ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

Experimental Investigation on Machinability Parameters Alluminium AL6061+AL203 using Single Point Cutter

[1]Danamu Sri Surya , [2]N Harsha, [3]M N V S A SIVARAM KOTHA, [4]G H Tammi Raju

[1]M.Tech student, [2]Asst Professor, Department of Mechanical Engineering, S.R.K.R. Engineering College, Bhimavaram, west Godavari district, Andhra Pradesh, India.

[1]srisurya106@gmail.com, [2]harsha.n@srkrec.ac.in, [2]sivaramkotha@srkrec.ac.in, [2]tammiraju@srkrec.ac.in

ABSTRACT - Aluminium metal matrix composites(AMMcs) has great demand due to the enhancement of excellent mechanical, thermal, metallurgical and electrical properties like light weight, better corrosion, thermal resistance and high damping capacity. The present investigation aims to establish the tribological characteristics of al 6061 and al7075 compositions reinforced with sic and flyash. Composites were fabricated by stir casting process and studied by using a pin-on-disc apparatus.The reinforcement silicon carbide and flyash were varied with percentages are 5% 10% 15% in AL 6061 and Al 7075 to improve the properties of base metal like strength stiffeness conductivity etc.., AMMCs are widely used in aircraft, Aerospace Automobile and various fields.

Keywords - AL6061+AL203, Alluminium.

I. INTRODUCTION

Aluminum alloys as metal matrix have often attracted researchers in recent past, as additional characteristics could be obtained by strengthened with certain other elements such as greater corrosion and thermal strength and high damping capacitance. Strengthenings are typically carried out to enhance characteristics of base metal such as strength, rigidity, conduction, etc. The key aim of designing reinforcing elements for these AMMCs is achieve desired properties through various matrix stages, reinforcement type synthesis paths, volume fraction processing parameters. Researchers designers are actively researching innovative clever technologies, lightweighted materials and high-performance materials for their ultimate use for automobile and aerospace industries, with ever growing demands and worldliness of technological upgrades. These characteristics traditional material are too difficult to obtain. Composites made up of aluminium metal matrix consist of many advantages over monolithic materials, including high resistance to weight, high resistance to wear, low cost, higher thermal conveying power, lower heat expansion coefficients high strength automotive industries. Reinforcements can withstand the given working temperature and other conditions in these composites. The properties of the aluminium metal composite matrix can be enhanced by means acceptable form of reinforcement with the aluminium matrix. In order to minimise wear, lubrication must be given in the area of wear resistance. However, it is often too hard to reach lubricant externally around damage pieces to minimise wear. Self-lubricated fabrics consist lubricant that can be automatically released during wear. Graphite and molybdenum disulphide are also one of the most widely used stable lubricant ingredients. Wear and friction is caused as two bodies come into contact with each other (sliding or rolling). Any of the system's energy is dissipated by friction and material loss is caused by wear. Therefore collection fitting material complement bodies is very critical. For friction and wear control, solid and liquid lubricants are used. For the nature material, a detailed insight into both wear and friction aspect is very important to choose right material. Although graphite is most commonly used solid lubricant, lack of strength for whole composite is one key drawbacks of using graphite as solid lubricant content. The composites metal matrix now take great deal of consideration to improvement of base metal properties. Aluminum is Earth's three richest element; there are only larger amounts of oxygen and silicone. In the real world, aluminium is widely used because resistance to rust, high weight density, thermal expansion, low melting point, etc. Their use encompasses number fields for their particular useful properties, for example, in home electronics, shipping, industry and trade. This work consolidates reported findings AMMCs with use of most common reinforcement elements, such as Silicon Carbide (SiC), Aluminum Oxide, Boron Carbide, Titanium

 DOI : 10.35291/2454-9150.2021.0072

Carbide, Graphite, Flyash, Zircon, Nanocarbon, Carbon nano-tubes, etc. Any reinforcement element form has been observed to enhance certain characteristics. Although little knowledge is currently available it is considered to help pick correct application of these composites in correct position by examining tribological characterization of AMMCs in each elements as strengthening factor. In addition, procedure or procedure for manufacture of AMMCs with reinforcement will also impact improvement and performance. Thus, purpose studying various manufacturing processes for AMMCs is to display most cost-effective production process which ultimately offers cost benefits and improved quality. The literature has shown that manufacturing process has major impact on composite's mechanical and tribological propensities by having its influence on matrix, grain size, porosity, reinforcing particle distribution aluminium / reinforcement couple interface characteristics. This vision was accomplished by execution of three strategic objectives: i. Reducing prices of discontinuously improved AlMMCs by 2010 is equal to current alternatives ii. Establish infrastructure required to provide AlMMCs with trust iii. Increasing AlMMC market size Composite material: A compound is blend two or more chemical-separated components or phases, separated by different interface, can be conveniently identified microscopic scale. In other words, composites are composites made out of 2 or more substantially different component materials of physical, chemical or mechanical characteristics which at macroscopic level in finished structure remain separate and unparalleled. These materials have greater combination properties than traditional materials when they are suitably built. They have at least one thing that single constituent cannot do. The constant and in most cases greater amounts available constituent is matrix. In the process composite processing it generally found that it is properties matrix that are enhanced. Reinforcement and matrix consist composite substance. The key step is called matrix and has constant character. Matrix is typically ductile in nature, improved step is maintained in desired state. Matrix's key role is assist loading move it secondary stage or strengthening. It binds and defends against mechanical injury, chemical damage and handling. The individual strengthening is also extracted desired shape is formed. In discontinuous manner, second ingredient is inserted or distributed into the matrix. The matrix phase, called fragmented or secondary phase, is rounded out. The distributed phase is usually tougher and heavier than matrix phase also known as reinforcement phase. Strengthens overall mechanical features matrix.

ALLOY: An alloy is metal or metal mixture separate metal part. A bonding character metal alloys are described. A single phase or combination metal phases can be stable metallic solution. Intermetallic compounds are alloys with given stichiometric and glass structure, whereas zintl phases also are known to be alloys according to form of bond. In wide range uses, alloys are used. In some cases, metal mix may reduce the cost material while retaining essential properties. The mixture metals, in some situations, confers synergistical properties as components of metal such as resistance to corrosion or mechanical power. E.g. alloys include steel, solder, metal, pewter, duraluminum, anamalgam of bronze. For usage and atomic purposes, alloy constituents are typically determined by mass percentage for fundamental science experiments. In addition to atomic arrangements which form alloy, alloys are traditionally categorised as substitutional or interstitial alloys. They may also be categorised as homogenous or heterogeneous (composed two or more stage) or intermatal (constructed from two or more phases).

1.1 Composites of different matrix material

- Metal Matrix Composites (MMC)
- Ceramic Matrix Composites (CMC)
- Polymer Matrix Composites (PMC)

1.1.1 Metal matrix composites

Metal Matrix Composites have many benefits over monolithic metals, such as higher specific module, improved reliability, better characteristics at higher temperatures, and lower thermal expansion coefficients. Composites are considered for different purposes because of certain properties metal matrix. Combustion chamber nozzle, housings, tubes, rope, heat exchangers, structural parts etc.

1.1.2 Ceramic matrix composites

Rising resilience is big target in manufacture of ceramic matrix composites. Of course it is hoped that strength and stiffness ceramic matrix composites can be strengthened and regularly seen.

1.1.3 Polymer matrix composites

Polymeric materials are most common matrix materials used. There are two explanations for this. The mechanical features polymers are usually ineffective for certain structural applications. Their strength rigidity in comparison to metals and ceramics are in particular poor. The strengthening other polymer components overcomes these problems.

1.2 METAL MATRIC COMPOSITES:

Composite substance made least two separate phases is metal matrix composite. One is metal or other materials such as ceramic (SiC, Al2O3 etc) or organic compounds, other material may be a separate metal or other material. When there are at least three distinct components, the hybrid composite would be named. MMCs have numerous advantages over traditional materials including high thermal and electrical conductivity, strong environmental chemical resistance, high impact resistance, erosion resistance, etc. In contrast to matrix alloy MMCs demonstrate greater strength and rigidity. In various areas

 DOI : 10.35291/2454-9150.2021.0072

like domestic furniture, automotive industries, aerospace, defence, commercial and industrial areas, etc., composite applications can be clustered according to their needs. Because of its high strength to weight ratio, composites of metal matrix play significant role in aerospace applications. This is attributed to efforts minimise weight in tandem with high value weight savings for higher performance and payload capability. Aeronautical applications include aircraft structure, aircraft motor, room structure and other spatial applications. An automobile engineer has demanded improved rigidity, low thermal expansion, corrosion tolerance, wear and cycle fatigue resistance, etc. On the automotive industry. In automotive applications weight saving is also critical for achieving high performance upgrades at lower cost. Examples include engines, braking mechanisms, drivetrain other vehicle applications for automotive applications. Improved efficiency is highly regarded in corporate and manufacturing industries. In the aerospace industry, too, many of the materials that help are used already in this field. For example, recreational, computer hard drives and other industrial applications will be business and industrial sectors. In various MMCs, aluminium matrix composites are commonly used as result their high strength weight ratio in various industries such as vehicles, aerospace, electronics, industrial machinery and sporting goods.

1.3 LIQUID-METAL-MIXING PROCESSES : The fluid/metal blending method requires introduction into liquid or semi-solid aluminium matrix reinforcing particles or short fibres by stirring process. In the method stir casting, ceramic particulate matter is inserted in fluid aluminium casting and is solidified. It is necessary to ensure good weight resistance between particle strengthening liquid melting aluminium alloy. Up to 30 percent ceramic particles can normally be incorporated in variety moulded aluminium alloys between 5 and 100 µm [16]. Surappa [4] Identifies another variation, known as compo-casting, stir casting process in which semi-solide ceramic particles are mixed into alloy. Since 1990s, commercially available particle-reinforced AlMMCs have been significantly available. The combination of enhanced mechanical and physical properties offered by reinforcement, while still retaining favourable metal working properties and mostly metallike results, has driven the interest in these MMCs. A second consideration was ability, by choice reinforcement composition along with alloy matrix, to adjust the mechanical and physical properties.

1.4LIQUID-METAL-INFILTRATION PROCESSES :

In liquid metals, the molten aluminium or its alloy are either transferred as lined bed rigid, standalone structure onto preform reinforcing. To protect their consistency and form, silica and alumina mixtures must also be used as binder. To overcome the wetting and capillary resistance, certain degree pressure is required and can vary from air to thousands of pascal. In this method, the idea was to use excellent strengthening properties product, which was formed in the main by casting to form net. This process can generate material with range of refuerction volume, but is optimal for refuerction levels above 50% and in some cases up to 80%. The materials provided by this process are therefore perfectly suitable for electronic packaging [19, 21]. Other method variants include in situ preparation and spray deposition. The drips may either be produced using moulded bath (Osprey process) in spray deposition technique or by continuous feeding into the rapid heat injection area cold metal (thermal spray process). In the development of AlMMCs, ceramic reinforcement was injecting into this process into spray. The AlMMC is relatively cheaply processed by spray deposition system with costs typically between stir cast P/M methods. In situ processing refers to various procedures, including oil solids, liquid liquid, liquid gas and salt reactions. In situ processing is required. These processes result in refractory strengthening in matrix aluminium alloys. For instance, alloy Al-Mg is positioned in path aluminium oxidation (DIMOX process) [4] in crucible on top ceramic preform and heated to proper temperature whole assembly in atmosphere free-flowing gas blend nitrogen. The al-Mg alloy molten then infiltrates in preform [22]. In development Toyota piston, discontinuous fibre preform was infiltrated by squeezed cast to increase wear resistance on piston ring land locally, liquid-metal-infiltration process was first successfully seen. Since then, technology for many car and military powertrains and suspension components has been adopted[20]. Solid-state processes Mixture of reinforcement (particles/whiskers) into solid state matrix require solid-state processes. These methods used historically to generate AlMMCs with highest property combinations using solid state-based processes like P/M. These materials are therefore used mostly for higher-performance applications, particularly in aerospace and auto industries, where they are used in high-performance modules, most which are fatigue-dominated. The ceramic whiskers were initially made, ceramic particles improved materials were subsequently followed. These materials have provided substantially improved characteristics on the base metal, albeit costly in terms of both reinforcement and manufacturing costs. They have also been used in variety of high performance, militarily and commercially. Owing to the health risk posed by whisker enhanced MMCs, particulate enhanced MMCs in many applications have replaced them, leaving advanced military applications for whisker-reinforced MMCs[23]. In addition to being of reduced cost, particulate reinforcement also demonstrated strength and rigidity gains almost as strong as those seen in whiskey reinforced compounds

 DOI : 10.35291/2454-9150.2021.0072

ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

1.5: PROPERTIES OF ALMMCS AND RESULTING END USES : Aluminum properties and AlMMCs Generally, because following characteristics, most of them imparted to their alloys and/or composites, aluminium has derived its significance in industrial and commercial applications:

i. The mass of aluminium is light; just one third steel is its density.

ii. Weather proof aluminium, common gases large variety of corrosive liquids are common ambient compounds.

iii. Aluminum is healthy and can be used for variety of foodstuffs.

iv. Aluminum is commonly used in variety of cosmetic uses, due to its high reflectivity.

v. Aluminum alloy strength can match (and exceed) often normal steel building strength.

vi. Aluminum is extremely elastic, property that enables used in shock-prone systems.

vii. In comparison to carbon stones would experience embreachment, aluminium has special mentality that maintains its hardness to very low temperature.

viii. Aluminum is easy work shape and can be quickly rolling on very thin gauges

ix. The electricity heat aluminium is almost critical as copper.

1.6 STIR CASTING PROCESS:

In this work casting procedure is used for manufacture hybrid metal matrix composite as seen in **Figure 1.** Stir Casting is liquid state manufacturing's easiest and cheapest process. The liquid composite material is then cast and solidified into sand casting mould. Mixing or stopping any chemical reactions between refreshment and matrix content is kept to correct temperature level. The temperature and stirring time is most important parameter for stir casting, since they affect the composite structure and properties. In the current job, stir casting is used where reinforcement particles (SiC, gr, MoS_2) are combined with mechanical stirring operation in liquid matrix state (Al6063 alloy). The inherent benefits this approach are described below. Casting is relatively easy and inexpensive. Distribution reinforced phase can be increased if process parameters are streamlined, including when reinforcement is mixed semi-solid state, use optimum speed stirrer form vortex, minimise surface tension matrix, to increase its wettability etc. Rheocasting is known way blend strengthening process in semi-solid state. The mixing refurbishing particles has been shown to be easier with high matrix viscosity than with low viscosity. However, Stir Casting has few drawbacks that must be taken into account during production. In an irritated casting process, focus is very necessary when reinforcing step in matrix is evenly distributed. Due to difference in density reinforcement matrix that can be fully mixed with fast mixing, particles frequently form agglomerates in an agglomerated phase. In terms of length, contents strengthening stage do not exceed 30%. The access of environmentally-friendly gases to melt can, however, be avoided because ambient gases react with molten metal and form oxides and unsolicited porosities. An Inert gas envelope should be provided to their atmosphere to prevent the reaction between atmospheric gas and molten metal.

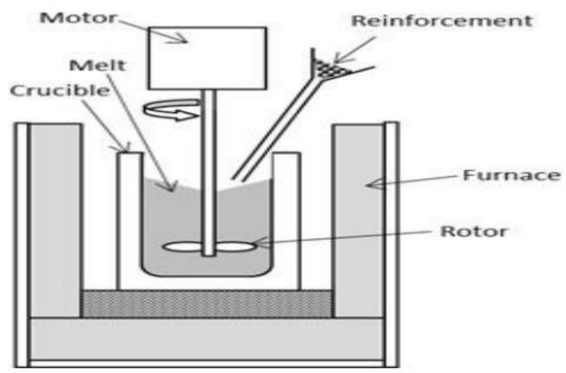

Figure 1. Stir Casting precess

Concept of Tribology:

The word "tribology" is derived from Greek word "tribos," meaning to rub or slip. The friction, wear and lubrication communicating surfaces is explored in tribology in relative movement. Tribology is interdisciplinary discipline that includes mechanical engineering, dynamic fluid, chemistry chemical technology, materials science and related industries in different areas. There is no wear and friction-related process, machines and appliances. Due to wear and friction issues, approximately70% of mechanical components malfunction while working. Owing to friction one third world's energy supplies, rest them are lost. The wear behaviour of materials is thus of prime importance.

WEAR

Wear is mechanism gradual material loss from touch and sliding working surfaces of solids. A poorly worn debris is unconnected stuff. The material is called wear withdrawn in relative movement from one or both rigid surfaces (sliding, rolls or impact). Mechanically abrasion, chemical reactions or mixture two processes is carried out and is usually accelerated very rapidly by increase in temperature. To avoid loss useful system components in automotive applications, it is extremely important to consider wear behaviour aluminium metal matrix composite.

II. LITERATURE SURVEY

Atla Sridhar, et al. (2019) [1]

In this research, they revealed the smart mechanical characteristics of metal matrix composite reinforced with carbide ceramic (SiC) material. However, metal-based composites need improvement in friction and tribology. In

 DOI : 10.35291/2454-9150.2021.0072

this analysis, an attempt is made by incorporating graphite, which acts as solid lubricant, to design a whole new substance. The graphite effect on the tribologic activity of hybrid composite Al7075/5 wt was studied in this report. SiC/X wt percent. Graphite percent (X=10, 5, 0). The study confirms wear efficiency by applying graphite to composite. The Al 7075 (aluminium alloy 7075) strengthened Sic-graphite was examined. The composites were prepared using metallurgy route. **Prasad reddy. A, et al (2019) [2]**

The tribological properties of nano-particle AA6061-reinforced nanoparticles were analysed at 2% SiC and X wt% Gr (x=0.0,1,1,1.5, and 3). This research seeks to process aluminium metal composites (MMCs), to be strengthened using alumina (Al2O3) and to analyse the mechanical and tribological behaviours. Al even though Al is more hard, heavier, wear resistant and corrosion safe at high temperatures. It is time to further develop characteristics to maximise its use applicability. With Al2O3 particles in aluminium metal matrix in various weight fractions, sintered Compacts have been packed (10 percent , 15 percent , 20 percent , and 25 percent). Then thorough study was performed of the mechanical and tribological properties for assessment efficacy methodology adopted in manufacturing. This is an efficient means adjusting the properties materials in various ways when appropriate. Composites aluminium metal matrix are effectively made with varying amounts of weight of alumina (Al2O3). Compression force on composites was effective matrix of composition is observed. Content hardness of Al2O3 percentage tends to improve. Density and hardness of composite materials decrease as GR increases. They also analysed the wear coefficient of friction using Gr material.

Jims john wessley. G, et al. (2019) [3]

The aluminium 6061 preparations and characteristics with reinforcements such as oxide and flying ash have been varied by a volume fraction of 5%, 10%, 15%, 9%, 11%. This composites are developed using stir casting process and used SEM and EDAX to perform micro-structural analyses. Six samples were produced with examination of their mechanical characteristics and microstructural characteristics and performance. Then the composite with Al 6061 and Fly Ash-3 percent, Al2O3-6 percent, showed improved mechanical properties, such as strength, wear resistance and stiffness, compared to the parent composite material, compared to volume fraction Magensium-1 percent. A hybrid Metal Matrix with AA6061 as matrix reinforcing alumina is cast and analysed, as well as small amounts of magnesium. Then the samples are mechanical and micro-level analysed findings obtained are obtained. The findings revealed an improvement in strength in tensile strength by 3% while using ash and alumina (90 percent AA 6061, 3 percent FA and 6 percent Al2O3&1 percent Mg). The SEM and EDAX micro-struktur analysis indicates strong relation between the reinforcement matrix. By improving certain mechanical features of alumina oxide and fly ash reinforcement, such as tension and toughness could be improved.

Rinki yadav, et al. (2018) [4]

Composites made aluminium metal matrix (MMC) have a vital role to play, due to their special combined properties, in diverse fields such as automotive, aerospace, military, aircraft, sheet metal construction etc. The characteristics such as high weight to strength, high wear resistance low costs increase the need for aluminium composites. Different processing methods to manufacture these composites are available. Stir casting is a commonly used technique for manufacture of aluminium composites in liquid phase processes. This article analyses impact of diverse reinforcements on aluminium alloy tribological and mechanical properties. Different reinforcements are used for manufacture composites like SiC, Al2O3, TiC, MoS2, etc. Depending on application we may manufacture composite material with single reinforcing or mixture two or more reinforcements. Besides, we can also use alumina coatings, calcium zirconia stabilised coatings, plasma electrolyte oxidation layers, etc. in order to enhance the aluminium alloy surface properties. This layers are commonly used if movement between two surfaces is desired. In this article, we have analysed many reinforced materials used for processing, mechanical and wear properties aluminium composites. It is evident from analysis of literature that properties composites depend largely on form of strengthening differ according to strengthening material. Adding red mud also improves plastic hardness. Composite hardness decreases when adding graphite particles but improves tribological behaviour.

Darshan, et al.(2018) [5]

The working paper addresses studies on microstructure and mechanical conduct and tribological characteristics with graphene nano composites of 4 different weight percentage aluminium alloy (7000 series). Composite Aluminum Matrix with nanograph is manufactured with casting process of liquid stir. Scanning electron microscopy and EDS have been studied for microstructure of the composites. Furthermore, plastic mechanical behaviour. Tensile properties such as hardness, maximum stress; performance strength and wear according to ASTM specifications were evaluated. The study shows that with increasing wear percentage and wear test performance, overall tensile strength, yield strength and composite stiffness increases, rate of wear increases. In the preparation of graphene-based aluminium alloy, technique liquid metallurgy was successfully implemented. The microstructure study has shown that uniform distribution (graphene) of reinforcing is observed and due to improper casting, certain specimen vacuums and porosity are present.

 DOI : 10.35291/2454-9150.2021.0072

ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

L. Natrayan et al. (2018) [6]

In this article, SiC and various leaf ashes (Bamboo leaf, Neem leaf and tamarind ashes) used as reinforcement were provided as AA6061 as matrix. AA6061 Metal matrix with different leaf ashes and silicon carbide as insulation was tested for its mechanical and wear properties. The findings show that micro or nano levels typically cause mechanical properties materials to expand while ash particles are present. BLA tends to produce more stiffness compared to TLA and NLA, according to our observation. Density has decreased as quality leaves ash increased; BLA is less than pure AA6061. Its porosity is overall 2.7943%. Compared to other processed samples, AA6061/SiC/BLA exhibits greater tensile strength and output strength. Mixing of the ashes and SiC with matrix in microstructure. It is apparent that SiC/leaf ashes particulates inside Al6061 metal matrix have no vaids and discontinuities in composites formed using stir casting process. Finally, composites tested mechanical and tribological properties of their respective microstructures and their wear-bearing surface.

III. METHODOLOGY OF THE WORK

Introduction The design details proposed study are given in this chapter. The chapter explains working and research design approach focused on selection of input criteria, selection of materials for manufacture of aluminium composites, processing processes, laboratory equipment and facilities used to determine the aluminium metal matrix composites properties, and the process parameters that were helpful inachieving them.

3.1: MATERIAL SELECTION

The constituents (of the composites to be manufactured) are defined in this section in relation to their characteristics, features, range, etc. to be included in the proposed work. Method and materials The table indicates how parent substance selected for this analysis is chemical in composition.

TABLE :1 COMPOSITION OF ALUMINIUM 6061

Elements of Al6061	Percentage %
Copper	0.4
Manganese	0.15
Magnesium	1.2
Silicon	0.8
Zinc	0.25
Titanium	0.15
Iron	0.7
Aluminium	96.35

TABLE:2 COMPOSITION OF ALUMINIUM 6061 BY WEIGHT PERCENTAGE

Elements of Al6061	Percentage %
Copper	0.20
Manganese	0.30
Magnesium	2.4
Silicon	0.40
Zinc	6
Titanium	0.20
Iron	0.50
Aluminium	90

In the analysis currently under way, reinforcing components are Silicon Carbide and Fly Ash. Silicon carbide particles have been one most common phases of enhancement for many metal composites based on aluminium alloy. They are hard brittle, high-force, extremely elasticity, highly thermal and electrical reactive ceramic particles. The remains boilers of thermal power plants are Fly Ash. It is available in abundance and even at very low prices since it is a byproduct. Table displays chemical compositions of Silicon Carbide and Fly Ash

TABLE 3:COMPOSISION OF SILICON CARBIDE & FLY ASH

Elements of Fly Ash	Wt%
CuO	0.01
Na_2O	0.34
MgO	0.38
CaO	0.63
K_2O	1.09
TiO_2	1.14
Fe_2O_3	2.78
Al_2O_3	19.09
SiO_2	59.98

The composite samples in present study are obtained by stir casting method. The stir casting apparatus used in the study is shown in **figure 2.**

Fig 2:stir casting apparatus

 DOI : 10.35291/2454-9150.2021.0072

International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

- Stir casting process was used to prepare SiC and Fly Ash matrix composites reinforced.
- To resistance oven, aluminium matrix alloyed has been melted.
- CERT The molten molten metal crucible was withdrawn from stove and sodium modifier processed And the liquid melt was allowed to cool down only below temperature of the liquid so that semi-solid melting could be obtained at free-heating state (500oC per hour).
- About two hours of Silicon Carbid particles have been preheated at 750°C. For stirring purposes, an electric resistance oven fitted with graphite impeller is used.
- Back As weighted and preheated up to 750° C for Fly Ash reinforcement prior to melting, same technique has been applied. It was done to encourage elimination and enhancement any remaining moisture.
- The Fly Ash preheated particles were inserted at steady rate of 5, 10, 15 wt% into the molten metal. T he molten alloy is thoroughly stirred manually for 15 minutes, on the reinforcing particles.
- A after manual stirring semicolivian fabric was heated by automatic mechanical stirring in resistance furnace using mixer to homogenise smelter for approximately 200 rpm. There was thermocouple dip calculation temperature of the molten metal.
- By continuation same process with mixing silicon carbide and ashe-fly, other formulations were prepared respectively by 10%, 15% by weight. It was split composites were replaced while the mould was cold.

3.2:EXPERIMENTAL EQUIPMENT AND FACILITIES

A description different machines and equipment used in present study to manufacture, characterise and test composites is given in this section. This section. Balance Weighing For measuring specimen before after an experiment, digital balance was used.

It is a very precise and reliable measuring instrument with 0.0001 g minimum.

Figure 3 : Weighing balance

3.2.1 CASTING FURNACE

A Casting oven is hot chamber oven and due to electric heating feature, walls furnace are radiated by heat. The substance that is heated does not have any interaction with flames.

`The casting furnace is used heat and, by theory convection and radiation, melt material to temperature requested. Figure reveals that casting stove has a mean temperature of 11000 C

Figure 4: Casting furnace

3.2.2 GRAPHITE STIRRER

A stirrer purpose is stir molten metal mix reinforcing particles into metal. The architecture of Stirrer plays an important role in maintaining vortex structure for homogenous particle dispersion. A graphite agitator with 45 degrees is seen in Figure 5. Stirrer speed is very important parameter for sustaining vortex in stir casting process. During the manufacture stir casting, 240 rpm is used to create vortex efficiently without scattering moulded aluminium.

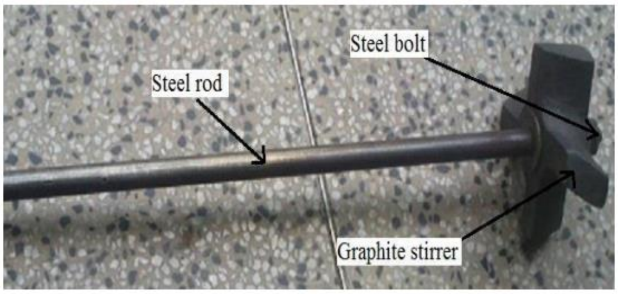

Figure 5: Graphite stirrer

3.2.3 TENSILE TEST

Whenever an external force mechanism operates on body, it is warped. The deformation disappears as the stresses are withdrawn when body is strained beyond its elastic boundary. It has also been found that the deformation does not seem to vanish completely past elastic boundary even though the forces are eliminated and some residual deformation persists. The core principle of the universal test machine is to provide force on a sample surface and measure force per unit area by means of the sample. The tensile strengths of the silicone carbide and fly ash aluminium metal composites are obtained by stir casting

 DOI : 10.35291/2454-9150.2021.0072

ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

technique in varying proportions and then heattreated measurements are tested on regular tensile sample. The sample sizes are chosen according to specifications ASTM E 646-98. Tensile checks on 20 tonne load capability of the UTM were conducted with strain gauges correctly calibrated.

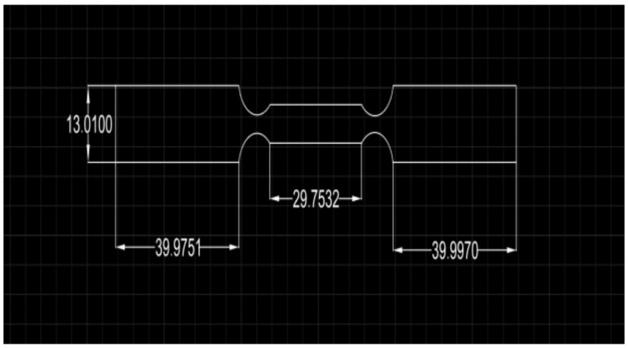

Fig 6:Tensile testing of specimen samples

3.2.4 HARDNESS MEASUREMENT

Composite surface features are major contributors to wear and friction. The mechanical properties substance are hardness. Hardness is easy and very basic way obtaining the material's mechanical strength. The underlying theory hardness test is the indentation force on specimen surface calculation of indentation dimensions. The Rockwell scale is hardness scale classified by material hardness. In contrast to pre load penetration, Rockwell test machine tests reliability depending on the penetration depth insect. The effect is an unmatched number like HRA, HRB, HRC, etc. The Rockwell scale is defined by last alphabetical letter. Figure 3.13 shows the rockwell hardness test machine Hardness casting mmc in a B scale of 1.588mm ball diameter and 100kgf was done in this study. in this study. Hardness was measured on all sides sample at three separate positions and sampled is cut between the composite material centres. The three separate sites were recorded on average.

Figure 7: Rockwell hardness testing machine

3.2.5 IMPACT TEST

Many devices or system parts are unexpectedly subjected to an impact blast. To assess whether substance is appropriate for resistance to impact. The Charpy impact test calls for nodded impact specimen with swinging weight or tup tied to pendulum that swings. At its v-section, the specimen is disturbed by effect, and the pendulum top swing is used to monitor amount of energy consumed (not even the hardness) in the process. Energy absorption is closely correlated with the material's fragility, the charpy test takes place at range of temperatures to demonstrate the ductile to broken transitions relationship in absorbed material energy. Specimens of effect was tested in the range between -452°F and 500°F at defined temperature ranges, e.g. -20° C, - 10° C, 0° C, 10° C, 20° C. The sample will be easily put in special holder in test system hits the exact temperature. The charpy test specimen is horizontally located and is protected on two side by notch faced away from the pendulum or striker. Charpy effect test is used to determine and use in quality management applications the relative hardness and/or affect toughness of products. where an inexpensive and swift test is.

Figure 8:Charpy testing machine

IV. RESULTS AND DISCUSSION

Hardness of the Composites Rockwell hardness testing system tests hardness composites. Table 4 shows hardness aluminium alloys and composites product matrix according to the weights reinforcing particles (silicon carbide, fly ash).

The hardness of composites can be understood by figure 9 as function weight increase percentage SiC, but due to its gentle nature, hardness relative to flyash is marginally lower The improvement in silicone carbide reinforcement in composite has been observed to increase the hardness and to achieve limit 15 wt. Percentage. Percentage.

The improvement of metal matrix composite hardness is due to hard SiC reinforcing particles, the uniform distribution of SiC among the composites in metal matrix and the increased composite density.

 DOI : 10.35291/2454-9150.2021.0072

ISSN : 2454-9150 Vol-06, Issue-11, FEB 2021

4.1 HARDNESS

TABLE 4 : HARDNESS OF THE COMPOSITES

S.No	SAMPLE	SiC	Fly Ash
1	AA6061	62.8	62.8
2	AA6061 + 5%	66	66.02
3	AA6061 + 10%	69	69.02
4	AA6061 + 15%	74	72.12

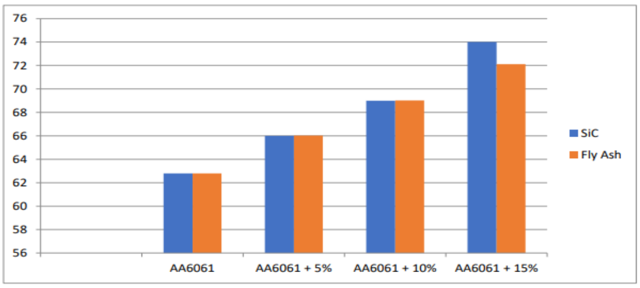

Fig-9: hardness strength graph of AL& SI

4.2 :TENSILE STRENGTH

Table 5:composision of tensile strength:

S.No	SAMPLE	SiC	Fly Ash
1	AA6061	115	115
2	AA6061 + 5%	122	126
3	AA6061 + 10%	126	132
4	AA6061 + 15%	130	135

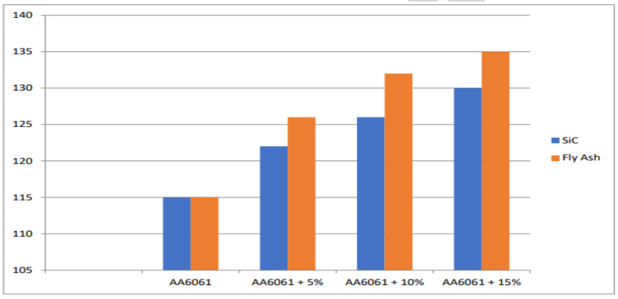

Fig10:Tensile strength graph of AL& SI

4.3 IMPACT STRENGTH

Table 6:composision of impact strength:

S.No	SAMPLE	SiC	Fly Ash
1	AA6061	2	2
2	AA6061 + 5%	2.8	2.5
3	AA6061 + 10%	3.5	3
4	AA6061 + 15%	4.5	4

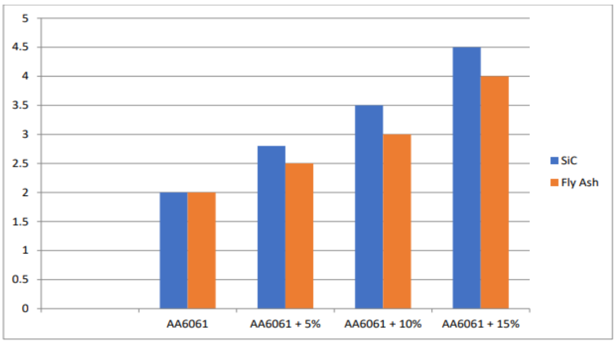

Fig11:Impact strength graph of AL& SI

V. CONCLUSIONS

This experimental study aimed at preparing an Al6061 hybrid metal matrix composite (AHMMC) with the non-metallic ceramic reinforcement materials SiC, Al2O3, and fly ash using the stir-casting technique and to explore its mechanical characterization. The density of the proposed composite is decreased and the mechanical properties, including hardness, tensile strength, and yield strength, were slightly lowered compared to that of an Al6061 MMC reinforced with a single ceramic reinforcement material.

The AHMMC prepared with equal amounts of SiC, Al2O3, and fly ash (each of 5 wt %) possesses a tensile strength of 117 MPa, a yield strength of 79 MPa, and a hardness of 53 BHN. Thepresent study is confined to observing the variation of mechanical properties with the simultaneousincrease of weight percentage of SiC and Al2O3in equal amounts in two steps (7.5% each and 10%each) and without any change in fly ash content. The following remarks can be made.

When the SiC and Al2O3 content of each increased from 5% to 7.5%, the tensile strength of thecomposite increased by 8.2%, the yield strength increased by 36.48%, and the hardness increased by 20%.

The increase of SiC and Al2O3 content from 5% to 10% leads to an increase of tensile strength and yield strength of the composite by 10.4% and 25%, respectively. However, the hardness of the composite decreased by 16%.

On comparison with the base metal Al6061, the proposed composite exhibits a good improvement in tensile strength, yield strength, and hardness. However, no significant change is observed in impact strength. In this work, a study was carried out to observe the mechanical properties of the proposed HAMMC with a change in weight percentage of two reinforcement materials (SiC and Al2O3) and no change in the amount of the third reinforcement material (fly ash). The present work may be extended to study the variation of mechanical properties by keeping the percentage wt of one reinforcement material other than fly ash constant and varying the

 DOI : 10.35291/2454-9150.2021.0072

percentage wt of the remaining two reinforcement materials.

LABORATORIES WORKS ON SPECIMENS

REFERENCES

[1] K. Kadirgama, M. M. Noor,M. M. Rahman, M. R. M. Rejab, C.H. C. Haron, K. A. Abou-El-Hossein, Surface Roughness Prediction Model of 6061-T6 Aluminium Alloy Machining Using Statistical Method, European Journal of Scientific Research ISSN 1450-216X Vol.25 No.2 (2009), pp.250-256

[2] N.B. Dodda Patter, H. M. Somashekar, N. Lakshmana Swamy Y., Vijaya Kumar, An Experimental Investigation to Optimize Machinability of Aluminum Alloy 6061 T6 using Taguchi Methods, International Journal of Mechanical Engineering January-June 2011 Volume 4 Issue 1

[3] N.Zeelan Basha, G.Mahesh,N.Muthuprakash, Optimization of CNC Turning Process Parameters on ALUMINIUM 6061 Using Genetic Algorithm , International Journal of Science and Modern Engineering (IJISME)ISSN: 2319-6386Volume-1, Issue 9August2013.

[4] P. Venkata Ramaiah, N. Rajesh, K Dharma Reddy, Determination of Optimum Influential Parameters in Turning of Al6061 Using Fuzzy Logic, ISSN: 2319-8753 International Journal of Innovative Research in Science, Engineering and Technology.

[5] Ali Abdallah, Bhuvenesh Rajamony, Abdulnasser Embark, Optimization of cutting parameters for surface roughness in CNC turning machining with aluminum alloy 6061 material , IOSR Journal of Engineering (IOSRJEN), ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 10 (October. 2014)

[6] V.Devkumar, E.Sreedhar, M.P.Prabakaran, Optimization of machining parameters on AL 6061 alloy using response surface methodology, International Journal of Applied Research 2015; 1(7): 01-04.

[7] M.S. Najiha, M.M Rahman, K. Kadirgama, Machining Performance of aluminum alloy 6061-t6 on surface finish Using minimum quantity lubrication, International Journal of Automotive and Mechanical Engineering (IJAME) ISSN: 2229- 8649 (Print); ISSN: 2180-1606 (Online); Volume 11, pp. 2699-2712, January -June 2015.

[8] Sohail Akram, Syed Husain Imran Jaffery, Mushtaq Khan, Aamir Mubashar, Liaqat Ali, A Numerical Investigation of Effects of Cutting Velocity and Feed Rate on Residual Stresses in Aluminum Alloy Al 6061, International Journal of Materials, Mechanics and Manufacturing, Vol. 3, No. 1, February 2015.

[9] Elssawi Yahya, Guo Fu Ding, Sheng Feng Qin, Optimization of Machining Parameters Based on Surface Roughness Prediction for AA6061 Using Response Surface Method, American Journal of Science and Technology 2015; 2(5): 220-231 Published online July 30, 2015.

[10] Devendra Singh, Vimanyu Chadha, Ranganath M Singari, Effect Of Nose Radius On Surface Roughness During CNC Turning Using Response Surface Methodology, International Journal of Recent advances in Mechanical Engineering (IJMECH) Vol.5, No.2, May 2016

[11] B.Balamugundan, L.Karthikeyan, Aathif Ahmed O F, Effect Of Material Properties And Cutting Parameters on Burr Formation During Milling Of Pre And Post Thermally Treated AA6061-T6 Alloys, International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Special Issue 37 (February, 2016), PP. 6-11.

[12] Sonali Priyadarshini, Dr. AM Mohanty, Performance analysis of surface roughness in Al alloy using different cutting parameters, International Journal of Multidisciplinary Research and Development Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: (RJIF 5.72) Volume 3; Issue 4; April 2016; Page No. 01-04.

 DOI : 10.35291/2454-9150.2021.0072