Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 10, October-2019

Review Paper on Study and Comparative Analysis of Effect of Sic and Graphite Composite on Aluminium

Mr. Ajinkya Ramrao Yadav
M.E, Mechanical Engineering,
Everest college of Engineering and Technology
Aurangabad.

Prof. Rahul D. Shelke
Associate Professor,
Mechanical Engineering,
Everest college of Engineering and Technology
Aurangabad.

Prof. Navnath S. Kalyankar
Assistant Professor,
Mechanical Engineering,
Everest college of Engineering and Technology
Aurangabad.

***Abstract*:- In this present work, systematic study has been conducted to investigate the wear phenomenon by adding micron size silicon carbide and graphite particles into Al6061 base. Al6061 compound was taken as the base lattice to which SiC and graphite particulates were utilized as fortifications. Al 6061-3, 6, 9% SiC-3, 6, and 9% were introduced to the base framework. The microstructural behaviour was analysed through scanning electron microscopy, which uncovered the uniform appropriation of SiC and graphite content in the Al matrix. Pin on-disc equipment was utilized to assess the volumetric wear loss of arranged samples, in which EN32 steel disc was utilized as the counter face. The outcomes uncovered that the volumetric wear misfortune was expanded with increment in applied load, disc speed and sliding distance for every one of the specimens. The outcomes additionally showed that the volumetric wear loss of the Al 6061-2.5% SiC-2.5% graphite composite was smaller than the Al6061 lattice. The worn out surfaces were portrayed by RSM analysis.**

1. INTRODUCTION

1.1 Background

Advances in the development of advanced composite materials from the early 1940s to phenolic glass structures / E to graphite / polyimide compounds used in the spacecraft are dramatic. Recognizing the weight saving potential that can be achieved through the use of advanced composite materials, resulting in lower costs and greater efficiency, explains this growth in anchoring technology, die cutting and tools, Compounds While improvements were made to the manufacturing method in the first two decades, a systematic study of the properties and mechanisms of fracture was in the foreground in the 1960s, and there has been an increasing demand for newer, stronger materials, more rigid and lighter in areas such as air and oil Space, Transport, Automotive and Construction.

1.3 PROBLEM STATEMENT

To know the amount of wear made, through the direct contact of the 6061 aluminum alloy with the surface of the metal counter, it is necessary to experimentally evaluate and measure the corresponding wear. The test is carried out under various operating conditions and under controlled conditions. To generate new performance data, two different percentages of sic and graphite reinforcement were chosen. The experiments must be performed on a standard pin-on-disc machine under high temperature conditions.

1.4 OBJECTIVE OF THE PROJECT

1. To study the chemical & mechanical properties of al 6061 material.
2. Material study
3. To measure the wear under different operating conditions. Therefore, the wear equation will be detected for all materials tested under various conditions.
4. The methodology used is the RSM method for the design of experiments using the orthogonal matrix.
5. Experimental validation of the material
6. Comparative study of the experimental results

2. LITERATURE SURVEY

A. Thangarasu used the FSP technique to produce AA6082 / TiC surface AMCs and to analyze the effect of TiC particles on the microstructure and on the dry sliding wear behavior. Surface AMCs containing five fractions of different volumes were created (0.6%, 12%, 18% and 24%). The FSP was performed using a tool with a rotation speed of 1200 rpm, a translation speed of 60 mm / min and an axial force of 10 kN to produce a surface compound. The microstructure of AMC AA6082 / TiC was studied by scanning and scanning electron microscopy (SEM). The distribution of TiC particles was quite homogeneous in the composite material, regardless of the volume fraction. AMC AA6082 / TiC showed a reduction in mean particle size during FSP. The wear rate was 0.00693 mg / m at 0 vol. % and 0.00303 mg / m at 22 vol. %

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Pardeep Sharma studied the reinforcement percentage that ranged from 0% to 12% in three stages. The percentage of reinforcement, load, slip speed and slip distance was the process variable. The response surface methodology was used to plan and analyze the experiment. The microhardness of the compounds is increased from 49.5 VHN to 44 VHN and macro-hardness from 31.6 BHN to 28.3 BHN, respectively, compared to the percentage by weight of Gr. The wear rate of composite materials decreases. with increasing composite speed. Slip speed and reinforcement and increase with increasing load, slip distance. The wear resistance of the developed composites was lower than that of the AA6082 model in all combinations of reinforcement, load, sliding speed and sliding distance. ANOVA has indicated that the sliding distance is the most influential factor followed by the slip speed, the reinforcement percentage and the load on the wear rate of the composite materials.

Shailesh Singh studied the tribological behavior of AA-6082 aluminum alloy reinforced with silicon carbide particles (3%, 4%, 5%, 6% and 7% by weight of SiC) produced by mechanical washing. agitation. The wear behavior during dry sliding of the samples thrown by shaking was analyzed using a pin in the wear of the disc. The SiC compound reinforced with a defect-free aluminum matrix was produced in the mechanical mechanical molding process. The tensile strength of the material has improved significantly with a larger amount of SiC. This method is the most economical and efficient way to produce an Al-SiCp compound. In the range of test parameters, the wear rate decreases as the SiC percentage increases, while the speed and the normal load increase from the minimum to the maximum limit, the wear rate increases.

P. Ramesh studied the aluminum matrix carbide matrix composite prepared with Al 6082 as base material and SiC as reinforcement material. The weight of the reinforcing material varies from 0 to 10% and several test samples are prepared. Various tests are performed to evaluate the performance of the compound and the results obtained are discussed. The 6082 aluminum alloy is used as reference material for this study. It is a medium strength alloy with excellent corrosion resistance. It has the highest strength of 6000 series alloys. The 6082 alloy is known as the structural alloy. In the form of a plate, 6082 is the most commonly used alloy for processing. The wear test was performed in three experimental ways in aluminum matrix composites. In the wear test considering four three-level variables of how to perform the experimental procedure. The addition of silicon carbide particles (SiC) causes an increase in density and porosity and further increases with the increase in the percentage of the particle fraction. The hardness of the Al-SiC compound increases with the increase in the percentage fraction of SiC particles

Sujan R has done many experiments that will improve and study the additional mechanical properties of the aluminum alloy made with the other metal or other material, such as a ceramic or organic compound, etc. In this paper, we try to study the mechanics and tribology properties of Al 7039 alloy, making it with different percentages of molybdenum disulfide particle reinforcement using the melting process. This work involves the study and observation of changes in the mechanical and tribological behavior of the metal matrix composite by performing tensile, compression, hardness and wear tests in accordance with ASTM. The tensile strength of Al 7039 reinforced alloy and unreinforced Al 7039 alloy was not decided due to impractical results. The compressive strength of Al7039 alloy was increased for a mixture of 3% molybdenum disulfide particles with an Al 7039 alloy compared to pure Al 7039 alloy.

Monika Walkowicz, 2018, Impact of oxidation of copper and its alloys in laboratory-simulated conditions on their antimicrobial efficiency, Copper and its alloys are known for their antimicrobial activity, which makes them appealing materials for various touch surfaces in public facilities. These materials are also known for being prone to tarnishing, especially in contact with human palm sweat. The paper describes investigations on tarnishing of copper and various copper alloys by oxidation at elevated temperatures. After evaluation of thickness and chemical composition of oxide layers, microbiological tests were carried out in order to determine the impact of oxidation on antimicrobial efficiency of copper alloys.

Siddabathula Madhusudan, 2016, Composite metallic materials (CMMs) are prepared by dispersing copper particulates in aluminium matrix using stir-cast technique. Their behaviour is compared with the alloy having similar composition. The effect of particulate composition is studied by varying the copper concentration between5 and 15 wt%. Hardness increased with increasing particulate contents in both cast and homogenized conditions. Composites show a 13% drop in strength and 15% drop in strain compared to the alloy.

Wei Cai, 2011, Effect of Al content on microstructure and properties of Cu- 22.7Zn-Al-1.0Ni alloy, The effects of Al content on the microstructures and the mechanic properties of complex brass (Cu-22.7Zn-Al-1.0Ni) in as-cast, hot-rolled and cold rolled strip were investigated. The results show that Al is able to significantly reduce the size of α phase and increase the area of β-phase. With the increase of Al content, α phase transforms from block to strip shape and distributes more uniform, and the tensile strength and hardness is improved, however, the elongation is decreased.

Md. Habibur Rahman, 2014, Characterization of silicon carbide reinforced aluminium matrix Composites, The Purpose of this work is to study about the microstructures, mechanical properties and wear characteristics of as cast silicon carbide (SiC) reinforced aluminum matrix composites (AMCs). AMCs of varying SiC content (0, 5, 10 and 20 wt. %) were prepared by stir casting process. Microstructures, Vickers hardness, tensile strength and wear performance of the prepared composites were analysed. The results showed that introducing SiC reinforcements in aluminium (Al) matrix increased hardness and tensile

International Journal of Engineering Research & Technology (IJERT)
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strength and 20 wt. % SiC reinforced AMC showed maximum hardness and tensile strength. Microstructural observation revealed clustering and non-homogeneous distribution of SiC particles in the Al matrix.

M. S. Prabhudev, 2014, Influence of Cu Addition on Dry Sliding Wear Behaviour of A356 Alloy, Influence of addition of copper (Cu) on the dry sliding wear behavior of A356 alloy has been reported in the paper. Effect of load, composition and sliding distances on A356 alloy before and after addition of Cu has been studied. Wear test surfaces were examined by SEM/EDX. It was found that wear resistance of A356 alloy decreases with increase in applied normal pressures and sliding distances. However, wear resistance of A356 alloy increased with Cu addition. Increase in wear resistance is mainly because of increase in strength/hardness of the alloy after Cu addition. SEM studies have shown that the layer of oxide material links both the surfaces there by improves sliding wear performance.

Pardeep Sharma, 2017, A study on wear behaviour of Al/6101/graphite composites, The current research work scrutinizes aluminium alloy 6101-graphite composites for their mechanical and tri-bological behaviour in dry sliding environments. The orthodox liquid casting technique had been used for the manufacturing of composite materials and imperilled to T6 heat treatment. The content of reinforcement particles was taken as 0, 4, 8, 12 and 16 wt.% of graphite to ascertain it is prospective as self-lubricating reinforcement in sliding wear environments. Hardness, tensile strength and flexural strength of cast Al6101 metal matrix and manufactured composites were evaluated. Hardness, tensile strength and flexural strength decreases with increasing volume fraction of graphite reinforcement as compared to cast Al6101 metal matrix.

Devaraju Aruri,2018, Wear and mechanical properties of 6061-T6 aluminium alloy surface hybrid composites [(SiC + Gr) and (SiC + Al2O3)] fabricated by friction stir processing, In this investigation, the influence of tool rotational speed on wear and mechanical properties of aluminium alloy based surface hybrid composites fabricated via Friction stir processing (FSP) was studied. The fabricated surface hybrid composites have been examined by optical microscope for dispersion of reinforcement particles. Microstructures of all the surface hybrid composites revealed that the reinforcement particles (SiC, Gr and Al2O3) are uniformly dispersed in the nugget zone. It was observed that the micro hardness decreases when increasing the rotational speed and showed higher micro hardness value in Al–SiC/Al2O3 surface hybrid composite due to presence and pining effect of hard SiC and Al2O3 particles.

Ricardo Augusto Gonçalves, 2015, Influence of Copper Content on 6351 Aluminum Alloy

Machinability, aluminum alloy (Al-Si-Mg). The machinability was evaluated from Measurements of drilling torque and drilling thrust force in cutting tool and surface roughness of the machined surface during drilling process. Samples of 6351 aluminum alloy were produced with different levels of copper (Cu) (0.07, 0.23, 0.94, 1.43 and 1.93%). Cutting speed and feed rate were varied in five levels (60 to 100 m/min and 0.1 to 0.3 mm/rev). The results showed that increasing the copper content in a Al-Si- Mg-Cu aluminum alloy increase the precipitation hardening through the stabilization of hardening phases like Al5Cu2Mg8Si6 and Al2Cu, also the increase in amount of Al2Cu.

S. C. Patnaik, 2018 Wear Characteristics of Aluminium-Graphite Composites Produced by Stir Casting Technique, Metal matrix composites (MMCs) are finding more applications due to their significantly improved properties such as high specific strength, high specific modulus, good damping capacity and good wear resistance compared to unreinforced alloys. In recent years, there has been an increasing interest in composites containing low density and low cost reinforcements. Graphite is one of the most suitable and low density reinforcement available for making light-weight and wear resistant parts for aircraft and automobile industry. At present the particulate reinforced aluminium matrix composites are gaining importance because of their low cost with advantages like isotropic properties and ease of fabrication.

Palanisamy Shanmughasundaram, 2014, Investigation on the Wear Behaviour of Eutectic Al-Si Alloy– Al2O3 – Graphite Composites Fabricated Through Squeeze Casting, Dry sliding wear test was conducted on Al –Si alloy – Al2O3 - Graphite composites which are fabricated through squeeze casting method, using pin –on –disc wear testing rig. The influence of parameters such as applied load, sliding velocity and weight percentage of graphite, on the wear loss of Al- 5 wt. % Al2O3 – Graphite hybrid composite was investigated through Taguchi and Analysis of variance (ANOVA).It was found that the applied load was the most influential parameter on wear followed by sliding velocity and weight percentage of graphite.

R. L. Deuis; 1997, Dry Sliding Wear Of Aluminium Composites-A Review, Aluminium-silicon alloys and aluminium-based metal matrix composites have found application in the manufacture of various automotive engine components such as cylinder blocks, pistons and piston insert rings where adhesive wear (or dry sliding wear) is a predominant process. Materials possessing high wear resistance (under dry sliding conditions) are associated with a stable tribo-layer on the wearing surface and the formation of fine equiaxed wear debris. For adhesive wear, the influence of applied load, sliding speed, wearing surface hardness, reinforcement fracture toughness and morphology are critical parameters in relation to the wear regime encountered by the material.

load, respectively. In addition, the influence of normal load is more profound than pass number at the increment of friction force.

T. S. Eyre 2016, commonly encountered industrial problems leading to the replacement of components and assemblies in engineering, the others being fatigue and corrosion. Wear is rarely catastropic, but it reduces operating efficiency by increasing the power losses, oil consumption, and the rate of component replacement. Wear, as part of the

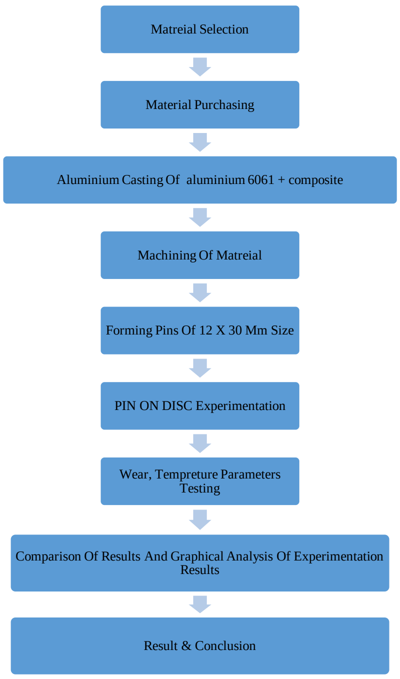
International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 10, October-2019

Tribology scene, is now receiving considerably more attention, although still lagging behind fatigue and corrosion in . research effort. Sufficient is known about wear mechanisms and their solution
to encourage greater application of this knowledge. There are, however, a number of problems which cause considerable difficulty in translating the results of research into industrial practice.

A.M.S. Hamouda, 1996, Mechanical Properties Of Aluminium Metal Matrix Composites Under Impact Loading, A flow stress modd based on plasticity theory has been developed for two different types of aluminium metal matrix composite materials subjected to high strain rate. A combined experimental and numerical techniques are used to determine the flow model parameters. Experimental results consisting of cylindrical impact compression tests and conventional mechanical tests are presented. The parameters of the proposed flow stress model were evaluated based on satisfactory agreement between the predicted and measured final dimension of the test specimen.

3. MTHODOLOGY OF PROJECT

The methodology of project is as follows,



CONCLUSION:

The purpose of this literature review is to have a broader perspective about the different proportions of composite-aluminium and choosing the best combination of the individual parameters considered.

1. Hardness shows the best results when the silicon carbide is employed at 5 % weight percent.
2. Hardness increases with the increase in silicon carbide but decreases with increase in graphite. Hence to obtain an optimum hardness of the desired number, both the reinforced material can be used in proper proportions.
3. Several reinforced materials such as graphite, fly ash, red mud and alumina has shown better results pertaining to tensile strength when compared to Silicon carbide.
4. For the improvement of compressive strength, fly ash particles are the most appropriate ones as it indurates the base alloy.
5. Ductility is one such property which tends to decrease with the addition of reinforced material. It decreases constantly when silicon carbide is reinforced whereas in the case of fly ash, it decreases drastically up to the addition of 10% and then gradually

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