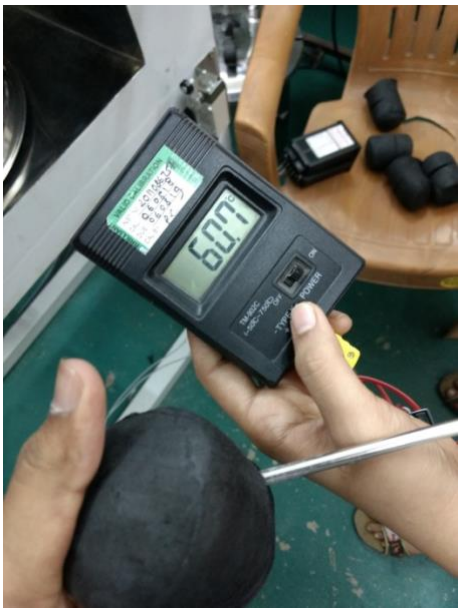

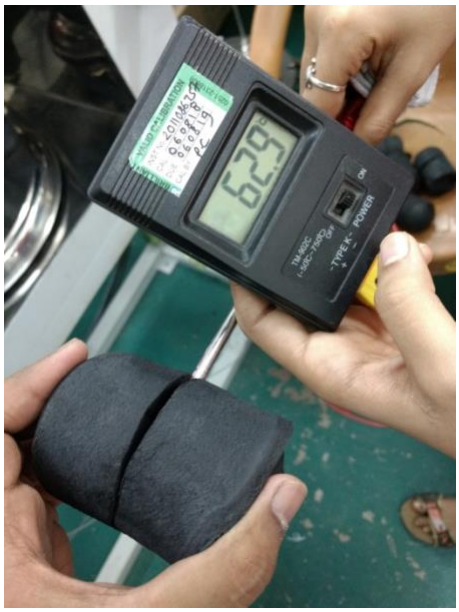

OBSERVATIONS:

By the physical observation, it has been found that preheating of natural rubber, which is having low elastic properties, when exposed to microwave radiation, it get more resilience and elasticity. The requirement of core temperature between 60-70°C has been successfully achieved.

K Komal

Miss Komal Bhoite
Tested By

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Batch Microwave Heat Treatment for Rubber curing

ISO 9001-2008 | ISO 9001-2015 | EMS 14001 | OHSAS 18001
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Customer :	**M/s. Premier Seals (I) Pvt. Ltd., Pune**
Process :	**Batch Microwave Heat Treatment for Rubber curing**

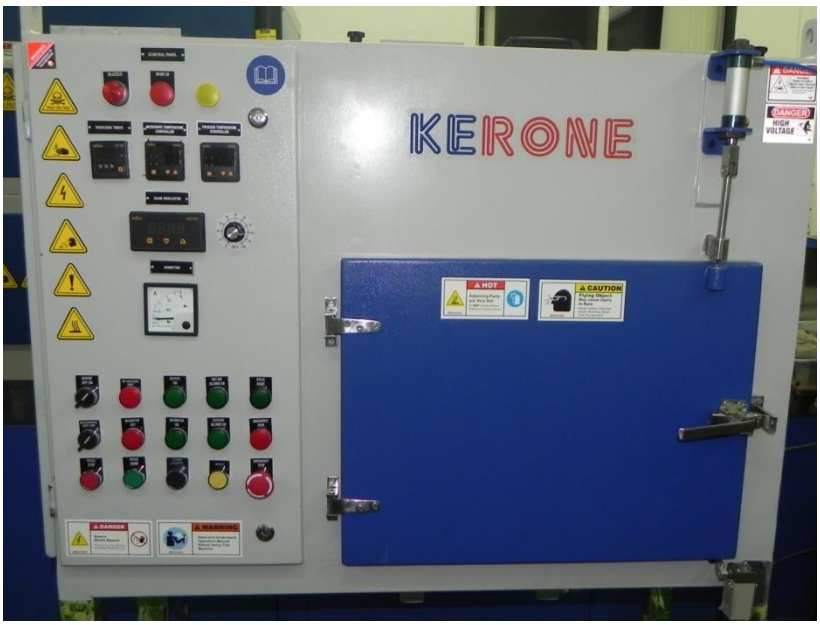
TEST REPORT No: 47/KRDC/LAB/17 Mum 01/10/2018

Date Sample reception : 01/10/2018
ID : 47/LAB/61

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 3 bags
Sampling date : 05/10/2018
Product : Natural Rubber
Requirement : Rubber curing (Temperature of core of product after treatment must be between 60-70^{o}C)
Start Date test : 05/10/2018
End Date test : 05/10/2018

EXPERIMENTAL SET UP:



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BATCH MICROWAVE HEATING SYSTEM SPECIFICATIONS:

Microwave Power	1.45 kW
Frequency	2450 MHz ± 50
Convective Power	1.5 kW
Microwave Exposure Zone (cavity)	500*350*350 mm^3
Exhaust Power	0.5 HP

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	34°C (±5°C)
Humidity (%)	≤73% 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
Digital Thermometer with sensor		**Model No: TM-902C** **Temperature range: -50~750°C** **Temperature accuracy: ±1°C**

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Infrared Thermometer		**Model: FLUKE 566** **Temperature Range: -40°C to 650°C** **Display Resolution: 0.1°**
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 given of rubber slabs having same shape and size in batch microwave heating system for rubber curing. For this, 12 rubber slabs has been placed in microwave system for different time period, different power and different temperature. The surface temperature and inner core temperature of sample has been noted.

ANALYTICAL RESULTS:

	Trial 1 (With dummy load)	Trial 2 (Without dummy load)
Microwave Power Gain (%)	**83**	**83**
Chamber Temperature (°C)	**70**	**70**
Hot Air Temperature (°C)	**85**	**85**
Heating Cycle Time (minutes)	**3**	**3**
Microwave Current (A)	**6**	**6**
Surface Temperature (°C)	**39-50**	**36-45**
Core Temperature (°C)	**70-90**	**60-120**

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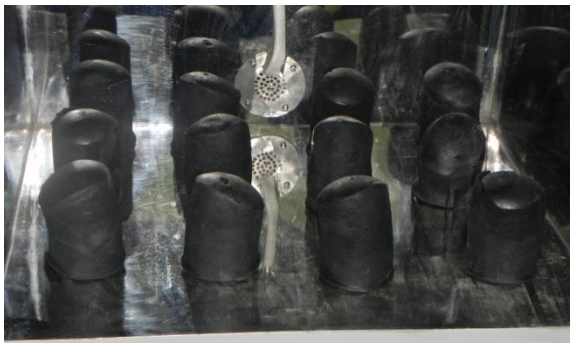
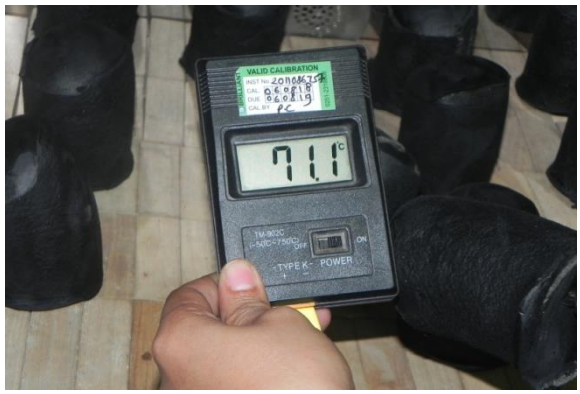
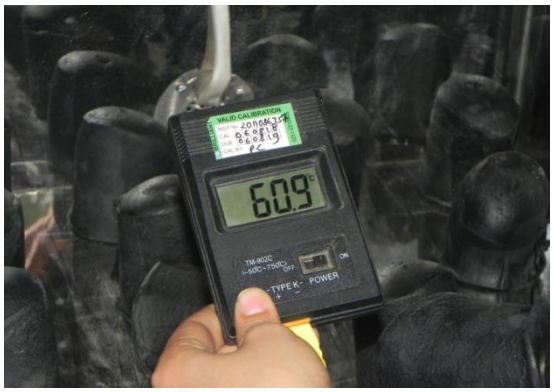
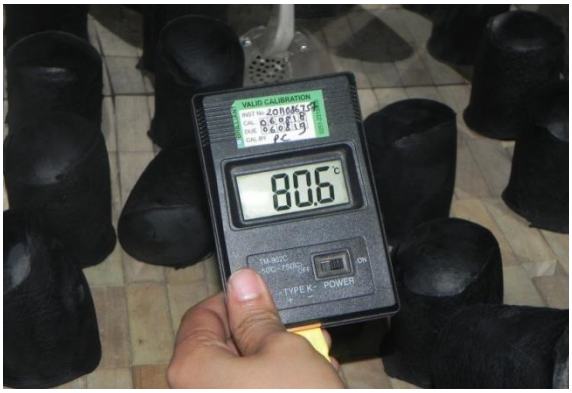
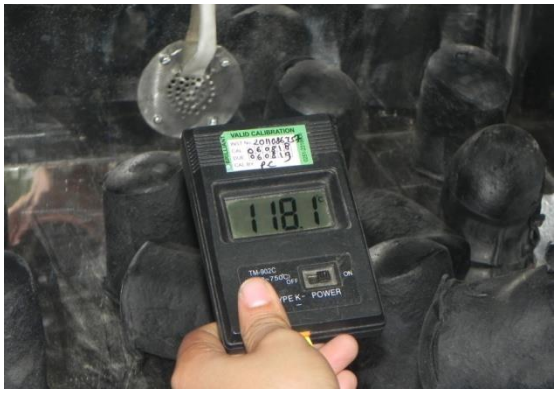
PICTURES DURING TRIALS:











WITH DUMMY LOAD **WITHOUT DUMMY LOAD**

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OBSERVATIONS:

By the physical observation, it has been found that pre-curing of natural rubber, which is having low elastic properties, when exposed to microwave radiation, it get more resilience and elasticity. The requirement of core temperature 60-70°C has been successfully achieved.

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Customer :	**M/s. Premier Seals (I) Pvt. Ltd., Pune**
Process :	**Batch Microwave Heat Treatment for Rubber Preheating**

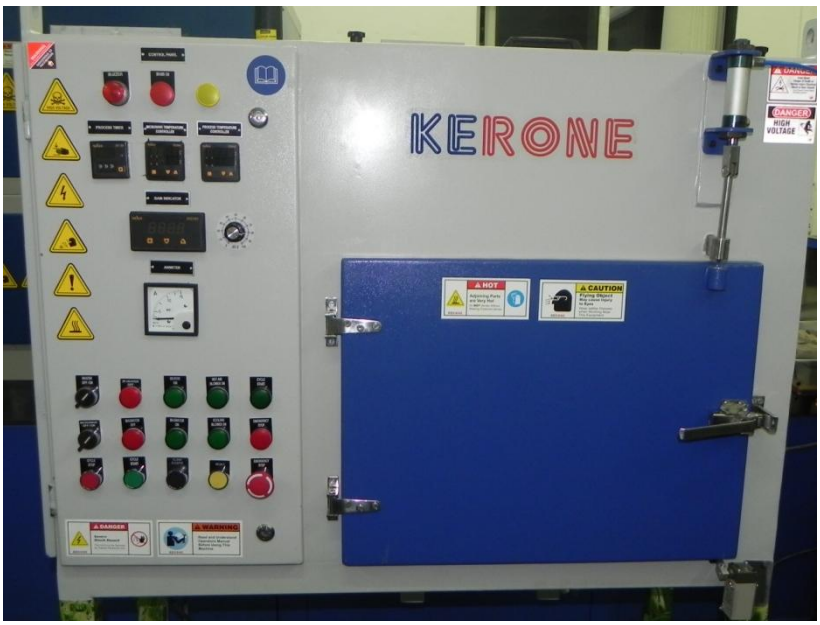
TEST REPORT No: 47/KRDC/LAB/17 Mum 01/10/2018

Date Sample reception : 01/10/2018
ID : 47/LAB/61

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 3 bags
Sampling date : 08/10/2018
Product : Natural Rubber
Requirement : Rubber Preheating (Temperature of core of product after treatment must be greater than or equal to 70°C)
Start Date test : 08/10/2018
End Date test : 08/10/2018

EXPERIMENTAL SET UP:



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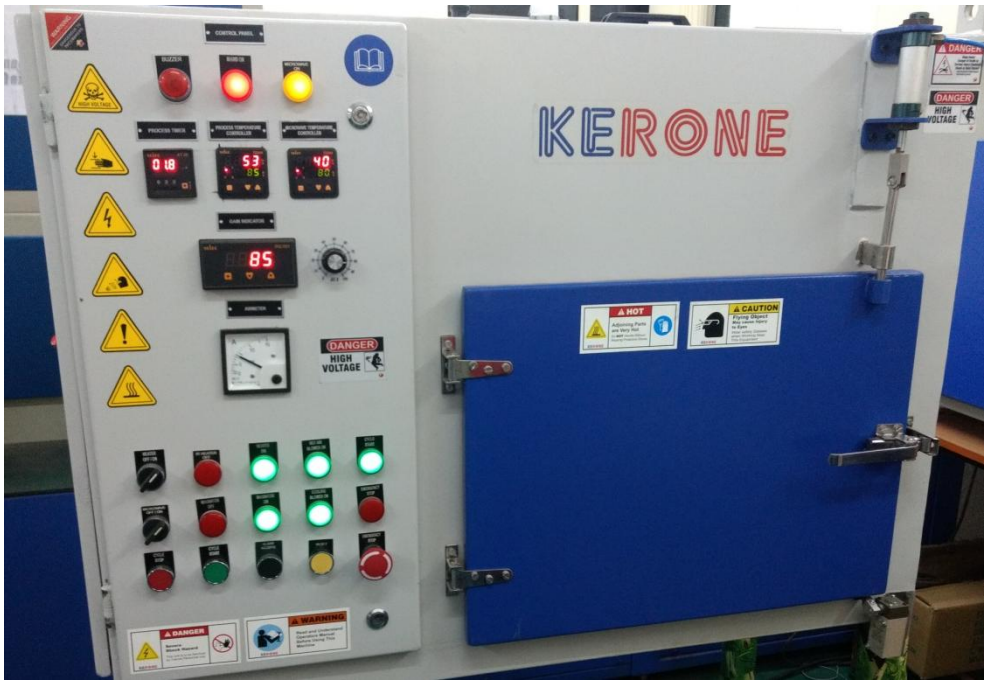

BATCH MICROWAVE HEATING SYSTEM SPECIFICATIONS:

Microwave Power	1.45 kW
Frequency	2450 MHz ± 50
Convective Power	1.5 kW
Microwave Exposure Zone (cavity)	500*350*350 mm^3
Exhaust Power	0.5 HP

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ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	28.6°C (±5°C)
Humidity (%)	≤58% 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
Digital Thermometer with sensor		**Model No: TM-902C** **Temperature range: -50~750°C** **Temperature accuracy: ±1°C**
Infrared Thermometer		**Model: FLUKE 566** **Temperature Range: -40°C to 650°C** **Display Resolution: 0.1°**
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**

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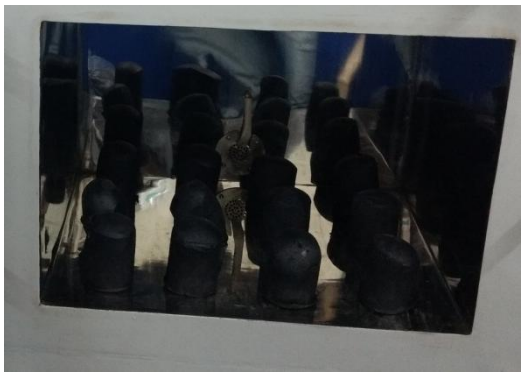
SAMPLE PREPARATION AND METHOD/PROCEDURE:

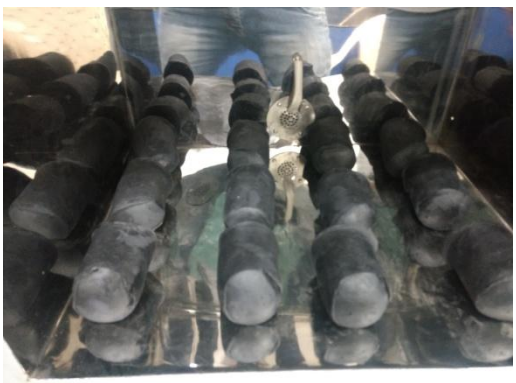
The experiment has been performed on given of rubber slabs having same shape and size in batch microwave heating system for rubber preheating. For this, rubber slabs has been placed in microwave system with different positions and heating treatment has been given for various parameters. The surface temperature and inner core temperature of sample has been noted.

ANALYTICAL RESULTS:

	Trial 1 (sample placed vertically)	Trial 2 (samples placed horizontally)
No. of samples	12	12
Microwave Power Gain (%)	85	85
Chamber Temperature (°C)	80	80
Hot Air Temperature (°C)	85	85
Heating Cycle Time (minutes)	3	3
Microwave Current (A)	7	7
Surface Temperature (°C)	40-45	40-60
Core Temperature (°C)	70-92	70-102

PICTURES DURING TRIALS:





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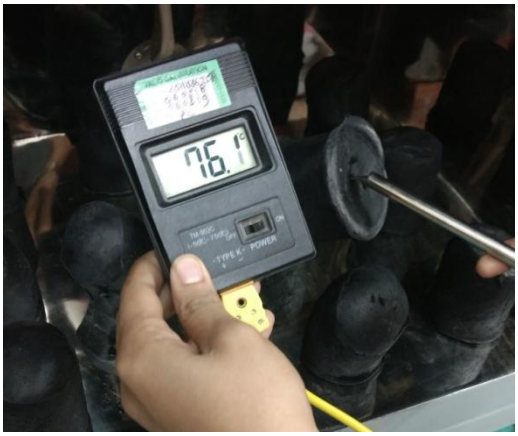

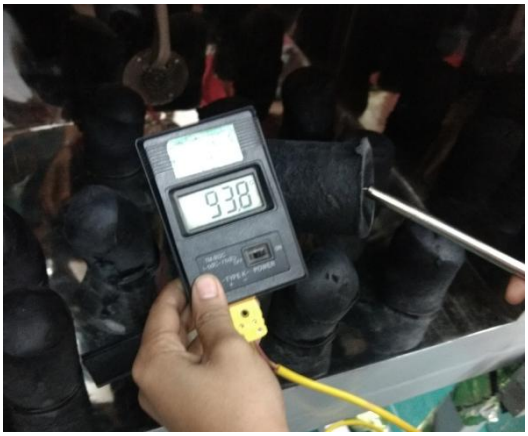

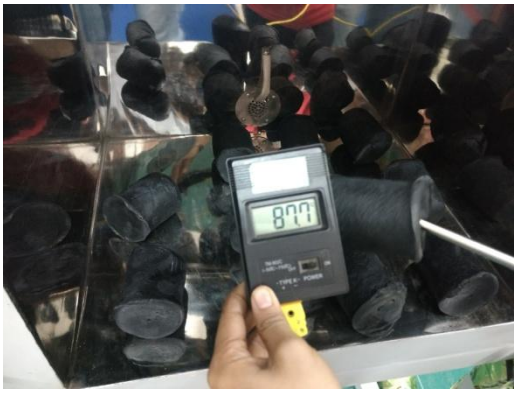

OBSERVATIONS:

By the physical observation, it has been found that preheating of natural rubber, which is having low elastic properties, when exposed to microwave radiation, it get more resilience and elasticity. The requirement of core temperature 70°C and/or greater than 70°C has been successfully achieved.

K Komal

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