iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** XII **Month of publication:** December 2019

DOI: http://doi.org/10.22214/ijraset.2019.12152

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue XII, Dec 2019- Available at www.ijraset.com

Experimental Investigation of Jet Erosion Wear for Aluminium Alloy 19000 due Solid-liquid Mixture

Kalpesh M. Khairnar[1], E. R. Deore[2], Purushottam S. Desale[3]
[1]PG Student, [2]HOD, [3]Associate. Prof., Mechanical Engineering Department, S.S.V.P.S.'s, B.S.D. College of Engineering, Dhule, India

***Abstract:** Erosion wear is a serious problem for slurry transportation and slurry handling equipment's. It plays an important role in design and operational conditions of slurry transportation system. This paper shows the experimental investigation of weight loss in copper material due to solid-liquid (slurry) impact by using different operating conditions and the validation of the readings using regression. For the experimental investigation, Jet Erosion pot tester is fabricated by using propeller for uniform distribution. Special arrangement is made for angular movement of test carrying fixture in which it can move from 10° to 85°. Different experiments are carried on Aluminium material for repeatability. For experimental study, different parameters like solid-liquid (slurry) concentration, particle size, variable angles (from10° to 85°) and time variable are used. These experimental repeatability readings are then validated by using Regression analysis . During this, it is observed that the erosion wear of Aluminium alloy (Ductile material) is maximum at 25°.*

***Keywords:** Erosion wear, Slurry containing Pot tester, Slurry flow, Repeatability, Regression.*

I. INTRODUCTION

Slurry erosion is happen because of the interaction of solid fittings, pipes etc. Where Slurry erosion is a serious particles suspended in a liquid and a surface which problem may lead due to the impingement of solid-liquid experiences loss of mass by the repeated impacts of (slurry) mixture on the surface of target material. This particles. It is one of the major sources of mass loss and slurry erosion may vary due to its impingement factors failure of several slurry equipment and hydraulic such as velocity of slurry, solid-liquid concentration, components used in many industrial applications. particle size, material properties of target surface, different Therefore, there is need to solve or minimize effect of operating angles, viscosity of slurry. During this mass loss. The slurry erosion is a difficult phenomenon experiments with different percentage of solid-liquid and it is not fully understood because it is influenced by concentration(10%, 30%), angle of inclination(10°, 25°, different parameters, which act simultaneously. These 40°, 55°,70°, 85°), particle size(362.5 µm, 512.5 µm) and time factors include flow field parameters, target material dependency, it seem that the erosion in the form of weight properties and erodent particle characteristics and its size loss for aluminium (Ductile) material is maximum at 25°.

II. EXPERIMENTAL PROCEDURE

The procedure has to be followed on erosion tester to calculate the erosion wear of different materials is as follow:

A. Firstly the specimen is cleaned properly.
B. Drying, if required.
C. Weighing the specimen (initial weight).
D. Clamp the specimen in fixture provided in test rig.
E. Setting the holder at required angle.
F. Weight the required sand as per concentration of slurry.
G. Mixing the proper amount of water and sand in tank.
H. Start the pump.
I. Adjust the flow rate to obtain desired value of mass flow rate and running the test for required time interval.
J. Removing the specimen from the fixture.
K. Cleaning and drying the specimen.
L. Weighing the specimen after erosion to measure the mass loss.
M. Repeat the steps.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue XII, Dec 2019- Available at www.ijraset.com

III.REGRESSION

Multiple regression is used to determine the correlation between a criterion variable and a combination of predictor variables, the statistical multiple regression method is applied. It can be used to analyze data from any of the major quantitative research designs such as causal-comparative, correctional, and experimental. This method is also able to handle interval, ordinal, or categorical data and provide estimates both of the magnitude and statistical significance of the relationships between variables Therefore, multiple regression analysis will be useful to predict the criterion variable of material erosion rate via predictor variables such as Angle, Time, Particle size, and solid concentration. In which experiment 48 test reading are conducted with variable time, concentration, angle, and size.

$Ea=0.00002123(C^{0.18})3T^{0.26}3S^{0.94}3A^{0.09}$

Where, Ea- Erosion rate of selected material, C- Solid concentration in percentage, T- Time in minute, S- Particle size in micron and A- Angle in degree. New empirical model Eq. (1) is developed for prediction of material erosion rate using Angle, Concentration, Time, particle size. It is observed that the proposed equation establishes relation among input variables and response variable. The average deviation observed in measured value and regression predicted value is 10.07563 % at confidence level of 89.92%.

	Input Parameter				Predicated Erosion And % Error		
Sr.	Concentration	Time	Size	Angle	Erosion		Error
No.	Percentage	Minutes	µm	Degree	Expt.	Regression	%
1	10	60	512.5	10	0.033	0.04	21.21
2	10	60	512.5	25	0.058	0.044	24.13
3	10	60	512.5	40	0.05	0.047	6.01
4	10	60	512.5	55	0.048	0.047	2.08
5	10	60	512.5	70	0.047	0.048	2.12
6	10	60	512.5	85	0.043	0.049	13.95
7	30	60	512.5	10	0.04	0.041	2.5
8	30	60	512.5	25	0.112	0.098	12.5
9	30	60	512.5	40	0.078	0.076	2.56
10	30	60	512.5	55	0.07	0.067	4.28
11	30	60	512.5	70	0.071	0.069	2.81
12	30	60	512.5	85	0.065	0.064	1.53
13	10	30	512.5	10	0.021	0.025	19.4
14	10	30	512.5	25	0.049	0.047	4.08
15	10	30	512.5	40	0.037	0.038	2.7
16	10	30	512.5	55	0.028	0.031	10.71
17	10	30	512.5	70	0.025	0.029	16.01
18	10	30	512.5	85	0.02	0.025	24.99
19	30	30	512.5	10	0.025	0.026	4.01
20	30	30	512.5	25	0.087	0.067	22.9
21	30	30	512.5	40	0.058	0.045	22.41
22	30	30	512.5	55	0.054	0.048	11.11
23	30	30	512.5	70	0.05	0.049	2.01
24	30	30	512.5	85	0.03	0.035	16.66
25	10	60	362.5	10	0.02	0.023	15.01
26	10	60	362.5	25	0.048	0.045	6.25
27	10	60	362.5	40	0.037	0.033	10.81
28	10	60	362.5	55	0.034	0.034	0.101
29	10	60	362.5	70	0.029	0.031	6.89
30	10	60	362.5	85	0.02	0.025	25.01
31	30	60	362.5	10	0.027	0.029	7.4
32	30	60	362.5	25	0.059	0.055	6.77
33	30	60	362.5	40	0.031	0.035	12.9
34	30	60	362.5	55	0.03	0.04	33.33
35	30	60	362.5	70	0.032	0.035	9.375
36	30	60	362.5	85	0.028	0.029	3.57
37	10	30	362.5	10	0.018	0.019	5.55
38	10	30	362.5	25	0.049	0.047	4.08
39	10	30	362.5	40	0.029	0.028	3.44
40	10	30	362.5	55	0.025	0.28	12.01
41	10	30	362.5	70	0.024	0.027	12.5
42	10	30	362.5	85	0.021	0.025	19.04
43	30	30	362.5	10	0.025	0.28	12.01
44	30	30	362.5	25	0.051	0.049	3.92
45	30	30	362.5	40	0.04	0.038	5.01
46	30	30	362.5	55	0.028	0.029	3.57
47	30	30	362.5	70	0.027	0.029	7.4
48	30	30	362.5	85	0.02	0.021	5.01
Average						10.07563	

IV. CONCLUSION

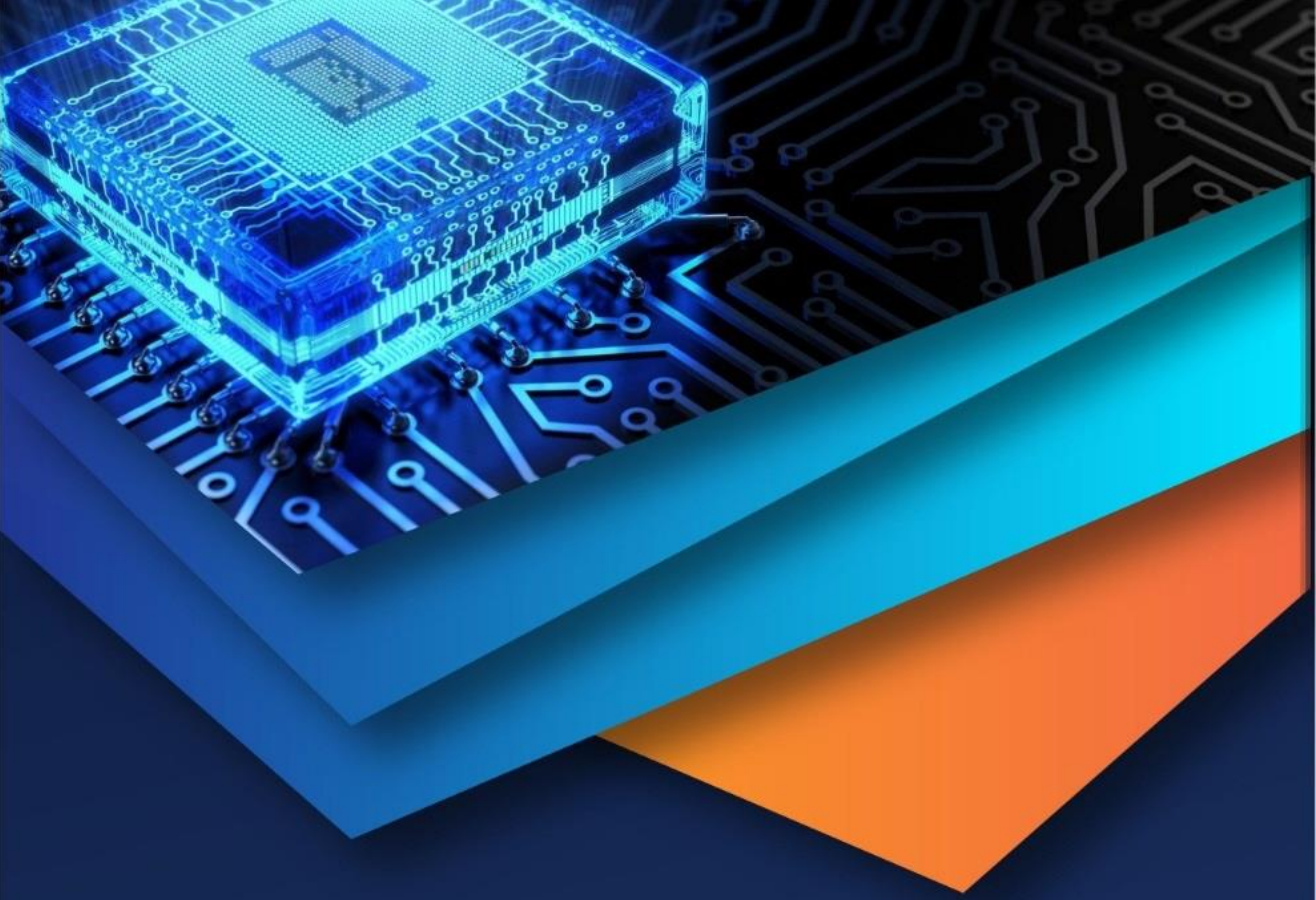
The present work has been carried out to investigate the slurry erosion behaviour of AA19000. A jet erosion tester of 7.3 litre capacity slurry pot similar to one developed by Desale. has been fabricated and used in the present study. The working of jet erosion tester was validated by conducting preliminary set of experiments using AA19000 as target material and IS sand as erodent. The erosion wear characteristics of AA19000 were examined and compared with the data available in the literature. Additionally, the eroded specimens were examined for validating and understanding the erosion wear mechanisms.

A. As the particle size of the IS sand is increase it gives the maximum weight loss for the maximum particle size. Means the weight loss is increase with increase in particle size respectively

B. The tests are taken for two time intervals first of 60minutes and another one is of 30 minutes. And after collecting the test results it is observed that the maximum weight loss is occurred at the 30 minutes tests as compare to the 60minutes tests that means the weight loss is always increases as time is increases.

C. It is observed that if the graph of wear rate versus impact angle is plotted for 512.5µm particle size for 10% and 30% concentration, time 60minutes and 30 minutes. The maximum weight loss is occurred at a 30% concentration and time 30 minutes. And the minimum weight loss is occurred at 10% concentration and time 60 minutes.

D. It is observed that if the graph of wear rate versus impact angle is plotted for 362.5µm particle size for 10% and 30% concentration, time 60minutes and 30 minutes. The maximum weight loss is occurred at a 30% concentration and time 30 minutes. And the minimum weight loss is occurred at 10% concentration and time 60 minutes.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY