Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 04, April -2018

MECHANICAL BEHAVIOUR OF ALUMINIUM-GRAPHITE-RICE HUSK ASH METAL MATRIX COMPOSITES

C.Neelima Devi[1], V.Mani Kumar[1]

[1]*Department of mechanical engineering, JNTUK-UCEV*

Abstract — *Aluminium metal matrix composites plays vital role at the present modern industrial sectors due to its advantageous properties. In the present work, the effects of graphite and rice husk ash on mechanical properties of Aluminium metal matrix composites are studied. It has been undertaken with an objective of exploring the use of rice husk ash as a low cost option. Finely distribution of graphite and rice husk ash particles improves the hardness and compression behaviour of the aluminium metal matrix composites through stir casting process.*

Keywords-*aluminium, graphite, rice husk ash, hardness, compression strength.*

I. INTRODUCTION

Aluminium metal matrix composites is remarkable for its ability to the aerospace industry and are important in other areas of transportation, automobile and structural materials, such as building facades and window frames. A unique combination of properties makes aluminium and its alloys on the most versatile engineering and construction material available today. Graphite powder is valued in industrial applications for their self-lubricating and dry lubricating properties. Rice husk ash is produced from the burning of rice husk which is a by-product of rice milling.

II. EXPERIMENTATION

Pure aluminium is melted in the resistance furnace maintaining temperature upto 800^0C. Concentration of rice husk ash is varied as 2%, 4% and 6% by weight. The samples of rice husk ash and graphite are priorly carried out with the pre heating process with the help of muffle furnace to remove moisture content in it. Pre heated rice husk ash and 5% graphite is mixed with the molten aluminium and stirred with help of mild steel stirrer for 3 to 4 min at 60 rpm. Experiments have been conducted under laboratory condition to assess the mechanical characteristics of the aluminium-graphite and rice husk ash metal matrix composites. This has been possible by fabricating the samples through stir casting technique. Figure 1 and Figure 2 shows stir casting equipment and crucible inside the furnace. Figure 3 shows the samples of aluminium, 5% graphite, 2%, 4% and 6% rice husk ash metal matrix composites.

Figure 1. Stir casting equipment

Figure 2. Crucible inside the furnace

Figure 3. Samples of aluminium, 5% graphite, 2%, 4% and 6% rice husk ash metal matrix composites

III. RESULTS AND DISCUSSIONS

3.1. Hardness

The Hardness tests of all samples are conducted using Rockwell hardness testing machine with a dwell time of 15 sec and applied load of 100 kgf during test. Figure 4 shows the plot between average hardness number and % weight fraction of rice husk ash with pure aluminium and 5% graphite.

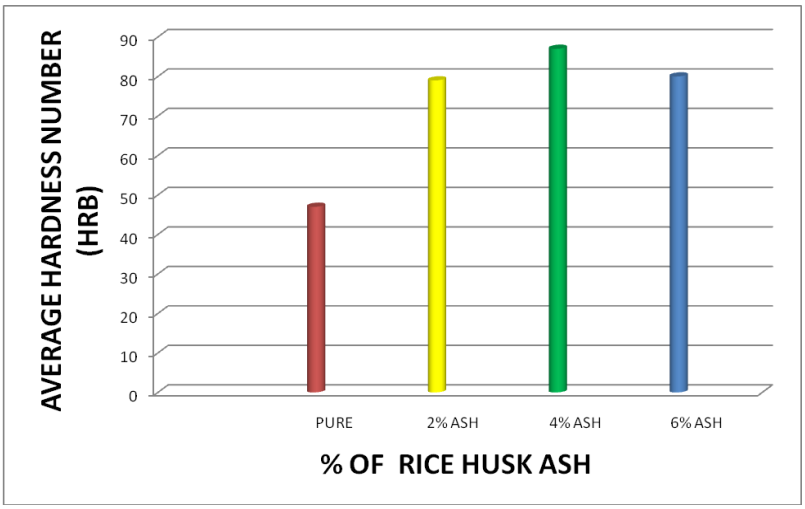

Figure 4. Plot between Average hardness number and % weight fraction of rice husk ash with pure aluminium and 5% graphite.

3.2 Compression Strength

The compression test of all the samples were conducted on the compression testing machine and the corresponding compressive loads (in kN) were noted for the two different percentages 20% and 40% of deformation in length. Figure 5 shows the plot between Load Applied and % Weight Fraction of rice husk ash with aluminium and 5% graphite.

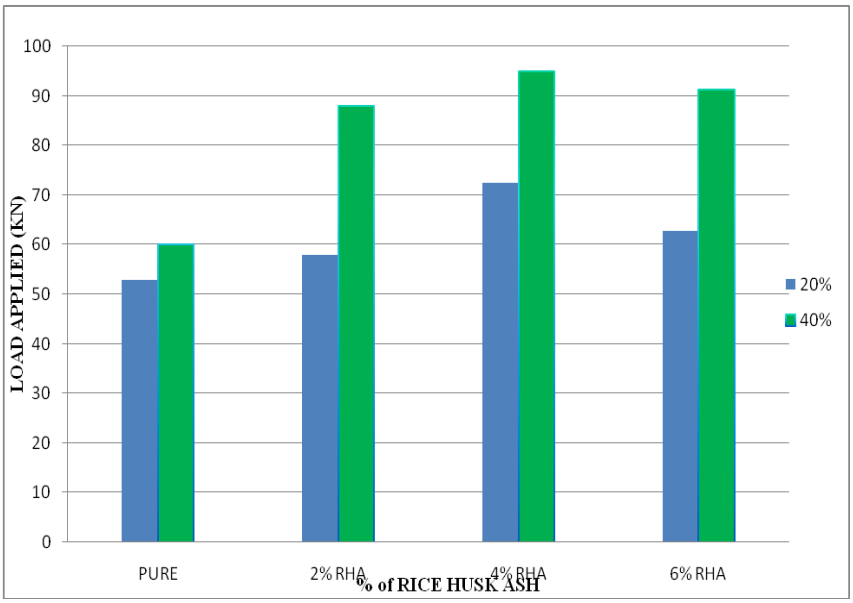

Figure 5. Plot between Load Applied and % Weight Fraction of rice husk ash with aluminium and graphite

3.2 Microstructural Analysis

Microstructure analysis of all the samples of aluminium metal matrix composite are studied and particles of graphite and rice husk ash are finely dispersed among the composite material. Figure 6 shows the microscopic observation of 93% aluminium+5% graphite+2% rice husk ash. Figure 7 shows the microscopic observation of 91% aluminium+5% graphite+4% rice husk ash. Figure 8 shows the microscopic observation of 89% aluminium+5% graphite+6% rice husk ash.

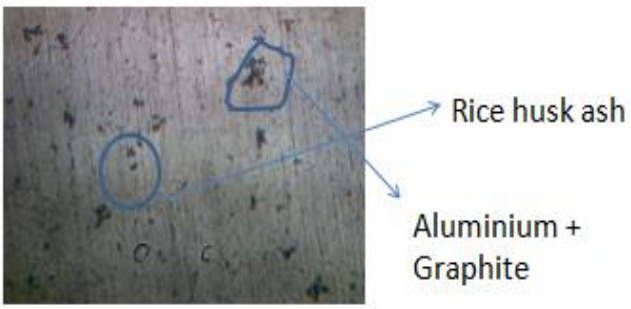

Figure 6. Microscopic observation of 93%Aluminium+5%Graphite+2%Rice husk ash

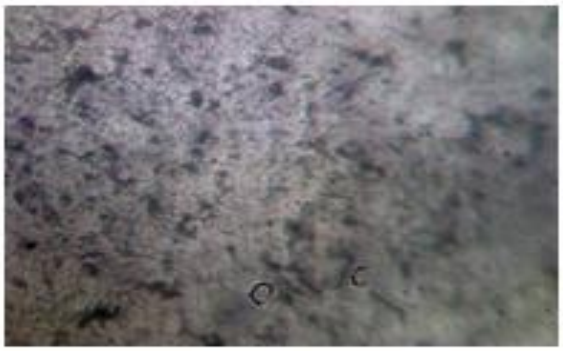

Figure 7. Microscopic observation of 91%Aluminium+5%Graphite+4%Rice husk ash

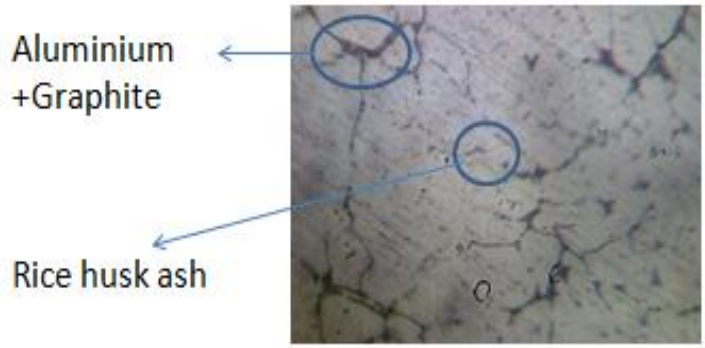

Figure 8. Microscopic observation of 89%Aluminium+5%Graphite+6%Rice husk ash

IV. CONCLUSIONS

Effect of 5 % graphite and rice husk ash as a reinforcement material in aluminium matrix has been discussed in the present work. The test specimens of different compositions of rice husk ash with aluminium and graphite are prepared by stir casting process followed by rockwell hardness test**.** Later compression strength and microstructure analysis are studied. It is observed from the test that as change in % weight fraction of rice husk ash, the hardness and compression test values of aluminium, graphite and rice husk ash metal matrix composite increased upto 4% weight fraction of rice husk ash and then it decreases due to the increased brittleness of the rice husk ash inside the aluminium, graphite metal matrix composite.

REFERENCES

[1] B.P.Krishnan, N. Raman, K. Narayanaswamy, and P.K. Rohatgi, " Performance of an Al-Si Graphite Particle Composite Piston in a Diesel Engine," Wear, vol.60, pp. 205–215, 1980.
[2] M. De Sanctis, "Structure and properties of rapidly solidified Ultra high strength Al–Zn–Mg–Cu alloys produced by spray deposition," Material Science Engineering, A141, pp.103–21,1991.
[3] X. Duan, Y. Hao, M.Yoshida , Ando T, Grant N. J, "Liquid dynamic compaction of aluminum alloy 7150," International Journal of Powder Metallurgy, vol.29(2), pp. 149–59,1993.
[4] P. Lengsfeld, J.A. Juarez-Lslas, W.A. Cassada, E.J. Lavernia, "Microstructure and mechanical behavior of spray deposited Zn modified 7XXX series Al alloys," International Journal of Rapid Solidification, vol.8, pp. 237–65,1995.
[5] L. P. Troeger, E. A.Starke, "Microstructural and mechanical characterization of a superplastic 6xxx aluminum alloy," Material Science Engineering A, vol.277, pp.102–13, 2000.
[6] L. K. Berg, J. Gjonnes, Hansen V, X. Z. Li, M. Knutson-wedel, G. Waterloo, et al. "GP-zones in Al–Zn–Mg alloys and their role in artificial aging," Acta Mater, vol.49, pp.3443–3465,2001.
[7] S. H. Lee, Y. Saito, T. Sakai, H. Utsunomiya, "Microstructures and mechanical properties of 6061 aluminum alloy processed by accumulative roll-bonding," Material Science Engineering A, vol.325, pp.228–35,2002.
[8] J. D. Robson, "Optimizing the homogenization of zirconium containing commercial aluminium alloys using a novel process model," Material Science Engineering A, vol.338, pp.219–29,2002.
[9] M. J. Starink, S. C Wang, "A model for the yield strength of overaged Al–Zn–Mg–Cu alloys," Acta Mater, vol.51, pp.5131–50, 2003.
[10] S. Biswas, A. Shantharam, N.A.P. Rao, K. Narayana Swamy,P.K. Rohatgi, and S.K. Biswas, " Bearing Performance of Graphitic Aluminium Particulate Composite Materials," Tribol. Int., vol.13, pp. 171 –176,1980.

