Evaluation of Mechanical Properties of Aluminium-Lithium (Al-Li) 8090 Reinforced With Silicon Carbide (Sic)

S.Hari charani, PG Student, JNTUA, Anantapur , India, haricharani318@gmail.com

Dr. B.Omprakash, M.Tech, Ph.D, JNTUA, Anantapur ,India,omprakash1715@gmail.com

Dr.R.Ganapathi, M.Tech, Ph.D, Anurag Engineering College(Autonomous),Kodhada, India.

Abstract **At recently, the use of Aluminium composites has tremendously increased in the defense and aerospace industries. Aluminium-Lithium (Al–Li) based composite have gained more importance in the recent years, due to their low density coupled with high strength and stiffness. An addition of Lithium (Li) can reduce the density and at the same time leads to increase in strength and stiffness. In spite of that Aluminium- Lithium (Al–Li) based composites have received relatively limited attention. Among the many ceramic reinforcements, Silicon Carbide (SiC) particles found to be excellent reinforcement with the Aluminium-Lithium (Al-Li) matrix. The incorporation of Silicon Carbide (SiC) particulates into the Aluminium matrix results in increase of strength and young's modulus, thus improving the specific properties of the material. Aluminium-Lithium-Silicon Carbide (Al-Li-SiC) composite also exhibits superior mechanical properties compared with the unreinforced alloy. Aluminium- Lithium-Silicon Carbide (Al-Li-SiC) composite can be prepared by using Stir Casting Technique to determining the Mechanical Properties such as Tensile Strength, Compressive Strength, and Hardness & Wear Resistance.**

Keywords – Aluminium – Lithium (Ai-Li), Sic.

I. INTRODUCTION

We have a great need of materials to processing the every object with special required properties for the emerging new technology. But the conventional materials are unable to meet these special properties like high strength to weight ratio. To reach these special properties we are preparing the new materials with the combination of two or more insoluble materials called as composites. Present Days hybrid metal matrix materials are play vital role in every stream of engineering field like mechanical, electrical, automobile, aerospace, material science, and marine engineering.

The main aim of the prepared of HMMCs was to improve the mechanical and thermal properties like tensile strength, hardness, wear resistance, thermal conductivity and melting point. Hybrid Metal Matrix Composites are preparing to fulfil the engineering needs at possible optimum costs. From tennis racquets to industrial rollers, and space antennae, advanced composites have proven superior to many other materials. Almost every consumer or engineering applicants are processing through these HMMCs. Aluminium Metal Matrix Composites (AMCs), Lithium Metal Matrix Composites or Li-Alloys are having low density value compare to the other metal matrix composites. These AMCs are mostly using as auxiliary to normal high density materials like steels in field of engineering. The cost of fuel, and maintenance, material Sand casting process is following from ancient days (4000 B.C.) to form metal components and turning is the basic metal cutting process to prepare finish components with less number of control factors at high quantity at less cost of process. A composite material will form by mixing at least two or more insoluble materials together. The base material is called as Matrix material and additives are called as Reinforce materials. Composites are divided based on the Matrix material like Polymer Composites or Elastomers, Metal Composites, Ceramic Composites or Glasses, Foams, and Natural Composites. Some of examples are Glass Fibre Reinforced composites, Ceramic Fibre Reinforced composites, Hemp soft, durable fibre that is cultivated from plants of the Cannabis genus, and Plywood.In composite materials quantity of weight or volume fraction for the Matrix and Reinforcement materials are, like as • Metal material 60-95% • Reinforcement material 40-at least 5% .

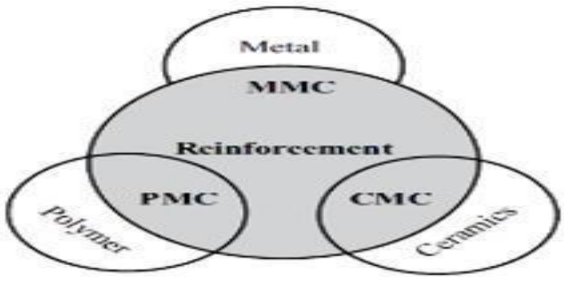

Fig1: Types of Composite

In Metal Matrix Composites the matrix materials are metals and reinforcing materials are like ceramics or polymers or natural materials. Some examples for MMCs are Cast

 DOI : 10.35291/2454-9150.2021.0528

ISSN : 2454-9150 Vol-07, Issue-06, SEP 2021

Aluminium-alloys, Iron, Steels, Ti-alloys, Cu- alloys, and Ni- alloys. These are having better properties like Mechanical, Thermal properties, and Electrical properties than the base materials which will help to fulfil the needs in the respective region after composition respectively. The Aluminium Metal Matrix Composites are having low density than the base material when we mixing up with the Ceramics like Silicon Carbides or Alumina or Silica or Boron Carbides or Silicon Carbide up to 40% weight of reinforcing material mixed up to base material through the various processing processes of HMMCs at optimum cost basis normally, by this process the base material easily lose their density values. Why because the ceramics are having low density value than the metals commonly.

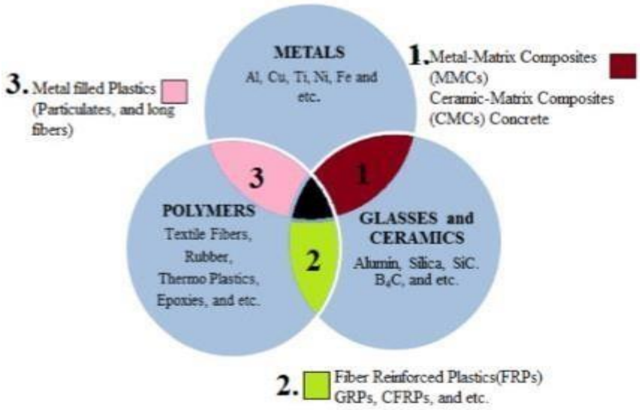

Fig 2: Description of Composite Materials

The selection of a material for a specific purpose is interest process. But this is mainly depended upon the parameters like Requirements of need, Fabrication Processes, Cost, and operating conditions of final objects. The constant would like for higher fuel potency in region and automobile industries has diode to the event of low-density Al-Li alloys. Additions of 1 Chronicles Li will scale back the density by concerning three-dimensional, with a concomitant increase in strength and stiffness. it's quite logical to think about reinforcing Al-Li alloys with ceramic particles so as to achieve an extra increase in strength and stiffness. Although some studies are done on Al-Li alloy-based composites in recent years Al-Li alloy-based composites have received comparatively restricted attention. This may be because of the hazards related to Li handling during alloying. A fastidiously maintained atmosphere or vacuum is required to stop loss of Li and also the associated fire hazard/burning at the process temperature, and all these result in high processing/material prices.

During this study, a simple and efficient experimental setup has been used by modifying the standard stir casting technique for the fabrication of Al-Li-SiC composites. Further, mechanical properties of assail particle-dispersed Al-Li–SiC composites and their age- hardening mechanics have additionally been studied.

II. ALUMINIUM ALLOY

Aluminium is the most abundant metal in the earth's crust about 8.1 % in form of its oxides. We didn't get the any metal in the form of our required base pure metal directly from the earth crust or from the nature. The oxide formation is alumina, occurs naturally as ruby, sapphire, corundum and emery.

Today, however, most aluminium we get is from an artificial mixture of sodium, aluminium and calcium fluorides. Aluminium can also be produced from clay, but the process is not economically feasible today.

Densit	2.7 g/cm^3
Melting Point	658^{0}c
Thermal Capacity	900 J/Kg
Thermal Conductivity	230W/m
Coefficient of linear expansion	24×10^{-6} /^{0}c
Electric Conductivity	60% as per I.A.C.S.
Electric Resistance	29×10^{-9} Ωm
Modulus of elasticity	70Pa

Table 1: Properties of Pure Aluminium

Alloying element	Improved Properties
Zinc-Zn	Increase strength and hardness. Possility for stress corrosion. Gives heat treatable alloys when combined with Magnesium (Mg).
Manganese-Mn	Increased yield and tensile Strength. Good resistance to corrosion.
Copper-Cu	Gives heat treatable alloys, improvement in Strength and Hardness, but reduces resistance in corrosion.
Magnesium-Mg	Improvement in Strength and Hardness. Good Corrosion Resistance, increased weald-ability.
Silicon-Si	Gives heat treatable alloys when combined with magnesium. Good corrosion resistance.

Table 2: Major Alloying Elements and Their Effects

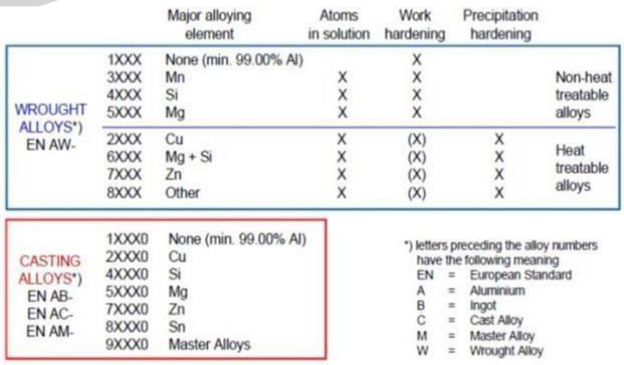

Fig 3: Aluminium Alloys Designation system as per European Standards (CEN)

The distinctive mixtures of properties provided by atomic number 13 and its alloys create atomic number 13 one amongst the foremost versatile, economical, and engaging antimonies materials for a broad vary of uses— from soft, extremely ductile wrapping foil to the foremost stern

 DOI : 10.35291/2454-9150.2021.0528

engineering applications. atomic number 13 alloys area unit second to steels in use as structural metals. It includes a density with a pair of.7 g/cm3, about third the maximum amount as steel (7.83 g/cm3). One cu ft of steel weighs regarding 490 lb; a cu ft of atomic number 13, solely regarding a hundred and seventy pound. Such lightweight weight, let alone the high strength of some atomic number 13 alloys (exceeding that of structural steel), permits style and construction of sturdy, light-weight structures that area unit notably advantageous for all the world that moves—space vehicles and craft further as all sorts of land- and water- borne vehicles.

Aluminium resists the type of progressive reaction that causes steel to rust away. The exposed surface of atomic number 13 combines with chemical element to make inert aluminium oxide film solely a couple of ten- millionths of a thick that blocks more reaction. And, in contrast to iron rust, the aluminium oxide film doesn't chip to show a recent surface to more reaction. If the protecting layer of atomic number 13 is damaged, it'll instantly seal off itself. The skinny chemical compound layer itself clings tightly to the metal and is colourless and transparent—invisible to the optic. The discoloration and flaking of iron and steel rust don't occur on atomic number 13.

Fittingly alloyed and treated, atomic number 13 will resist corrosion by water, salt, and alternative environmental factors, and by a good vary of alternative chemical and physical agents. The corrosion characteristics of atomic number 13 alloys area unit examined within the section "Effects of Alloying on Corrosion.

Mechanical Properties: The mechanical properties of 8090 rely greatly on the temper of the fabric.

8090-8771

Heat treated 8090 (8090-8771temper) has most enduringness no over 540MPa and most yield strength no over 470MPa. the fabric has AN elongation (stretch before final failure) of V-E Day. it's terribly extremely corrosion-resistant and has smart strength.

8090-T3

T3 temper 8090 has an final enduringness of 340MPa (49,300psi) and yield strength of a minimum of 210MPa (30,500 psi). It's a failure elongation of thirteen. The T3 temper is typically achieved by homogenizing the forged 8090 at 750 °C for many hours, quenching, so aging at a hundred and twenty °C for twenty-four hours. This yields the height strength of the 8090 alloy. The strength comes in the main from finely spread eta and eta precipitates each among grains and on grain boundaries.

8090-T8151

T651 temper 8090 has a final enduringness of 450MPa (65,300 psi) and Brinell hardness of 121. It's a failure elongation of seven. These properties will modification reckoning on the shape of fabric used. Thicker plate might exhibit lower strengths and elongation than the numbers listed higher than.

8090-T7

T81 temper has a final enduringness of 440MPa (63,800psi) and a yield strength of 340MPa (43,300psi). It's a failure elongation of thirteen. T81 temper is achieved by over aging (meaning aging past the height hardness) the fabric. Usually this can be} often accomplished by aging at 100–120 °C for many hours so at 160–180 °C for twenty-four hours or additional.

S NO	Property	Value
1	Density	2.54g/cc
2	Melting point	600-655^{0}C
3	Specific heat capacity	0.93J/(g-^{0}C)
4	Modulus of elasticity	77GPa
5	Thermal conductivity	95W/m.k

Table 3: Physical Properties of Al (8090)

$$SiO_2 + 3\,C \xrightarrow[+\,618.5\ kJ]{} SiC + 2\,CO$$

S NO	Property	Value
1	Ultimate tensile strength	540MPa
2	Yield strength	470MPa
3	Elongation	8 %
4	Brinell Hardness	138-142
5	Shear strength	300MPa

Table 4: Mechanical Properties of Al8090

III. SILICON CARBIDE

Silicon inorganic compound, additionally referred to as abrasive, may be a distinctive compound of carbon and chemical element and is one amongst the toughest offered materials.

The molar mass is forty.10 g/mol. it's an easy compound with the atom hooked up to chemical element through a triple bond, going each atoms with a positive and electric charge. However, the bonding between them valence character, instead of ionic. Solid carbide exists in many alternative crystalline forms, with the polygonal shape crystal structure being the foremost unremarkably found one Occurrence.

DOI : 10.35291/2454-9150.2021.0528

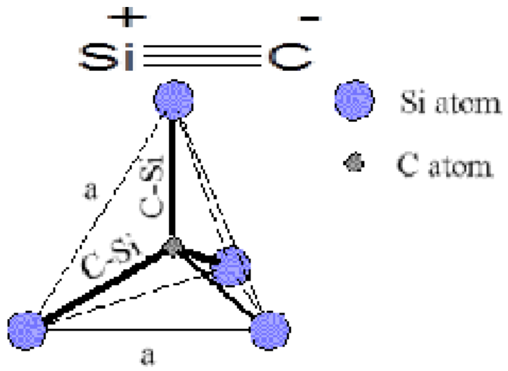

Fig 4: structure of silicon carbide

Silicon carbide happens naturally because the rare mineral moissanite. Production carbide (SiC) may be a artificial mineral most typically created in impedance furnaces, by the industrial process, named when the Yankee E.G. Dean Acheson UN agency fancied it in 1891. In associate degree Dean Acheson chamber, a combination of carbon material (usually oil coke) and a oxide or quartz sand is reacted with chemicals at high temperatures within the vary of 1700 – 2500°C leading to the formation of α-SiC following the most reaction:

The energy for the reaction is provided by the resistive heating of a black lead core done by connecting this core to 2 electrodes at each ends of the chamber.

SiC develops as a solid cylindrical metal bar round the core, with radial layers starting from black lead within the within, to α-SiC (the highest grade material with coarse crystalline structure), β-SiC, scientific discipline grade and eventually un-reacted material on the surface. These are often created as either black or inexperienced, counting on the standard of the raw materials

After a cooling amount, the assault metal bar is sorted accurately and additional processed for various applications. The assault crude material is rigorously crushed, classified, typically polished once more, and optionally with chemicals treated so as to get the particular properties that it'll be applied. These ensuant process steps truly account for the majority of our power and of the worth we tend to raise our product.

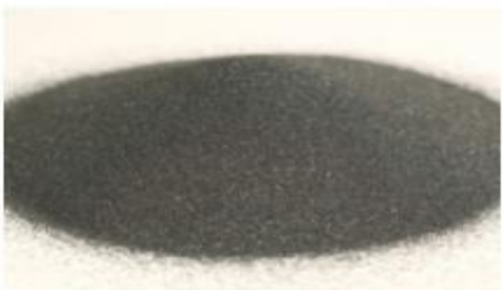

Fig 5 : Silicon Carbide Powder

IV. EXPERIMENTAL PROCEDURE

Material selection and composite preparation:

The metal alloy used as matrix material within the present study of Al-Li alloy (8090Al) . The experimental setup used for fabricating the composites may be a simple modification of the standard softens stirring technique that has been delineated very well. Within the early years. A schematic diagram of the stir casting set- up utilized in this study is. The modification comes within the kind of a steel hood, inert atmosphere so as to forestall the loss of metallic element. In previous studies, a stirring of the soften had been done either within the open or employing a chamber with a provision. this sort of atmosphere chamber restricts the direct read of the soften throughout melting and stirring. The simple improvisation utilized in this study excludes the need of mistreatment such furnaces and prevents loss of Li at the same time. The steel hood (gas cover) are often upraised or inclined to have a read of the soften. This additionally permits the activity of the temperature of the soften handily by dipping a thermocouple as and once needed. The steel hood will also be inclined (on the opposite facet an argon-carrying pipe is command as delineated below) to produce additional noble gas cowl throughout stirring. The matrix alloy was melted during a stainless-steel melting pot during a resistance-heated chamber. The chamber was lined with the steel hood (gas cover) and chemical element gas was responded to it to prevent loss of Li and any hearth hazard . The gas cover was removed simply before the addition of assault particles. Preheated assault particles were other through the edge of the vortex, that was created by stirring the soften with a mechanical vane. a protecting atmosphere was maintained throughout stirring.

Fig 6: Stir Casting Machine

V. FABRICATION METHOD

Aluminium alloy 8090 matrix material was received in the form of. (950 gm) ingot .The ingots were cut into smaller pieces of about 3 to 5 grains weight for each piece The reason for this was to minimize the dwelling time, or in the other words, to make the alloy melt faster Another benefit of using smaller pieces is to help to give more precise reading during weight them. The ingots were cut to the

 DOI : 10.35291/2454-9150.2021.0528

small pieces by using a cut off machine, with a cutting wheel of grade HH especially for non- ferrous metal, with a continuous flow of coolant, to avoid any overheating of the ingot and also the cutting wheel after cutting, the ingots were washed using warm water. Al 8090 with Silicon Carbide (SiC) was carried out using an analytical balance by varying the wt% are shown below.

The graphite crucible was placed inside a steel chamber this method was almost similar to the method used in wet ability test 1 to 4 A J-type thermocouple was inserted into the steel chamber to give a feedback of the temperature inside the chamber to the temperature controller of the furnace.

The furnace was preheated to 100°C, and the nitrogen gas set to flow continuously at a rate of 3cc/min All the substances, Aluminium alloy 8090 with SiC were placed inside a graphite crucible. The crucible was then placed in a stainless steel chamber inside the furnace, and the chamber closed In order to get a controlled temperature inside the chamber and inside the crucible, the temperature of the furnace was increased step by step, to reach to the temperature of 850°C (took about 4 hours period) This temperature was raised in steps to 200°C, 500°C and 850°C with a ramp time of 2hrs, 1 hr, and 1 hr respectively.

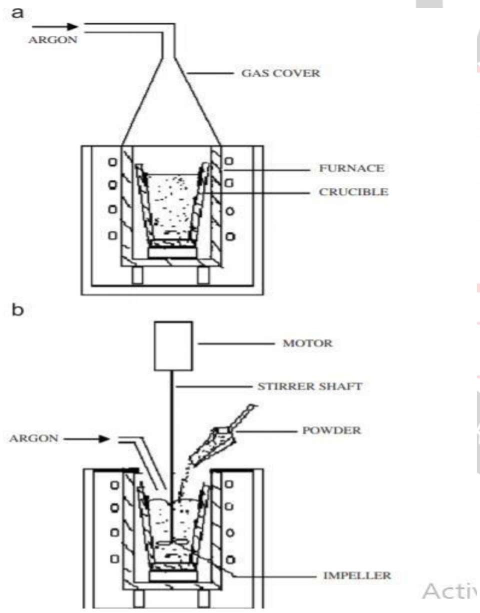

Fig 7 Schematic diagram of the stir casting set-up used for fabricating the composites

(a) Before SiC additions and

(b) During the addition of particles.

Sample No	Matrix AL 8090(gms)	Reinforcement SiC(gms)	Total Weight(gms)
1	950	38	988
2	950	76	1026
3	950	114	1064

Table5:Preparation of samples by Different Compositions.

VI. PREPARATION OF COMPOSITE SPECIMEN

The primary furnace and components, as well as three mild steel stirrer blades, make up the experimental setup. Preheating is the initial step in the experiment. The empty crucible and the reinforcement powder, SiC, are separately heated to a temperature that is near to the main process temperature. Inside the furnace, the graphite crucible is used to melt the aluminium alloy 8090(950gms) ingot. The ingot was first warmed at 560°C for 4–5 hours. In the muffle furnace, silicon carbide powder is also preheated to 300 degrees at the same time. Then, while the preheated powder is physically combined with each other, the crucible with aluminium alloy is heated to 840 degrees. The metal–matrix is then held at the same temperature in the furnace. The aluminium alloy pieces and Silicon Carbide powder are totally melted in the furnace. The stir-ring device is lowered into the crucible and set to the proper depth inside the furnace. The material is vigorously stirred for 10 minutes at 700 rpm, uniformly spreading the additive powder in the aluminium alloy matrix. During the final mixing phase, the furnace temperature should be kept at 830°F.

VII. MECHANICAL TESTINGS OF COMPOSITES

A) TENSILE TEST

Metals, wood, polymers, and most other materials are all subjected to the tensile test. Tensile loads are those that have the tendency to rip the specimen apart, putting it in tension. They can be carried out on any specimen with a known cross-sectional area and gauge length that can be subjected to a uniform tensile force.

Tensile tests are performed to figure out how a material would behave under static, axial tensile, or stretch loads.

Sections E8-2016a (metals), D638 (plastics), D2343 (fibres), D897 (adhesives), D987 (paper), and D412 (paper) contain ASTM standards for typical tensile tests (rubber).

The maximum tensile stress that a material can achieve during a test is called ultimate tensile strength.

PROCESS:

The "ASTM E8-2016a" method is used to perform the tensile test.ensile tests are used to determine a material's tensile qualities, such as tensile strength. The highest tensile stress that can be created in a material is called its tensile strength.

An appropriate specimen must be obtained in order to conduct a tensile test. The size and features of this specimen should meet ASTM criteria. The cross- sectional area and a pre-determined gauge length can be calculated and marked prior to the test.

- The specimen is next inserted into a tensile load machine and placed in the appropriate grippers. The

 DOI : 10.35291/2454-9150.2021.0528

machine can then be used to apply a steady, continuous once it has been loaded.

• During the test, data is collected at certain points or increments. Data points may be more or less frequent depending on the substance and specimen being tested. The applied load as well as the change in gauge length is included in the data. The load is usually read in pounds or kilos from the machine panel.

• An extensometer is used to measure the change in gauge length. The amount of deformation or deflection throughout the gauge length during a test is measured with an extensometer, which is firmly attached to the machine or specimen.

• Data points are collected while paying great attention to the readings until the material begins to yield noticeably. When deformation continues without having to raise the applied load, this is visible. The extensometer is withdrawn at this point, and loading is continued until failure. This latter loading can be used to calculate ultimate tensile strength and rupture strength.

• Once the data has been gathered, the tensile stress that has produced and the strain that has resulted can be determined. The applied load and cross-sectional area are used to compute stress. Strain is calculated by dividing the change in length by the original length.

SAMPLE	COMPOSITION OF COMPOSITE SPECIMEN	ULTIMATE TENSILE STRENGTH
SAMPLE-1	Al-950 gms + SiC-38 gms	48 Mpa
SAMPLE-2	Al-950 gms + SiC-76 gms	93 Mpa
SAMPLE-3	Al-950 gms + SiC-114 gms	160 Mpa

Table 6: Tensile test values

Fig 8: Samples after Tensile Test

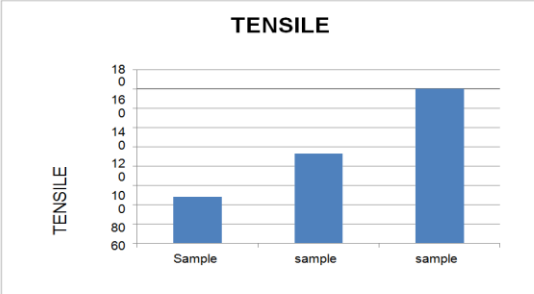

Fig 9: Graphical representation of Tensile Test values on Composite samples.

B) HARDNESS TEST

Brinell hardness is measured by pressing a hard steel or carbide sphere of a particular diameter into the surface of a material under a specified load and measuring the diameter of the indentation left behind. A pressure measurement is the consequence, but the units are rarely mentioned.

Penetration. As a result, the majority of hardness tests include determining the amount of force necessary to implant a particular indentation in a specimen's surface OR the size of the indentation generated by applying a specified load.

Other types of hardness tests, such as the sclera scope, require the rebound of a dynamic or impact force, and the indenter utilised differs depending on the test selected. The quantity of rebound obtained is used to determine the specimen's surface hardness.

• The Rockwell and Brinell hardness tests are two common hardness tests. Sclera scope, surface abrasion testing, Vickers, and Tukon-Knoop are some of the other test methodologies performed.

HARDNESS TESTING PROCESS

• A steel ball with a diameter of 10 millimetres is used as an indenter in most tests. 250 Kg, 500 Kg, 3000 Kg are the standard loads.

Brinell hardness is measured by pressing a hard steel or carbide sphere of a particular diameter into the surface of a material under a specified load and measuring the diameter of the indentation left behind.

The Brinell hardness number, or simply the Brinell number, is calculated by dividing the load applied by the number of Brinells is calculated by multiplying the weight in kilograms by the indentation's actual surface area in square millimetres. A pressure measurement is the consequence, but the units are rarely mentioned.

Sample	Composition of composite Specimen	Trail1 (BHN)	Trail2 (BHN)	Trail3 (BHN)	Average
Sample 1	Al-950 gms + SiC-38 gms	65	65	64	64.66
Sample 2	Al-950 gms + SiC-76 gms	63	62	62	62.33
Sample 3	Al-950 gms + SiC-114 gms	78	80	82	80

 DOI : 10.35291/2454-9150.2021.0528

ISSN : 2454-9150 Vol-07, Issue-06, SEP 2021

Table 7: Hardness Values of Composites [In BHT]

Fig 10: Samples after Brinell Hardness Test

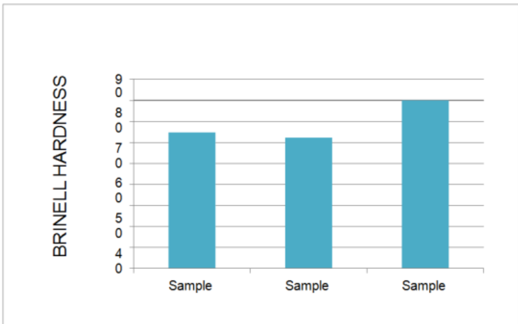

Fig 11: Graphical representation of Hardness Test values on Composite samples.

C) IMPACT TESTING

The ability of a substance to withstand a sudden impact is known as impact strength. The impact test was carried out in a Charpy impact test bed, as illustrated in the picture. The tests were carried out using an impact tester in accordance with "ASTM D 256". The impact test specimen measured 10mm X 10mm X 55mm thick. As illustrated in the image, the specimen was positioned horizontally in the test bed. From the standard height, the pendulum was raised and made to strike the specimen**.**

Fig 12: Impact test machine

Samples	Impact strength(joules)
S1	2
S2	2
S3	4

Table 8: Impact test values on composite

Fig 13: Samples after impact test

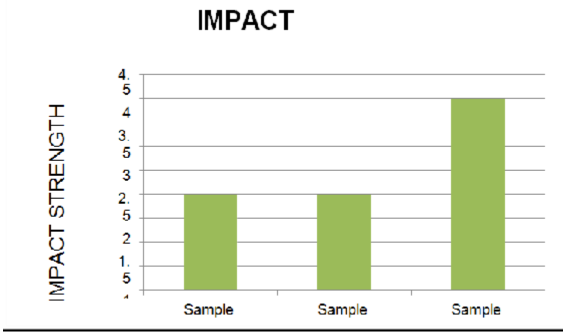

Fig 14: Graphical representation of impact Test values on Composite samples.

D) COMPRESSION STRENGTH TESTING

Compressive strength, or compression strength, is a material's or structure's ability to endure stresses that cause it to shrink in size, as opposed to tensile strength, which withstands loads that cause it to lengthen. Tensile strength, compressive strength, and shear strength can all be studied separately in the research of material strength.

Some materials break at their compressive strength limit, while others deform permanently, therefore a certain degree of deformation can be regarded the compressive load limit. Compressive strength is an important factor to consider while designing structures. The precise test method and measurement conditions have an impact on compressive strength measurements. Compressive strengths are typically expressed in terms of a technical standard.

The test specimens were prepared in accordance with the ASTM E9 standard. The Universal Testing Machine was also used in the testing. The specimens were squashed between two flat plates during the testing process. One was moveable, while the other was stationary, and their deformations were measured under varied weights.

SAMPLE	COMPOSITION OF COMPOSITE SPECIMEN	COMPRESSIVE STRENGTH
SAMPLE-1	Al-950 gms + SiC-38 gms	224 Mpa
SAMPLE-2	Al-950 gms + SiC-76 gms	266 Mpa
SAMPLE-3	Al-950 gms + SiC-114 gms	209 Mpa

Table 9: Compression test values on composite

DOI : 10.35291/2454-9150.2021.0528

Fig 15: Samples after compression test

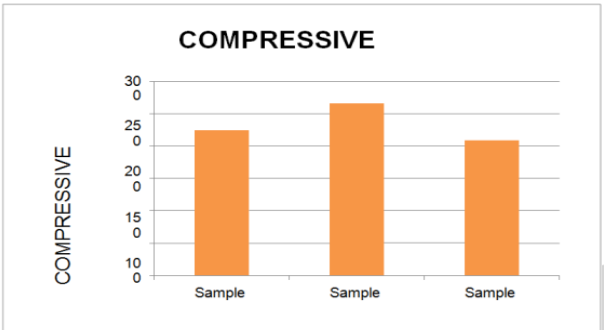

Fig 16: Graphical representation of compression Test values on Composite samples.

WEAR RESISTANCE TEST

Wear resistance is a phrase that is frequently used to characterise a material's anti-wear qualities. The test specimens were prepared in accordance with the ASTM E122 standard. However, the scientific definition of wear resistance is ambiguous, and there is no standard measure for measuring it. Nonetheless, the (relative) wear resistance is frequently calculated as the inverse of mass loss or volume loss. Relative wear resistance can also be calculated by comparing the wear loss of a reference material to that of the studied material under the same testing conditions. In any event, the significance of a numeric number of wear resistance should be explicitly stated.

E) PIN-ON –DISC WEAR TESTER

A pin is loaded against a flat rotating disc specimen in a pin-on-disc wear tester, and the machine describes a circular wear path. Under pure sliding conditions, the machine can be used to analyze wear and friction qualities of materials. The specimen can be either a disc or a pin, with the other serving as the counter face. Pins of different geometries can be used. As a counter face, a ball made of commercially accessible materials such as bearing steel, tungsten carbide, or alumina (Al2O3) can be employed, earning the moniker "ball-on-disc."

Using a precision balance to estimate the weight (mass) loss, profiling surfaces, or measuring the wear depth or cross-sectional area of a wear track using a microscope to determine the wear volume loss or linear dimensional change are all common wear assessment procedures.

Table 10: Wear test values on composite

Sample no	Initial weight(g)	Final weight(g)	Abrasion loss(g)	Wear Rate (%)
1	5.1285	4.9521	0.1764	3.44
2	5.1028	4.9543	0.1485	2.91
3	5.1079	4.9393	0.1686	3.30

Fig 17: Samples after wear test

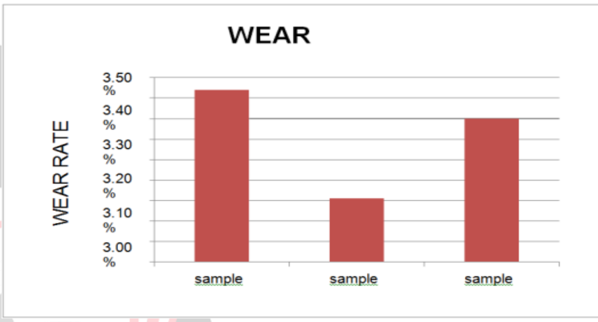

Fig 18: Graphical representation of wear Test values on Composite samples.

VIII. CONCLUSION

The current study looks at how to make an aluminium (8090) alloy reinforced with SiC composite. The composite's mechanical behaviour led to the following results.

1. A new type of aluminium alloy based on SiC reinforcement has been successfully fabricated.

2. It was discovered that the tensile strength of sample 3 (160 Mpa) is greater than that of samples 1 and 2 (48 and 93 Mpa). The plentiful rise in tensile strength, on the other hand, is attributed to applied tensile load transfer to the tightly bonded SiC reinforcements in Al matrix, increased dislocation density near the matrix-reinforcement interface, and grain refining strengthening effect. All three samples had tensile strengths ranging from 48 to 170 MPa.

3. The hardness of sample 3 of these composites, which has a value of 80 BHN, is found to be higher. The presence of tougher and well-bonded SiC particles in the Al matrix, which obstruct dislocation movement, increases the hardness of AMCs. Three samples have

 DOI : 10.35291/2454-9150.2021.0528

hardness ranging from 60 to 85 BHN.

4. The compressive strength of sample 2 of these composites, which has a value of 266 MPa, is found to be higher. This is due to the addition of SiC, a strong material, to Aluminum, which necessitates significant strength to compress the AMCs. Three samples had compressive strengths ranging from 220-270 MPa.

5. However, sample 3 has a higher impact strength due to the aluminium alloy's adherence to the SiC. All three samples have impact strength of approximately 2-4 joules.

6. However, the wear resistance analysis for sample 2 is satisfactory. This is because during the wear test, the softer Al matrix is worn away first from the sample's surface, leaving the hard SiC particles on the worn surface. The Al matrix is protected from further wear by the exposed SiC particles.

SCOPE OF FUTURE WORK

Future researchers have a lot of room to investigate this field of study. This work can be expanded to investigate other tribological and thermal features of this composite, such as abrasion, microstructure, and thermal conductivity behaviour. Various elements of such composites can be studied, such as the use of other potential fillers in the construction of metal matrix composites and the evaluation of their mechanical and erosion behaviour, and the experimental results can be assessed in the same way.

ACKNOWLEDGEMENT

I would like to express a deep sense of gratitude and thank profusely my supervisor **Dr. B. Omprakash** M.Tech, Ph.D sir, Assistant Professor, Department of Mechanical Engineeringfor his great sincere and valuable guidance, suggestions and attitude, which inspired me to submit the thesis in the present form. His dynamism and diligent enthusiasm have been highlyinstrumental in keeping my spirits high. His flawless and forthright suggestions blended with an innate intelligent application have crowned my task with success.

I wish to thank **Dr. B. Durga Prasad** M.Tech, Ph.D, Associate Professor & Head, JNTUA College of EngineeringAnantapuramu, Department of Mechanical Engineering, for his support and extreme cooperation, motivation and encouragement without which it would have been impossible to carry out this work.

I would like to express thanks to Mechanical Engineering department faculty for helping me throughout my course at Jawaharlal Nehru Technology University College of Engineering, Ananthapuramu. I express my profound thanks to K.Naresh, Shiksgs Engineering works, Hyderabad, who has encouraged me to complete the project by providing all necessaryfacilities to carry out the work in the lab. Finally, thanks to my family and everyone who helpedme in writing the thesis and gave me suggestions towards this Thesis. I would like to extend my special thanks to all the Teaching and non-teaching staff of Mechanical Engineering Department, JNTUA College of Engineering Anantapuramu.With Gratitude Sirivella Hari Charani.

REFERENCES

[1] M.Gupta and M.K. Surappa, "Processing- microstructure- mechanical properties of Al based metalmatrix composites synthesized using casting route", International Journal of Engineering Materials, Vol. 104107, pp. 259–274,1995.

[2] D.J.Lloyd, "Particle reinforced aluminium and magnesium matrix composites", International Journal of Materials, Vol. 39, pp. 1–23,1994.

[3] R.J. Arsenault, L. Wang andC.R. Feng, "Strengthening of composites due to micro structural changes in the matrix", International Journal of Metallurgy and Materials, Vol. 39, pp. 47–57, 1991.

[4] B.N. Pramila Bai, B.S. Ramashesh and M.K. Surappa, "Dry sliding wear of A356-Al- SiCp composites", International Journal of Wear, Vol. 157, pp. 295– 304, 1992.

[5] K.K. Sankaran and N.J. Grant, "The structure and properties of splatquenched aluminium alloy 2024 containing lithium additions", International Journal of Materials Science Engineering, Vol. 44, pp. 213–227, 1980.

[6] B. Manish Roy, B. Venkataraman, V.V. Bhanuprasad, Y.R. Mahajan and G. Sundararajan, "The effect of particulate reinforcement on the sliding wear behavior of aluminium-matrix composites", International Journal of Metallurgical Trans. , Vol. 23, pp. 2833–2847, 1992.

[7] C. Gonzalez, A. Martin, J.Llorca, M.A. Garrido, M.T. Gomez, Rico and J.Rodriguez, "Numerical analysis of pin on disc tests on Al-Li/SiC composites", International Journal of Wear, Vol. 259, pp. 609–612, 2005.

[8] Ranjit Bauri and M.K. Surappa, "Processing and properties of Al- LiSiCp composites", International Journal of Science and Technology of Advanced Materials, Vol. 8, pp. 494–502,

[9] J.Rodriguez, P. Poza, M.A. Garrido and A. Rico, "Dry sliding wear behavior of aluminium- lithium alloys reinforced with SiC particles", International Journal Wear, Vol. 262, pp. 292– 300,2007.

 DOI : 10.35291/2454-9150.2021.0528