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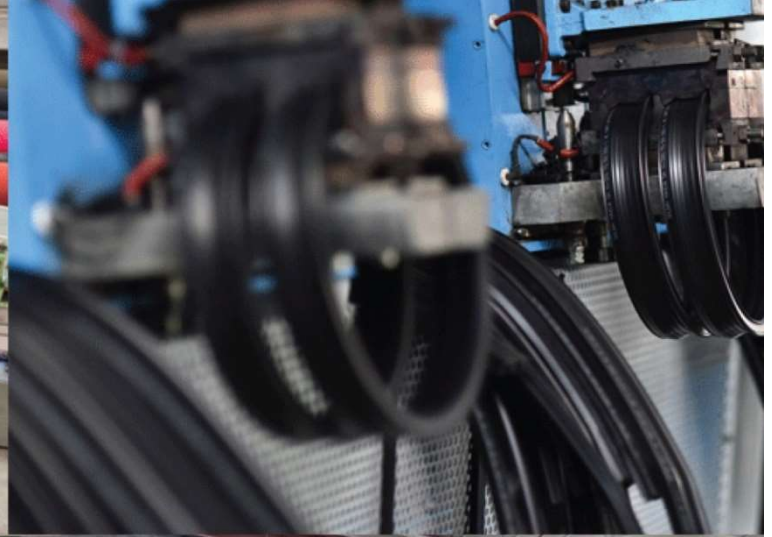
A.M.P.E.R.E (EUROPE)

In Association With



ELECTRO MAGNETIC (Innovative technologies)

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



**Continuous Infra-red Heat Treatment
for Drying of Metal Slime**



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Customer :	M/s. Hindustan Zinc Limited
Process :	Continuous Infra-red Heat Treatment for Drying of Metal Slime

TEST REPORT No: 47/KRDC/LAB/17 Mum 05/01/2019

Date Sample reception : 05/01/2019
ID : 47/LAB/74

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 5 kg
Sampling date : 05/01/2019
Product : Metal Slime
Requirement : Final moisture of product should be equal to or less than 10%
Start Date test : 05/01/2019
End Date test : 05/01/2019

LABORATORY EXPERIMENTAL SET UP:



Format: F/R&D/01



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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 special reflectors	6 Nos (-each having 1 kW, 406 mm heating 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 length	1400 mm
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

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ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	28.1°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

EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model :FLIR E-30 Resolution: 160x 120IR 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



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SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on metal slime without adding any additive under continuous infrared heating system to speed up the drying rate. For this experimental run, some amount of sample has been taken in SS tray with uniform thickness of layer of 20 mm and drying has been done under infrared heating system at particular temperature and time with toppling. Initial weight, final weight after drying, initial moisture content and final moisture content after drying has been noted.

ANALYTICAL RESULTS:

Sr. No.	Setting Temp(°C)	IR Exposure Time(minutes)	Initial Wt(grams)	Final Wt(grams)	Initial MC (%)	Final MC (%)
1.	180	5.4	1000	797	31.9	13.3
2.	180	8	1000	768		11.9
3.	180	10	1000	685		1
4.	180	8	1000	753		10.6
5.	160	9	816	617		8.5

Note: Trial 4 and 5 has been taken with exaust blower in ON condition.

THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

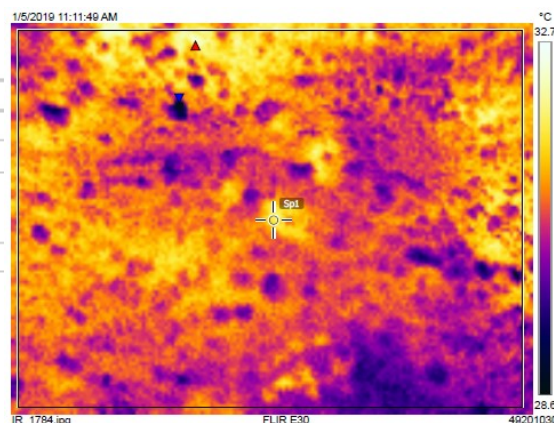
1. Before Heat Treatment:

Measurements

Bx1	Max	32.4 °C
	Min	27.7 °C
	Average	30.8 °C
Sp1		31.6 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C



Format: F/R&D/01



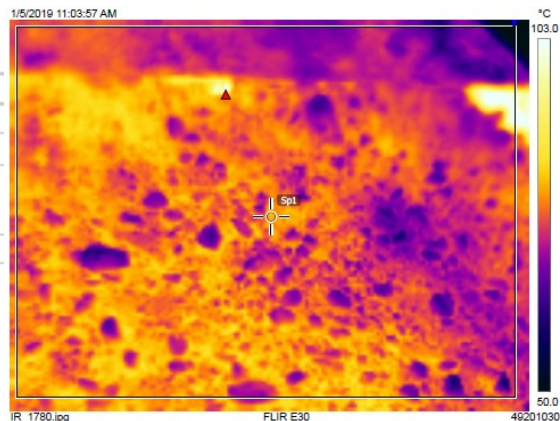
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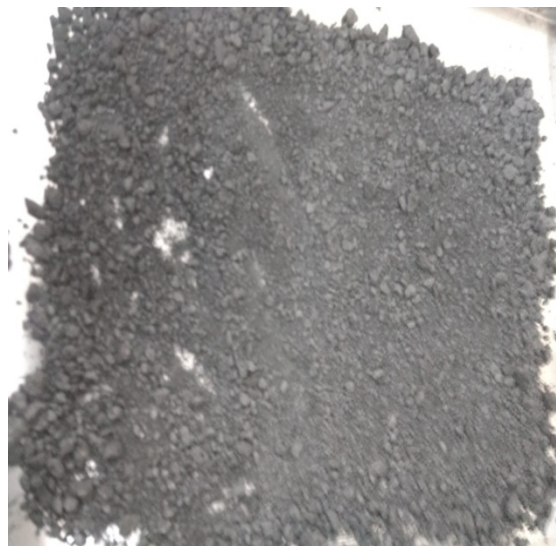
2. After Heat Treatment:

Measurements		
Bx1	Max	109.7 °C
	Min	41.3 °C
	Average	78.1 °C
Sp1		83.1 °C

Parameters	
Emissivity	0.95
Ref. temp.	20 °C



BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



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MOISTURE ANALYSIS REPORTS:

Drying started		Drying started		Drying started	
Date : 5-01-2019	Time : 10:48:51	Date : 5-01-2019	Time : 11:23:13	Date : 5-01-2019	Time : 11:50:05
Model: AGS200	Serial number : 138	Model: AGS200	Serial number : 138	Model: AGS200	Serial number : 138
Drying parameters		Drying parameters		Drying parameters	
Product : Test	Drying temperature : 105.0 °C	Product : Test	Drying temperature : 105.0 °C	Product : Test	Drying temperature : 105.0 °C
Drying profile : standard	Mode : Short mode	Drying profile : standard	Mode : Short mode	Drying profile : standard	Mode : Short mode
Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples	Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples	Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples
Initial weight : 0.969 g	Final weight : 0.660 g	Initial weight : 0.700 g	Final weight : 0.607 g	Initial weight : 0.897 g	Final weight : 0.790 g
Drying time : 00:06:40s	Sampling interval : 20 sec	Drying time : 00:02:20s	Sampling interval : 20 sec	Drying time : 00:03:20s	Sampling interval : 20 sec
Moisture : 31.9 %		Moisture : 13.3 %		Moisture : 11.9 %	
NOTE Initial		NOTE After 5.4 minutes		NOTE After 8 minutes	
The analysis performed by: <u>KKomal</u>		The analysis performed by: <u>KKomal</u>		The analysis performed by: <u>KKomal</u>	
Signature.....		Signature.....		Signature.....	

Drying started		Drying started		Drying started	
Date : 5-01-2019	Time : 13:47:58	Date : 5-01-2019	Time : 15:17:44	Date : 5-01-2019	Time : 16:34:39
Model: AGS200	Serial number : 138	Model: AGS200	Serial number : 138	Model: AGS200	Serial number : 138
Drying parameters		Drying parameters		Drying parameters	
Product : Test	Drying temperature : 105.0 °C	Product : Test	Drying temperature : 105.0 °C	Product : Test	Drying temperature : 105.0 °C
Drying profile : standard	Mode : Short mode	Drying profile : standard	Mode : Short mode	Drying profile : standard	Mode : Short mode
Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples	Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples	Calculation : $\frac{(m_0 - m)}{m_0} \times 100\%$	Finished : 3 samples
Initial weight : 0.800 g	Final weight : 0.792 g	Initial weight : 0.771 g	Final weight : 0.689 g	Initial weight : 0.922 g	Final weight : 0.844 g
Drying time : 00:02:20s	Sampling interval : 20 sec	Drying time : 00:02:00s	Sampling interval : 20 sec	Drying time : 00:02:00s	Sampling interval : 20 sec
Moisture : 1.0 %		Moisture : 10.6 %		Moisture : 8.5 %	
NOTE After 10 minutes (at 180°C)		NOTE After 8 minutes (with exhaust blower)		NOTE After 10 min (at 160°C) (with exhaust blower)	
The analysis performed by: <u>KKomal</u>		The analysis performed by: <u>KKomal</u>		The analysis performed by: <u>KKomal</u>	
Signature.....		Signature.....		Signature.....	

Format: F/R&D/01

The value obtained is already corrected for possible recover value stated, if applicable. This document may not be reproduced or disclosed wholly or partly in any part thereof without the written consent of the laboratory management or customer. This document relates only to the specimen samples processed. The processed sample will be kept in this laboratory for 7 days from the date of heat treatment.



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OBSERVATIONS:

The drying behavior of metal slime has been investigated under the continuous infrared heating system. The drying rate is found to be increasing with respect to increasing drying time. It has been found that the moisture content on the dry basis (%) decreases with respect to increase drying time. As per physical investigation, it has been observed that there is complete drying with required moisture content without burning effect.

A handwritten signature in black ink that reads "K Komal".

Miss Komal Bhoite
Tested By