CHARACTERISATION AND FABRICATION OF Al6063-Si MMC BASED COMPOSITE

S.Baskaran[1], S.R.Krishna[2], B.Karthik[2], P.Dinesh Kumar[2], V.keerthivasan[2]
1- Asst. Professor, Department of Mechanical Engineering, Indra Ganesan college of Engineering, Trichy,
2- UG Scholars Department of Mechanical Engineering, Indra Ganesan college of Engineering, Trichy,
Tamil Nadu

ABSTRACT- Aluminium based metal matrix composite which can be used in many applications like architectural, window frames, doors, shop fittings, irrigation tubling due to the properties has light weight high strength and coefficient of thermal expansion. Al 6063 has a low strength cast able alloy with moderate hardness. In a refractory reinforcement it is generally improves the hardness, tensile strength and high temperature of the material. Al 6063-Si composite of 5 & 8 wt% as reinforcement are manufactured using stir casting technique. The specimen which can be prepared as per the international standards tensile and hardness are performed. The microstructure which can be better dispersion of reinforcement in the matrix. It was found that hardness which can be increases with increase in wt% of Si reinforcement. Hardness and tensile strength of 8wt% Si composite is found to be higher than 5 wt% Si

I.INTRODUCTION

Now days the modern glass doors which can used aluminium al6063 as frames. In such that way the strength, hardness will be low . In addition that the high strength, hardness, high modulus refractory of particles to the ductile metal matrix produces the material whose mechanical properties are intermediate between the matrix alloy and the ceramic reinforcement. The simple term 'composites' gives indication of the combinations of two or more material in order to improve the properties. In the past few years, materials development has shifted from monolithic to composite materials for adjusting to the global need for reduced weight, low cost, quality, and high performance in structural materials Metals have a useful combination of properties such as high strength, ductility and high temperature resistance, but sometimes have low stiffness, whereas ceramics are stiff and strong, though brittle. Aluminium and silicon carbide, for example, have very different mechanical properties

1.Properties of Al6063

Aluminum alloy Al 6063 is a medium strength alloy commonly referred to architectural. It is normally which can be used in intricate extrusions. It has good surface finish , high corrosion resistance, is readily to welding.

Element	Percentage %
Cu	0.1
Cr	0.1
Mn	0.1
Mg	0.45-0.9
Si	0.2-0.6
Ti	0.1
Zn	0.1
Fe	0.5
Other total	0.15
Other each	0.05

Chemical composition of Al6063 Alloy

Properties of Si

Chemical property of Si

Element	Percentage %
Silicon metal powder	98.5

II.FABRICATION OF MMC:

Stir Casting:

Stir casting process of metal matrix composites was inroduce in 1968. Stir casting process is suitable for manufacturing composites with up to 30% volume fractions of reinforcement materials. In a stir casting process, the reinforcing phases are distributed properly by mechanical stirring. In stir casting process two different materials are mixed together by melting and stirring.

Al6063 is a matrix material is initially drop to the stir casting furnace when the temperature at 700^0C after the few minutes the reinforcement material Si is added at 5% of Al6063 with 470-530 rpm by stirring, before the process graphite is apply the stirrer and furnace to avoid any chemical reaction and erosion, this process is repeated on added reinforce material 8%.

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Stir casting setup

III.LITERATURE SURVEY

3.1 COMPOSITE

Composite material which is a combination of two or more materials in which a reinforcement which is metal or a non-metal like oxide or carbide or ceramic is added to a base material which may be in form of polymer or metal and the resultant material's properties are better than the individual properties of constituent material.

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3.2 METAL MATRIX COMPOSITE

The aluminium and alloys have to maintain their as the metal matrix material which can be develop of metal matrix composite. This is a primarily due to the broad spectrum of unique properties that offers at relatively low processing cost. Some of the attractive property combinations of Al based matrix composites are high due to specific stiffness and strength, high temperature properties, thermal conductivity, and low thermal expansion. To fabricate such MMC, many methods are available. They may be sintering or stir casting or in situ casting or moulding etc..,

IV MATERIAL

4.1Al6063 ALLOY

In general the al6063 which can be used in architectural, window frames, doors, shop fittings, irrigation tubling due to the properties has light weight high strength and coefficient of thermal expansion . They are also have a more resistance to corrosion. per the ASTM handbook aluminium and its alloys are excellent matrix material as they have very good affinity for bonding to reinforcing materials especially ceramic material.. It's has an high cost limits its use to applications where cheaper alloys which can't be suitable. used in transport applications, including marine, automotive and aviation, due to their high strength-to-density ratio. Their strength and light weight which is also be desirable in other fields glass frames shop fittings the al6063 aluminium alloy which can be used.

V METHODLOGY

The composites used to produced by stir casting method. The matrix materials which can be used in the present work is Al 6063 and the reinforcement material is silicon (Si) particulates. The castings of Al 6063 matrix composites are prepared with 5 & 8wt% Si as reinforcement.

A. Hardness Test

The hardness test specimens are prepared as per the standards Figure-2. Identify the material of the given specimen . Know the major load, type of indenter and scale to be used for the given test specimen For the aluminium the major load was 100kg. the intender was used is1.58mm diameter steel ball. The scale is B.

Fix the indentor and place the given specimen on the anvil of the machine. Select the major load from the knob available on the right of the machine. Raise the anvil using the rotating wheel till the specimen touches the indentor and then slowly turns the wheel till the small pointer on the dial reaches the red mark position. Now the specimen is subjected to a minor load of 10kg. Push the loading handle in the forward direction to apply the major load to the specimen and allow the load to act on the specimen for 15 seconds. Release the major load by pushing the loading handle in the backward direction and keep the minor 10kg load still on the specimen. Read the Rockwell hardness number either from 'C' or 'B' scale, as the case may be, directly on the dial and record it. Release the minor load of 10kg by rotating the hand wheel and lowering the screw bar. Repeat the experiment to obtain at least 3 different sets of observations for the given specimen by giving a gap of at least 3mm between any two adjacent indentations and 1.5mm from the edge. Find the average value, which will be the rockwell hardness number for the given specimen.

HARDNESS TESTING SETUP
FIGURE-2

point A and B at a distance of 2.5 times the rod distance on the either side of the centre mark so that the distance between A & B will be equal to 5 times the rod diameter and is known as initial gauge length of rod. Insert the specimen in the middle cross head and top cross head grip of the machine so that the two points A and B coincide with grips. Apply the load gradually and continue the applications of load. After sometime, there will be slightly pause in the increase of load. The load at this point is noted as yield point . Apply load continuously till the specimen fails and note down the ultimate load (Pa) and breaking load from the digital indicator. Remove the specimen from the machine and join the two pieces of the specimens. Measure the distance between the two points A and B. This distance is known as final gauge length of the specimen. Measure the diameter of the rod at neck . Determine the yield stress, ultimate stress, nominal breaking stress, actual breaking stress, percentage elongation in length and percentage reduction in area using the following formula..

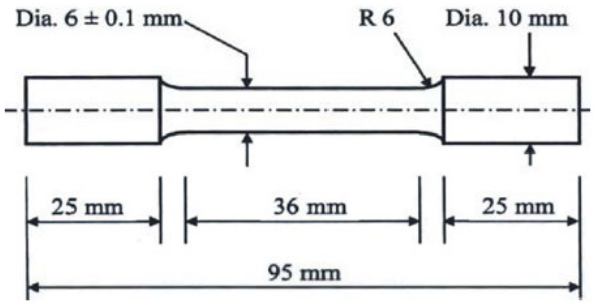

FIGURE -3

B. TENSILE TEST

HARDNESS, TENSILE STRENGTH RESULTS

Composite sample	Average Hardness(VHN)	Average Tensile Strength(MPa)
Al 6063-5% Si	56.1	105.9
Al 6063-8% Si	56.8	108.5

The tensile test specimens are prepared with dimensions according to the ASTM standards. The tensile test specimen is as shown in the figure 3.

Measure the length (L) and diameter (d) of the given specimen. Mark the centre of the specimen using dot punch. Mark two points P and Q at a distance of 150mm on either side of the centre mark so that the distance between P and Q will be equal to 300mm. Mark two

UTM setup

VI. RESULTS AND DISCUSSIONS

A. Hardness Test

Figure shows the hardness distribution in the composites with different wt% of reinforcement. Hardness increases with increase in wt% of Si at the composite. But the improvement of hardness is noticed. Since the wt% of Si is very small there is no appreciable increase in hardness as the wt% of reinforcement increases. Increasing trend of hardness from 5% Si by wt is higher compared to 8% Si. This is the requirement of an optimum wt% of reinforcement in the matrix for better hardness

B. TENSILE TEST

8wt% Si composite and the readings are tabulated. It was observed that tensile strength increases with the increase in wt% of Si. The extent of increase is higher for the higher percentage of Si in the matrix as shown in figure 8.

VII. CONCLUSIONS

According to the distribution of the particles has the perfect interface bond between reinforcement and matrix which can be promoted by stirring. The density will be increased while comparing to SiC. The hardness will be equal comparing to SiC. Then the tensile strength will also be high. The fabrication will be easy due to low melting point Material improvement of hardness which can be observed in the composites with increase in weight percentage of Si reinforcement particles. In the turning operation the 5% which is better than the 8%, because the chips formed in the 8% was the powder form which is not better than the 5% of reinforced particles. The microstructure shows better dispersion of reinforcement in the matrix.

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