International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

Effect of Mechanical Properties on Palm Sprout Shell Ash Reinforced With Al-6061 Alloy Metal Matrix Composites

PG Student Ram Babu Matta   Prof. Ravindra Babu P   Associate Prof. J A Ranga Babu
Department Mechanical Engineering
Gudlavalleru Engineering College
Andhra Pradesh, India
mattarambabu62@gmail.com

***Abstract*- Technological advancement is progressing in geometric progression to meet the industrial/commercial requirements of design engineers hybrid properties are inevitable. These hybrid properties are substantially ameliorated than that of individual constituents. The properties of any new generation material are highly influenced by their homogeneity in composition. Stir-casting is one of the promising techniques to produce the components at homogeneous mixing of constituents. In the present work, in order to improve the mechanical properties like impact strength, hardness, density and wear resistance of aluminium (6061) - reinforced with palm sprout shell ash at different weight proportions. Current work is ambition to examine that influence of reinforcement of palm sprout shell ash on mechanical properties of aluminum alloy and composites prepared by stir casting technique. The samples are manufactured by varying the weight percentage of reinforcement by 1, 2 and 3 wt%. The micro structural characteristics of composites are studied by using optical microscope. Mechanical properties such as impact strength, hardness are studied and compared the results with base Aluminium alloy results.**

***Keywords*- Palm sprouts shell ash, Al-6061, Stir casting, Hardness and Impact strength**

I. INTRODUCTION

Exhibiting enhanced mechanical and technological properties compared to conventional materials for many real time engineering applications. With the controllable mechanical properties Aluminium Metal Matrix Composites (AMMC) are used as a possible material for a variety of applications such as automobile components, mineral and chemical processing units, transportation industries and aerospace sector and so on [1],[2]. Due to their relation of structure to properties like specific stiffness, specific strength, MMCs obtained more awareness in research and practical applications. Practical utilization rate of MMCs are being in progressive way particularly in aerospace and automobile industries owing to their enhanced properties such as elastic modulus, hardness, tensile strength at room and elevated temperatures, wear resistance with significant weight to lead ratio [3],[4].

In recent past researchers shows more interest on low cost reinforcements. Amid of them fly ash is one of lowest cost reinforcement available at large quantity as a solid waste [5],[6]. B Praveen Kumar et al. [7] studied the mechanical and metallurgical properties of Al-4.5% Cu alloy reinforced with bamboo leaf ash. They concluded that density of the composites is decreased and hardness was increased with increasing of weight percentage of the bamboo leaf ash. The maximum hardness attained at 4% of bamboo leaf ash.

S.D.Saravanana et al. [8] studied the mechanical properties such as tensile strength, compressive strength, hardness and ductility of the Al-Mg-Si alloy reinforced with rice husk ash. From the results it was confirmed that tensile strength, compression strength and hardness are increased and ductility is decreased with increasing fraction of rice husk [9].

Ch.Hima Gireesh et al. [9] An experimental Study has been carried on the mechanical characterization of aluminium metal matrix composites using fly ash and Aloe Vera as reinforcement materials separately. The density of AMC-AV is lower and ultimate tensile strength, hardness higher than both base pure aluminium and AMC-FA. B. Vijaya Ramnath Studied Evaluation of mechanical properties of aluminium alloy–alumina–boron carbide metal matrix composites. The Hardness of the composite is higher and tensile strength, flexural strength are lower than the base material pure aluminium because base material having more alumina content [10],[11].

II. MATERIALS AND METHODS

1. Materials

Matrix material for present research work aluminium 6061 was selected and alloy received in the form of billets the chemical composition of alloy is presented in given below table1.Palm sprout shell ash was selected as reinforcement and they were processed as per standard procedure. Magnesium chips were also used to improve the wet tability between matrix alloy and reinforcement during production of the composite materials.

Table 1.Chemical composition of aluminium 6061 alloy

Element	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Al
%	0.65	0.7	0.25	0.15	0.9	0.07	0.25	0.15	others

2 Methods

2.1 Preparation of Palm Sprout Shell Ash:

Palm sprout shells were collected from farmlands having more number of palm trees in AP India and collected shells are shown in given below figure 1.The shells upper part was filed with the help of file to remove shell tow then cut into small pieces and remove the inner part of shell. After removing inner part of shells they were washed with distilled water to remove the sand particles and dirty. There after shells were dried in the presence of UV rays for seven days to complete elimination of moisture content. Then burned in the presence of air in mud pot until to reach our required carbon less white ash and carbonization of shells were shown in the figure 2 Finally ash was sieved by using BS standard sieve of mesh size is 50 microns.

Fig.1 Palm Sprout shells (PSS)

Fig.2 Carbonization of PSS

Fig.3 Palm Sprout Shell Ash (PSSA)

2.2 Production of MMC

Stir casting technique is one of the promising techniques to fabricate the composite materials. So for present research composites are produce through stir casting route. In this work aluminium 6061 was used as matrix alloy and palm sprout shell ash as reinforcement to produce composites by two step stir casting technique accordance with Alaneme and Aluko (2012a). The aluminium 6061 was in the form of billets then cut into small pieces to freely insert into crucible at the beginning of process to determine the quantities of reinforcement percentages are to be used 0%, 1%, 2% and 3% are added to produce the composites. Load the induction electric resistance furnace with alloy and preheating furnace with reinforcement.

The alloy was heated above liquid state up to 800^0 C then alloy comes into a liquid state. The reinforcement was heated up to 250^0C for one hour to eliminate the dampness and increase the wettability between reinforcement and matrix alloy. For all castings palm sprout shell ash size were maintained fewer than 50 microns. The molten metal is allowed to cool at temperature of 620-650^0C in semi solid state. The reinforcement introduced into a molten metal in presence of argon gas.

At this stage 0.1% of magnesium chips were added to increase the wettability between matrix alloy and reinforcement into the semisolid state of alloy. Then manual stirring was performed up to 5-6 minutes. Then mixed slurry was super heated up to 750^0C and secondary stirring was performed by mechanical stirrer at speed of 600rpm for 10 minutes to reach uniform distribution of palm sprout shell ash in matrix alloy 6061. High purity argon gas was used as a protective shroud on surface of melt. After complete absorption of the palm sprout shell ash into matrix alloy 6061.

The ready composite flow into a permanent steel mould preheated 350^0C of length 200mm, diameter 20mm. The prepared composite is conditioned at room temperature from mould. The fabricated composites are cut into required dimensional samples for microstructure examination, hardness and impact test.

International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

III. MEASUREMENT OF MECHANICAL PROPERTIES

1. Microscopic Examination

A The samples of alloy and composites were prepared by 10mm diameter, 10mm length respectively to examine the surface microstructure by utilising optical microscope. Normal metallographic procedure is used to polishing the samples and Keller's reagent is used as etchant and the microstructure of the specimens were observed consequently by optical microscopy.

2. Hardness Test

Hardness of alloy and composites were measured by using Brinell hardness tester. Specimens were machined by 10mm diameter and 10mm length respectively then polished with different graded emery papers to get smooth surface finish.

3.Impact Test

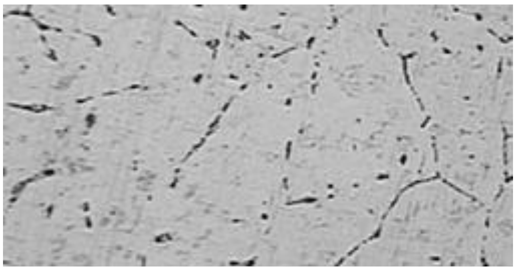
The specimens were prepared for charphy impact test of dimensions 10*10 mm^2 area and 55mm length to check impact strength by using universal impact testing machine. And also V slot was created by sawing then filed it. Below image shows impact test pieces before test. check impact strength by using universal impact testing machine. And also V slot was created by sawing then filed it. Below image shows impact test pieces before test.

Fig. 4 Impact test pieces before test

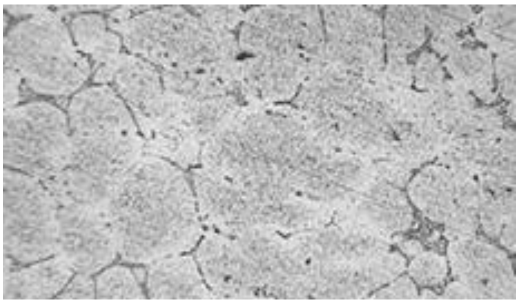
IV. RESULTS AND DISCUSSION

1. Microstructure Steady

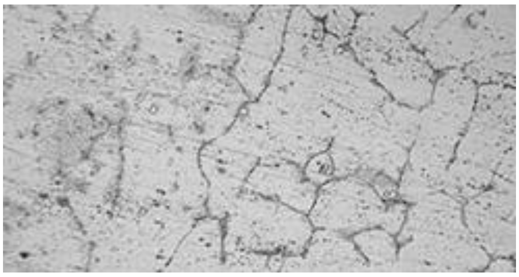
Palm sprout shell ash used in composites was characterised by optical microscope. It can be seen that the grains are coarse compared to Figures (b), (c) and (d) with finer grains when PSSA of 50µm was used as the filer. PSSA of smaller particle size with higher surface area refined the grains of the alloy. It was also observed that PSSA dispersed in AA6061 alloy as seen from the homogeneity of the microstructures. Figures (b), (c) and (d) respectively show the micrographs of the composites reinforced with 1, 2 and 3wt% PSSA of 50µm particle size.



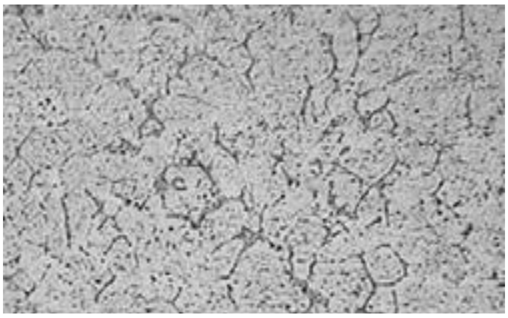
(a)



(b)



(c)



(d)

Fig.5 Microstructure of alloy and composites

2. Hardness

Hardness of alloy and composites observed that Brinells hardness values are increases when increasing of reinforcement volume fraction compared to base alloy Al6061. Because of two reasons they are mainly palm sprout shell ash containing silicon carbide and alumina. And values are indicated in given below graph.

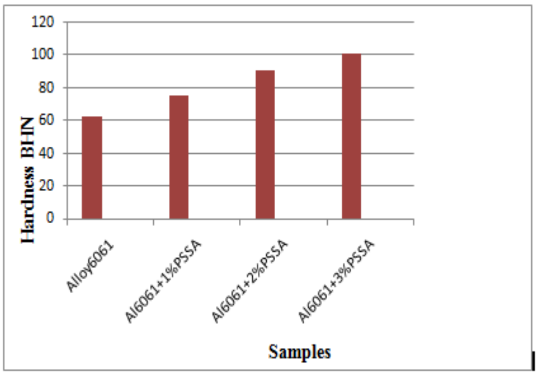


Fig.6 Graph drawn between hardness and sample

3. Impact Test

The impact strength observed from results energy absorbed by the alloy is lower than composites. When reinforcement volume fraction increases then impact specific power would increases. Impact specific power graph is shown in the given below figure.

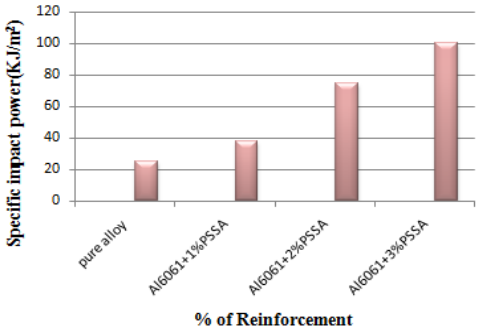


Fig.7 Graph drawn between specific impact power and samples

V.CONCLUSSION

Following conclusion summarised for Al-6061+PSSA composites.

- Composites were fabricated successfully with PSSA by stir casting.
- The micrographs reveal the precipitation of PSSA in acicular form at grain boundaries of the alloy structure.
- Hardness of composites were increases when compared with alloy because alumina and silicon carbide present in PSSA.
- 4.Specific impact power of composites increases with increasing reinforcement percentage when compared with base alloy

REFERENCES

[1] C.S. Ramesh, S. Pramod, R. Keshavamurthy journel of Materials Science and Engineering A 528 (2011) 4125–4132.

[2] Madhu kumar *, Uma shankar, Materials Today: Proceedings 5 (2018) 7604–7608.

[3] E. Subba Rao and N.Ramanaiah Influence of Heat Treatment on Mechanical and Corrosion Properties of Aluminium Metal Matrix composites (AA 6061 reinforced with MoS2) Proceedings 4 (2017) 11270–11278.

[4] Himanshu Kala, K.K.S Merb*, Sandeep Kumar, Procedia Materials Science 6 (2014) 1951 – 1960

[5] V.S. Aigbodion∗, S.B. Hassan, J.E. Oghenevweta Journal of Alloys and Compounds 497 (2010) 188–194

[6] G.V.N.B. Prabhakar ,*, N. Ravi Kumar , B. Ratna Sunil, * Materials Today: Proceedings 5 (2018) 8391–8397.

[7] B. Praveen KUMAR, Anil Kumar BIRRU Trans. Nonferrous Met. Soc. China 27(2017) 2555−2572.

[8] S.D.Saravanan, M.Senthil Kumar, Procedia Engineering 64 (2013) 1505 – 1513.

[9] Ch.Hima Gireesh, K.G.Durga Prasad, K.Ramji, P.V.Vinay, Proceedings 5 (2018) 3289–3297.

[10] B. Vijaya Ramnath , C. Elanchezhian , M. Jaivignesh ,S. Rajesh , C. Parswajinan , A. Siddique Ahmed Ghias, Materials and Design 58 (2014) 332–338.

[11] "D A Prasad Reddy*, P Vamsi Krishna, R Narasimha Rao, N V Murthy, Materials Today: Proceedings 4 (2017) 3959–3971.