

Regression Analysis of Hardness of Hybrid Metal Matrix Composite Using Wheat Husk Ash and Red Mud

Rishi Dewangan¹, Aditya malhotra², Divesh parihaar³

¹Assistant , Dept of mechanical engineering

^{2,3}Dept of mechanical engineering

^{1,2} Amity University Rajasthan

Abstract- This Study has been conducted to evaluate hardness of metal matrix composite hybrid composite using red mud and wheat shell ash. 9 types of sample was prepared by using red mud and wheat shell ash added as impurity by varying percentage of 5 to 15% through stir casting technique. Further it is tested for hardness and its brinell hardness values varies from 30 BHN to 48 BHN . taguchi analysis was employed to check its optimal input parameters and found that red mud and load parameter have high contribution and also regression analysis is also evaluated to check relation between output and input parameter for further analysis.

I. INTRODUCTION

Aluminum is light weight and high strength metal which 2nd most malleable and 6th most ductile non magnetic metal .During production of aluminum around 30 -40 % residue Red mud is produced which creates some hazardous problem due to its disposal , alkaline nature(Ph 10.5-12) and small amount of radioactive element. Due to red mud industrial composition (Fe₂O₃, TiO₂, CaO, Al₂O₃ etc) its utilized in may field like reduction of heavy metals like scadeum[1],used as phosphorus adsorbent[2] ,used for acidic leaching process[3] in refractory material[4], in grinding process[5], to develop catalyst for biodiesel production[7], to make geopolymer[8],in ceramic materials[10] and also developing metal matrix composite [11].

Metal matrix composite is one type of composite material which have combined and also best property of particulate and reinforcement element. In recent years there are many researcher used bio waste such as rice husk ash, bamboo ash, apricot ash , wheat straw ash etc . [] out of so these bio waste , wheat husk ash utilized in various application like used for developing cement[11] ,for extraction of siliaca[12], preparation of hypnotic aerogel silica[13], used for making surfactant[14] and also for removal of golden yellow particle[15].

]there is no work done for developing metal matrix composite using bio waste and red mud . so red mud and wheat straw ash were utilized for developing different composite in varying percentage. Stir casting technique was utilized and further it was tested for hardness. All result was corrected by regression analysis .

II. EXPERIMENTATION

Red mud has the higher amount of Fe₂O₃ & Al₂O₃ and wheat husk has the higher amount of silicon. Red mud and wheat shell ash composition are shown below. In this research work Metal matrix composites by using red mud and wheat shell ash which percentage varied from 5 to 15% and remainder is aluminum. Stir casting techniques used for development of metal matrix composites. During process temperature maintained at 700-800 °C and stirring speed maintained at 50 rpm to get homogenized mixture. All these mixture arranged according to following table:

Table 1: Composition chart

S.No	Al(gm)	Red Mud(gm)	Wheat husk ash(gm)
1	300	15	15
2	300	15	30
3	300	15	45
4	300	30	15
5	300	30	30
6	300	30	45
7	300	45	15
8	300	45	30
9	300	45	



Figure 1: developed metal matrix composite

According to above table 9 samples metal matrix composite were prepared by using stir casting process. Further this entire sample grind , polished and compose flat for situate into brinell hardness machine. This brinell hardness test was done by using a pay laod of 10 KN with 10 mm diameter carbide indenter ball. After unloading the pay load round impression evaluate by small microscope and check its value by brinell hardness chart regardless of load and impression diameter. :

III. RESULT AND DISCUSSION

Hardness is parameter to check material strength by dividing its load to its spherical indentation. Brinell hardness specimen used to check its hardness value. This value calculated by lay out flat and polish section in brinell hardness specimen. Based upon indentation diameter and brinell hardness chart its hardness number tabulated which result are shown below:

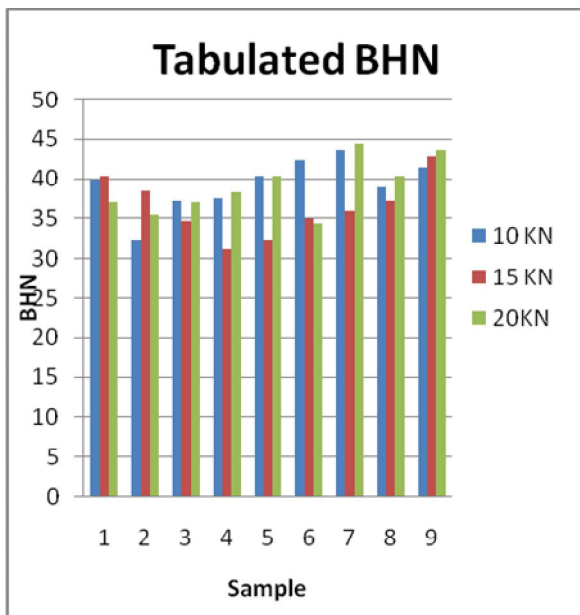


Figure No 2: Evaluated BHN on different load

From this tabulated result its shown that sample no 7 put maximum value of hardness this is because it content have 15% of red mud which work as reinforced element and upto 10 % of wheat shell composition hardness increases and also with red mud composition hardness value increases.

IV. REGRESSION AND ANOVA ANALYSIS

Regression and anova analysis can be utilized to check optimal process parameter on BHN value.

Regression BHN= 36.1 + 0.017 wheat sheell ash + 0.366 red mud - 0.090 load.(1)

from comparison of above equation and tabulated BHN found that there is only 5 % overall error in hardness so it can be further utilized for another similar type of analysis.

Now anova analysis has to be tabulated in minitab software using BHN as response and whaet shell ash , load , red mud and there combination take as ,model parameter in generalized anova linear model having 95% confidence level, which is as follows:

Table 5 Anova table for BHN

Source	DF	Seq SS	Adj SS	Adj MS	F	P
wheat shell ash	2	0.805	0.805	0.403	0.04	0.957
red mud	2	143.66	143.606	71.803	7.94	0.006
load	2	50.09	50.098	25.049	2.77	0.103
Wheat shell ash *red mud	4	25.89	25.89	6.473	0.72	0.597
red mud*load	4	47.78	47.78	11.946	1.32	0.318
Error	12	108.5	108.5	9.045		
Total	26	376.7				

From this it's concluded that wheat shell ash contribution is very less and this parameter also provide no significant value and red mud contribution is highest and also fall into significant level in 95% confidence level anova analysis . so from tabulated BHN and anova analysis maximum percentage of red mud and minimum percentage of wheat shell ash have maximum hardness value and also further be utilized for other analysis.

V. CONCLUSION

Different sample of metal matrix composite using red mud and wheat shell ash which shown optimum value of

hardness, this result are also tabulated using regression equation and anova analysis and evaluated this study can be further utilized for other analysis like SEM ,XRD , corrosion analysis etc. and also from above result and discussion sample 7 have maximum and optimum value of hardness. This research work uses industrial waste as well as biawaste so it is expected to reduce the environment problem and also it leads to reduce the cost of overall composite material cost

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