Comparative Study on Mechanical Behaviour of Hybrid Metal Matrix Composite of Aluminum Using Red Mud and Coconut Shell Ash

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Abstract- *In this research work, mechanical behavior of Al metal matrix composite reinforced with red mud (industrial waste) with coconut shell ash(Agro waste) was evaluated. This work was designed to assessing the suitability of developing low cost high performance Al metal matrix hybrid composite. Red mud and coconut shell ash particulate added with varying percentage 2 to 15% through stir casting process. Hardness and density were was evaluated and further corrected by using Anova and regression analysis and concluded that high red mud and low coconut shell abd concluded that red mud has highest contribution on hardness value and also hardness value.*

Keywords- Red mud, coconut shell ash , anova and regression analysis

I. INTRODUCTION

Metal Matrix Composite(MMC) is composition of two materials in that one needs to be metal and second can vary regarding the type[1], quality and properties

we are expecting in the final product.[2] Often ceramics or organic compounds are used due to the fact that the addition of those can vary the property of parent metal. [3]

Coconut shell is an agricultural waste which can be found in abundance in environment and also is hazardous for the environment.[4] Biodiversity in India comprises of tropical region coconuts are found in abundance,[5] 0pand hence it is projected as the new source of energy bio-fuel.[6][7][8]Industries are booming at an alarming rate and hence are the industrial waste. Red Mud is also an industrial waste by aluminium industries.[9][11] Currently, red mud is being used for gas cleaners and water treatment and also one of its major application in building material additives.[10][11] And is Also used for Heavy metal extraction.[12][13]

Very less work is done by using red mud with coconut shell ash. This paper comprises of making of Metal Matrix Composite with aluminium as base metal, industrial waste red mud and biosorbent coconut shell ash.

Also Taguchi Method of analysis is used in this paper this is a statistical approach to optimize the process parameters and improve the quality of component manufactured.[14][15][16]

II. EXPERIMENTATION

In this project, Coconut Shell Ash (CSA) is being used because of its chemical composition being Al2O3, CaO, Fe2O3, K2O, MgO, Na2O, SiO2, MnO and ZnO ; als Red mud is being used because of its chemical composition being Fe2O3, Al2O3, SiO2, CaO, Na2O, TiO, K2O and MgO.
Particle size of CSA used 600 micron and Red mud is 300 micron. Addition of all the three component i.e. Aluminium, Red Mud and CSA in the following amount are mixed based upon following composition:

Table 1: composition chart

S.No	Al(gm)	Red Mud(gm)	Wheat husk ash(gm)
1	210	10	10
2	210	10	20
3	210	10	30
4	210	20	10
5	210	20	20
6	210	20	30
7	210	30	10
8	210	30	20
9	210	30	30

Based upon these composition all this 9 samples are stir caste and further machined for brinell hardness and density test.

Figure 1: Prepared Composite

All these 9 samples are perfectly polished and transverse section are tested are tested for hardness on the pay load of 10 KN in brinell hardness tester there. These results are further corrected in anova and regression analysis for better understanding of correlation between input and output parameters.

III. RESULT AND DISCUSSION

Hardness is property to check load against its indentation and also it is co related with tensile strength value, hardness is always proportional to its hardness value. Here brinell hardness tester were used to check its hardness value by putting 10 KN pay load for 15 seconds. Based upon its indentation diameter and brinell hardness chart brinell hardness value are evaluated and sample density is also evaluated to check its strength to weight ratio so both results are shown in below graphs:

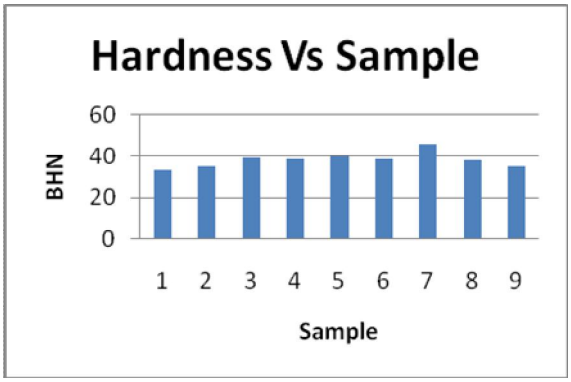

Figure 2: Evaluated BHN for different samples

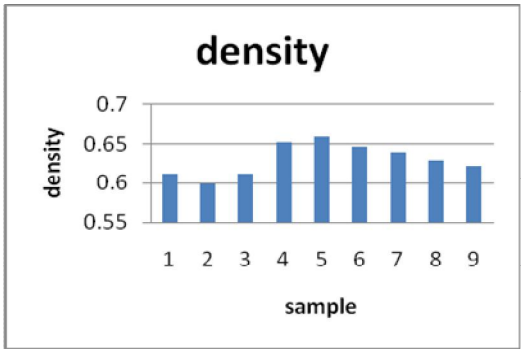

Figure 3 : density for all the samples

From the above graphs hardness and density of sample 7 is maximum and also density of sample decreases with increasing amount of red mud and coconut shell ash and also hardness value for all samples are similar but maximum hardness value is put by sample no 7 which have highest red mud and minimum coconut shell ash because in Fe2 O3 and TiO2 present in red mud promotes strength and hardness and also less amount of SiO2 works as good reinforcement after that its increases the density and brittleness.

3.1 Regression and Anova results

Regression analysis is utilized to check relationship between input and output parameters here input parameter are wt% of red mud and coconut shell ash and output parameters are density and BHN value .

The regression equation for BHN

BHN = 36.1 + 0.197 red mud - 0.088 coconut shell ash

The regression equation for density

Density = 2.54 - 0.00233 red mud + 0.00017 coconut shell ash

All BHN and density are corrected in regression analysis and 5 % overall error in both value so these regression analysis can be further utilized for similar type of analysis .

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

Table 2: Anova table for BHN

Source	DF	Seq SS	Adj SS	Adj MS	F	P
A	1	23.364	96.369	96.369	36.6	0.002
B	1	4.682	51.438	51.438	19.5	0.007
A*B	1	74.477	74.477	74.477	28.3	0.003
Error	5	13.168	13.168	2.634		
Total	8	115.69				

here A= Red mud , B= Coconut Shell ash

From the above anova table it is concluded that all the parameter falls into significant level (95% confidence level) and combination of red mud and coconut shell have maximum contribution (60%) and in anova result there are only 10% error which is very good result so these type of combination further utilized for similar type of analysis.

IV. CONCLUSION

Metal matrix composite using red mud and coconut shell ash is successfully developed and its tested for brinell hardness and density value and also it is corrected by using regression analysis which shows good result and also from all sample sample no 7 shows optimum value of hardness to density result . this study further be utilized other analysis like SEM , XRD , corrosion analysis etc and also these work utilized waste material and also it leads to reduce the overall cost of composite material

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