ENVIROMENTAL SCANNING ELECTRON MICROSCOPY AND SURFACE ROUGHNESS ON AL -8011 HYBRID METAL MATRIX WITH CHICKEN BONE FLY ASH

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Abstract. Aluminum Metal Hybrid matrix composites, which have made changes to pure material with respect to natural environmental properties like rusting, wear and tear, light, weight etc. In this study, Aluminum 8011 hybrid metal matrix composite fabricated by stir casting methods using L 9 orthogonal array. The environmental properties has been investigated, Environmental scanning electron microscopy, surface roughness were investigated with the casted aluminum hybrid composite. The aluminum hybrid composite was casted with 2%mg with variations of 2%, 3%, 4% of chicken bone ash and 3%, 6%, 9% of SiC as obtained from the microstructure and Environmental scanning electron microscopy. Pin on disc in which wear test shows improved material properties of hybrid matrix composite. Surface Roughness of different parameter been analyzed with taguchi method using design of experiments.

Keywords: Al-8011, Chicken bone fly ash, scanning electron microscopy, surface roughness, stir casting

Introduction

In account of research development in the nanotechnology over decades as the need for hybrid, metal nano composites have improved the performance of the material. The hybrid metal matrix composites has a wide range of factors accessed with the proper distribution of nanoparticles is the major work in the hybrid composites. As the improved results of the alloy Al-8011 casted with combinations of chicken bone ash.

In addition, Sic 2%, 3%, and 4% and 2% of magnesium. In which the chicken bone fly ash has increased the hardness and reduced wear properties of the casted material. The fly ash act as a low cost nanocomposite material has helped to change the properties of the aluminum. The microstructure shows that material has been tightly packed, as reinforcements are highly magnetic to bond the material. This hybrid composite can change the aviation industry as our material shows results of increased hardness ,reduced wear and tear , and ductile . Investigation of Mechanical properties.
Formulated Hybrid Composite Aluminum 8011 Reinforced with B4C and Al2O3 by Stir Casting Method, R. Badrinath, has reviewed that hard ceramic particles increase the strength of the aluminum hybrid composites [1]. The Comparison of the Microstructure and Hardness of Al-B and Al-Mg-B Composites by Mohammad Reza Derakhshesh has studied the various bonding properties of the nanocrystals by the microstructure and scanned electron microscopy [8]. Experimental analysis of the microstructure and properties of Al-8011 by variation of copper content, Tauheed Khursheed has reviewed that hardness and tensile test. It shows that test results informed in phrase that different amount of salts added through the scanned electron microscopy has increased the hardness and wear properties [6]. Preparation and Characterization of an Aluminum 6061 Alloy based Metal Matrix Composite G. Jims John Wessley has studied that good bonding between the reinforcements and hybrid matrix composite [4]. Wear Behavior of Al 8011-Chicken Bone Ash Metal Matrix Composites Arun Prakash, has reviewed that abrasive wear and the influence of load, surface hardness, sliding speed, wear reinforcement fracture and morphology are the parameters that look into the wear properties [3]. Hardness and Tensile Properties of Knee Brace Produced from Cow Bone and Periwinkle Shell Composites, Abdul Kareem Suleiman has studied those properties of adding bone fly ash has increased the hardness of the hybrid metal matrix [2].

2. Experimental setup

MATERIALS

An Aluminum 8011 alloy with silicon carbide and magnesium as the primary alloying element selected. Chicken Bone fly ash selected as a reinforcement nanomaterial of 300 microns. The study is concentrated on hardness [5], wear, surface roughness and scanned electron microscopy properties of the composite materials.

![Stir Cast Material](Fig1.jpg)

STIR CASTING

The Reinforcements of chicken bone fly ash, silicon carbide and magnesium has been distributed into matrix by Stir casting of hybrid metal matrix composites when alumina particles into aluminum melt by stirring. Molten aluminum 8011 matrix alloys containing the silicon carbide powders [9]. Motorized stirrer in the furnace was used to stir the nano particles. The formulated molten metal, with silicon carbide particles, can then be die casted. Stir casting advisable for hybrid metal matrix composites up to 20% volume of reinforcement material. during the melting and casting processes. The final distribution of reinforcements of casted material depends on properties changed.
The experimental boundary varies with the nature of the materials with the liquedification process, physique of stirrer, compactness, and rate of hardness\cite{7}. The sharing of the strength depends on the molten matrix depends on the area of the motorized stirrer, fixing of the motorized stirrer in the melt, with decreasing in temperature, of 720c and then attribute of the reinforcements were added.

3. Experimental results

ENVIRONMENTAL SCANNING ELECTRON MICROSCOPY [SEM]

A scanning electron microscope (SEM) test scans a concentrated electron beam over a polished surface to generate an image. The electrons in the beam interact with the specimen, manufacturing different signals that can be nearly used to obtain information using vacuum chamber about the surface topography and composition. A beam of electrons is focused onto the surface of a specimen-using microscope, camera. Then electromyography is similar with respect to both X, and Y directions, the electrons that are returned back on the specimens surface was collected and then multiplied in magnifications.

The microscope can project highly magnified images because the area scanned on the specimen surface can be varied but the displayed image, so the area of the hybrid matrix specimen scanned to the fixed area of the display is a function of the microscopes magnification. Electrons, which was created by the source, were created up to 40 kV. The size in the Condenser lenses and then images are pointed towards the specimen through the Objective lens reaches the specimen. The wavelength is scanned across the hybrid matrix sample creating election-solid interactions. It gives different types of results given by –the Secondary electrons give information about the hybrid matrix topography, the scattered electrons which give results about al-8011 hybrid matrix composition.

![Figure 2.](image1.png)

![Figure 3.](image2.png)

![Figure 4.](image3.png)

![Figure 5.](image4.png)
As samples shown from fig 2 – 7 samples. as the 6th sample shows that reinforced material is tightly bonded with Al-8011

SURFACE ROUGHNESS

As it is not advisable to machine a specimen with perfectly smooth surface using cutting tools. the distortion and fluctuation are bound to occur. Factors affecting Vibration, material quality, type of machining, rigidity of the machine center, type & material of cutting tool, cutting condition like feed, speed, depth of cut. A portable stylus which is drawn across the surface at a constant speed for a fixed distance across the material. An wavelength signal was obtained and magnify to produce a enlarged vertical magnification as the test report shows that samples from 1 to 6 effectively as it shows that the surface is smooth at sample 6.

| SPEED | FEED | DEPTH OF CUT | Rz | R2 | R1 | R6 | R11 | R12 | R21 | R22 | R23 | R3 | R4 | R41 | R42 | R43 | R44 | R45 | R5 | R55 |
|-------|------|--------------|-----|----|----|----|-----|-----|-----|-----|-----|----|----|-----|-----|-----|-----|----|----|----|
| 800   | 1    | 1.051        | 1.112 | 7.065 | 0.768 | 0.971 | 0.499 | 0.408 | 0.769 | 8.253 | 1.46 | 1.984 | 8.735 | 2.482 | 2.507 | 13.04 | 3.339 | 6.281 | 19.949 |
| 600   | 1.5  | 1.162        | 5.181 | 22.054 | 1.388 | 1.422 | 7.404 | 1.274 | 1.492 | 6.024 | 1.926 | 2.036 | 11.741 | 2.059 | 2.421 | 14.528 | 4.475 | 5.532 | 24.823 |
| 600   | 2    | 1.052        | 5.339 | 22.065 | 4.688 | 5.355 | 24.256 | 1.171 | 1.368 | 5.962 | 3.317 | 3.88 | 16.149 | 3.888 | 4.986 | 18.524 | 4.034 | 9.977 | 30.904 |
| 1200  | 1    | 1.354        | 3.316 | 9.321 | 1.468 | 1.794 | 6.018 | 0.794 | 0.941 | 7.332 | 2.346 | 2.033 | 5.011 | 4.074 | 3.368 | 16.467 | 4.667 | 5.137 | 23.334 |
| 1200  | 1.5  | 1.373        | 7.139 | 25.126 | 1.786 | 3.145 | 9.773 | 1.39 | 1.872 | 8.541 | 3.045 | 2.924 | 14.124 | 4.074 | 5.22 | 16.054 | 3.694 | 7.042 | 17.127 |
| 1200  | 2    | 0.5          | 7.049 | 7.319 | 26.974 | 5.374 | 7.567 | 27.034 | 1.278 | 1.684 | 5.335 | 3.957 | 4.089 | 16.974 | 5.268 | 5.667 | 17.654 | 7.741 | 7.813 | 20.687 |
| 1800  | 1    | 1.5          | 2.697 | 5.316 | 14.054 | 2.389 | 3.457 | 9.334 | 1.367 | 0.955 | 11.935 | 6.304 | 3.347 | 11.324 | 7.069 | 5.334 | 19.427 | 9.485 | 12.041 | 16.954 |
| 1800  | 1.5  | 0.5          | 3.489 | 8.012 | 27.649 | 4.021 | 7.815 | 14.567 | 1.687 | 1.687 | 17.704 | 0.774 | 7.934 | 25.537 | 7.847 | 12.007 | 19.847 | 9.995 | 10.664 | 19.604 |
| 1800  | 2    | 1            | 3.557 | 8.706 | 30.24 | 6.147 | 12.781 | 28.542 | 1.984 | 1.984 | 15.375 | 8.547 | 12.607 | 15.427 | 8.019 | 8.048 | 21.378 | 11.054 | 6.774 | 32.014 |

Table 1: surface roughness data
| Level | Ra    | Rq    | speed  |
|-------|-------|-------|--------|
| 1     | 16.28 | 16.28 | -19.34 |
| 2     | 17.79 | 17.79 | -20.14 |
| 3     | 19.73 | 19.73 | -21.97 |
| 4     | 21.94 | 19.64 |        |
| 5     | 24.25 | 22.11 |        |
| 6     | 19.64 | 22.60 |        |
| 7     | 22.11 | 20.02 |        |
| 8     | 20.02 | 21.94 |        |
| 9     | 22.60 | 24.25 |        |
| Delta | 7.97  | 7.97  | 2.63   |
| Rank  | 1.5   | 1.5   | 3      |

Table 2: surface roughness result

The graph shows that the surface roughness weaken with elevate in speed.

Figure 8: surface roughness graph
Conclusion

1. ENVIRONMENTAL SCANNING ELECTRON MICROSCOPY [SEM]
   As the test results show that in addition of the chicken one fly ash the results show that
   materials are tightly bonded as the nano composite bonds with Al-8011.

2. SURFACE ROUGHNESS
   As the test results show that the material has undergone various parameters on turning process
   with speed of 600, 1200, 1800 respectively and variations of feed and depth of cut. On
   analyzing the casted specimens the Ra ,Rq and Rz values was studied and analysed with
   respect to design of engineering using taguchi method and found that surface roughness is
   less at higher speed.

FUTURE WORK
As the material shows that surface roughness is high at lower speed an addition of graphite
will lower the surface roughness at lower speeds.

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