

Customer :	<b>Bhabha Atomic Research Center (BARC), Mumbai</b>
Process :	<b>Evaporation of absolute ethanol on polyurethane substrate by continuous Infra-red radiation exposure</b>

**TEST REPORT No: 47/KRDC/LAB/17 Mum 19/12/2018**

Date Sample reception : 27/01/2018  
ID : 47/LAB/21

**SAMPLE DESCRIPTION:**

Sampling : Made by the requestor  
Sample Condition : Acceptable  
Quantity : 2 litre of absolute ethanol 99.9 % and polyurethane (PU) substrate (- 5 numbers)  
Sampling date : 01/03/2018  
Product : Substrate – Polyurethane Films ( length 530 mm, width 310 mm , 0.2 mm thickness and weight 22 gms)  
Requirement : Deposition of CNT Powder and evaporation of sprayed ethanol on PU substrate  
Start Date test : 03/03/2018  
End Date test : 05/02/2018

**LABORATORY EXPERIMENTAL SET UP:**



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**LAB CONTINUOUS INFRA-RED HEATING SYSTEM SPECIFICATIONS:**

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

**Environment-laboratory Ambient Conditions:**

<b>Temperature (degree C)</b>	30.2 degrees C (±5 degrees C)
<b>Humidity (%)</b>	<39 % RH
<b>Pressure (kN/m2 or kPa)</b>	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:**

<b>Name of Equipment</b>	<b>Picture of Equipment</b>	<b>Specifications</b>
<b>Compact Thermal Imaging Camera</b>		<b>Model : FLIR-E-30</b> <b>Resolution : 160x120</b> <b>IR Thermal Sensitivity of 0.10 degree C</b>

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**SAMPLE PREPARATION AND METHOD/PROCEDURE:**

For each experimental run, 25 ml of ethanol has been considered for coating on polyurethane film with the aid of sterilized cotton and fed to Infra-red exposure zone at different temperature and exposure time.

The processed film has been collected at discharge point of heating machine and then recorded the temperature profile of coated film.

**SAMPLE PICTURES:**



**Polyurethane (Substrate)**



**Absolute Ethanol (99.9%)**

**ANALYTICAL RESULTS:**

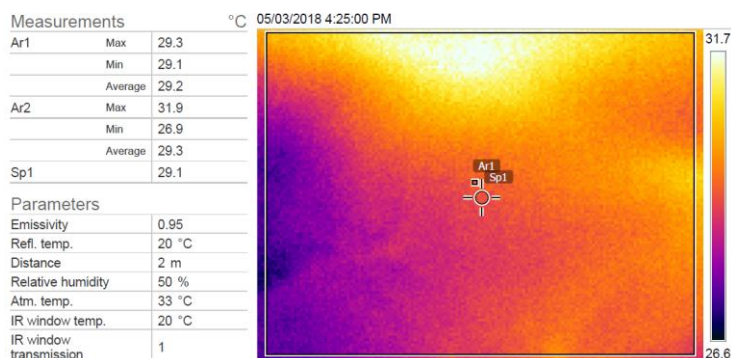
Setting Temperature: 70°C

Emitter Gain: 70 %

Sr. No.	Experiment No.	Infra-red Exposure Time(seconds)	Product Temperature(°C)
1.	A	120	49.4
2.	B	90	45.3
3.	C	60	41.2

**THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:**

**1. Before heat treatment:**

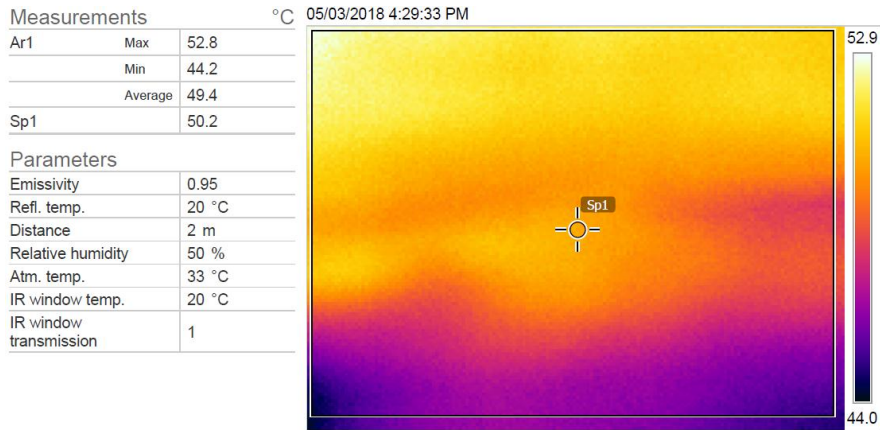


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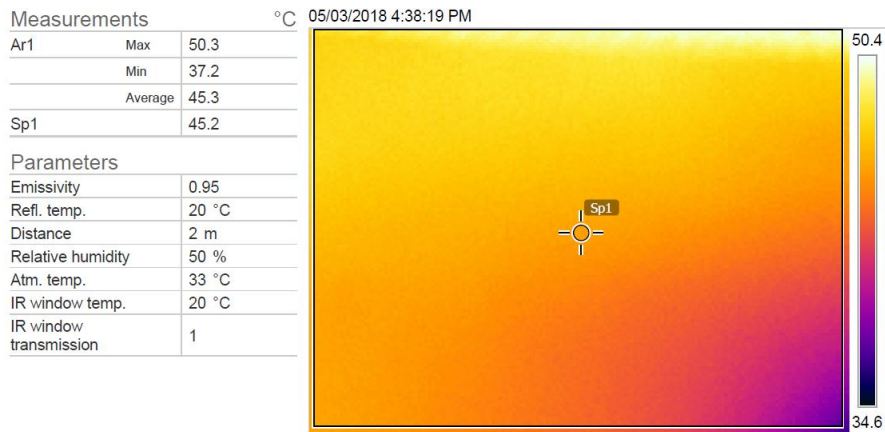
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**2. After heat treatment:**

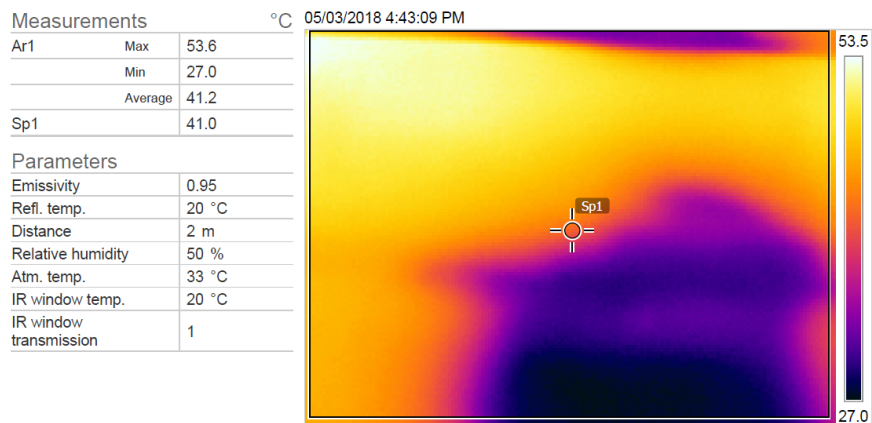
**A.**



**B.**



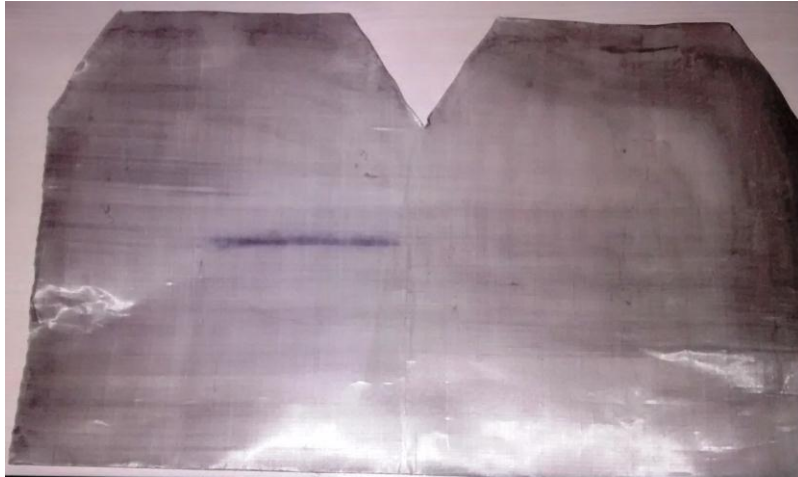
**C.**



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### SAMPLE AFTER PROCESSING:

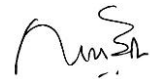


### OBSERVATIONS/CRITERIA FOR EVAPORATION OF ETHANOL:

By the physical investigation, it has been observed that sprayed ethanol film absolutely evaporated, when exposed to Infra-red radiations and no structural shrinkage, brittleness effect has been found on the polyurethane substrate. It is also recommended that if user wishes to examine the percentage of volatile or migrated chemical compound, damage resistance, and tensile strength after the heat treatment to be done for further analysis.



Miss Komal Bhoite  
Tested By



Dr. Uttam K. Goswami  
Approved By

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