

Experimental Analysis on Mechanical Properties of Aluminium Alloy (6061) and Titanium Carbide Using Stir Casting

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Abstract

In this paper, we proposed the material stir casting by using characteristics of al (6061) and Titanium. Objects are rarely selected for organized uses due to it has required joining of characteristics of mechanical. The aluminum (6061) matrix mixture consists augmentation object is created to examine attributes of mechanical like tensile strength, wear, hardness. In the first moment of this investigation, we have chosen aluminum (6061) as a matrix phase and titanium oxide as a reinforcement phase. The aim of this paper is to research attributes of mechanical of al (6061) metal matrix in various macro meter shaped like AL, and TITANIUM CARBIDE was taken as base material and varying composition. Between production they have selected mix throwing due to mix throwing method are easiest as well as low-price as well as characteristics of mechanics like tensile strength and bending strength have been evaluated. So, In final stage of our project results should have more accuracy rather than the other properties.

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1. Introduction

Aluminum materials or essentially composites are mixes of materials. They are comprised of joining at least two materials so that the subsequent materials have certain structure properties on improved properties. The Aluminium mixture objects comprise of explicit quality, explicit solidness, progressively warm soundness, consumption as well as wear opposition, exhaustion lives.

AL, Tic, is a metal lattice mixture comprising of al framework bySic, Granite objects. That Contains high warm conductivity and mostly utilized in macro electronics as substance for gadgets as well as thickness multichip separations, when that helps with expulsion of warmth. Mixture objects are prepared by consolidating at least three objects in where objects have extraordinary attributes that are totally not quite the same as the individual materials included.

A mixture is grouping of three objects in where like objects, named strengthening stage, as filaments, sheets, or particles and is installed in different objects named as grid. Strengthening object as well as network objects that are metal, earthenware or polymer. Not at all like metallic combinations, every material included the composite holds their unique substance, physical and mechanical properties. Further, these composite materials are notable for their prevalent quality and firmness together with low thickness. On contrasting and mass materials, these materials display critical weight decrease in completed item.

A. Metal Matrix Composite

Metal Matrix Mixtures has various applications over single metals mass such as particular modulus, particular quality, best attributes at raised temperatures, as well as lesser coefficient of thermal expansion. Because of these

attributes metal grid mixtures are considered for wide range of applications viz. combustion chamber nozzle, housings etc. Metal grid mixtures consists of metallic grid materials (Al, Mg, Fe, Co, Cu, etc.,) dispersed in a ceramic (Oxides or metallic (Molybdenum) phase. These composites are manufactured by solid state processing, liquid metal processing, vapour state processing, plasma or spray deposition and in-situ processing.

B. Ceramic Matrix Composite

Ceramic Grid mixtures (CMC) consists of a ceramic grid joined in dispersed phase. Reinforcement may be in the form of either continuous or discontinuous fibres. Composites are reinforced either by long monofilament or long multifilament fibres. Short fibres are of Silicon Carbide (SiC), Titanium Boride (TiB₂), Aluminium Nitride (AlN), Zirconium Oxide (ZrO₂) and other ceramic fibres. The majority of the CMCs are processed by the Chemical Vapour Deposition method. One of the main objectives in producing ceramic matrix composites is to increase the toughness.

2. Literature Review

Right now, author concludes a proficient blending innovation to accomplish a uniform dispersion of uncoated particles inside an aluminum combination framework has been created. The MC-HPDC process offers close net shape parts of high trustworthiness. Quantitative picture investigation uncovered an improved molecule appropriation in the composite. The high dispersive shearing activity and high power of disturbance made by the twin fastens the barrel lead to a uniform conveyance of the fortification by beating the elasticity of agglomerates. It was seen that drawn out shearing hinders the blend quality. Quantitative investigation of the fortification dispersion and mechanical properties affirmed the upsides of the MCHPDC process over ordinary procedures. Improved mechanical properties are accomplished due to auxiliary consistency and solid interfacial holding.

Current study authors conclude that the reason for this audit paper was to feature the ebb and flow inquire about center including HSAW of Aluminum Alloy and its composites. A noteworthy assemblage of test information has been accounted for in the territory of HSAW showed in result. The two most basic Abrasive wear test contraption are nail to plate and scraped area analyzer. Nonetheless, Comparison of trial information is troublesome because of the wide scope of wear parameters and counter face materials utilized. Numerous scientists have explored impact of burden, support size, volume portion, type and size of rough paper on wear conduct. By and by, various works have been led in and different arrangement Al-2024. Aside from these arrangement of aluminum compounds exceptionally restricted work has been done on HSAW.

Along these lines, future research requires examining the wear conduct of other Aluminum compounds and its composites in the field of HSAW. An endeavor has been done to layout the wear parameters for testing on the Pin on Disk and Abrasion analyzer and impact of parameters. Accordingly, the data checked on right now direct significance with the impact of parameters in wear conduct of Al compound and its composite.

3. Methodology

A. Materials

(i). Aluminum (6061)

AL is precipitation aluminium alloy, containing magnesium and silicon as its major alloying elements. It was named as Alloy 61S, that is created in 1935. That contains characteristics of mechanical, displays good weld stability, as well as is commonly extruded (second in popularity only to 6063). It is frequent alloy of aluminium for general-purpose use.

It is commonly available in pre-tempered grades such as -O (annealed), tempered grades such as -T6 (solutionized and artificially aged) and -T651 (solutionized, stress-relieved stretched and artificially aged).

Chemical Composition:

The alloy composition of is:

Titanium min 0.6%, max 0.9% by weight
Iron no min, max 0.8%
Copper min 0.19%, max 0.7%
Manganese no min, max 0.15%
Magnesium min 0.4%, max 2.2%
Chromium min 0.07%, max 0.85%
Zinc no min, max 0.36%
Other elements no more than 0.07% each, 0.18% total
Remainder aluminum (95.85–98.56%)

Mechanical properties

The attributes of mechanical of depend greatly on the temper, or heat treatment, of the material. Young's Modulus is 69 GPa (10,000 ksi) regardless of temper.

Annealed (-O temper) has max tensile strength no more than 120 MPa (18,000 psi), and max yield strength no more than 55 MPa (8,000 psi). The material has elongation (stretch before ultimate failure) of 25–30%.

T4 temper has an ultimate tensile strength of at least 210 MPa (30,000 psi) and yield strength of at least 110 MPa (16,000 psi). It has elongation of 16%.

T6 temper has an ultimate tensile strength of at least 290 MPa (42,000 psi) and yield strength of at least 240 MPa (35,000 psi). More typical values are 310 MPa (45 ksi) and 270 MPa (39 ksi), respectively.[5] In thicknesses of 6.35 mm (0.250 in) or less, it has elongation of 8% or more; in thicker sections, it has elongation of 10%. T651 temper

has attributes of mechanical. Dedicated rate for thermal conductivity for T6 at 15 °C is.



Figure 1: Aluminum (6061)

Welding:

It is profoundly weldable, such as utilizing tungsten idle gas welding or metal inactive gas welding. Commonly, in the wake of welding, attributes close to weld like of - O, lost quality of max 60%. Subsequent to welding, object can normally age as well as reestablish a portion of its quality also. In any case, Alcoa Handbook prescribes plan quality of object adjoining weld that ate considered as 36 MPa without appropriate warmth treatment after weld reference required average filler material is 4042 or 5356.

Extrusions

It is a compound utilized in creation of expulsions long consistent cross-segment auxiliary shapes delivered by pushing metal with a molded pass on.



Figure 2: Photograph of Tensile testing specimen

(ii) Titanium Carbide:

Titanium carbide, TiC, is an extremely hard refractory ceramic material, similar Tic. It gives image of powder which is in black with the sodium chloride (face-centered cubic) crystal structure. Tic is utilized in

development of cermet, that are utilized to machine steel materials at high cutting speed. Titanium carbide is utilized as a heat shield coating for atmospheric re-entry of spacecraft.



Figure 3: Titanium Carbide

Two methods of Titanium Carbide, alpha as well as beta (rhombohedral), have fundamentally the same as physical properties, with the exception of that the graphene layers marginally in an unexpected way. Alpha Titanium Carbide might be level or clasped. Alpha structure that are changed over to the beta structure through treatment or beta structure returns to alpha structure when that is warmed over 1300 °C. His acoustic and thermal properties of Titanium Carbide are highly anisotropic, since phonons propagate quickly along the tightly-bound planes, but are slower to travel from one plane to another.

(iii) Fabrication of Al Alloy and TiC

Research process recognized for thesis work:

Step 1: Preparation of sand mould

Green sand is used with restricting material to shape adapt as well as drag or centers of form.

Step 2: Preparation of Specimen of different compositions:

The element is mixed proportionately by weight in the ratio sample 1 and sample 2.

Step 3: Machining of specimen for test.

The material needs to be sized as a required shape.

The sand casting operation:

The sand throwing activity includes emptying of liquid metal into sand shape, the hardening on the throwing inside the form, and the expulsion of the throwing. Impact as well as dissemination of warmth with specific sand shape blend when throwings cementing, impact of progression of fluid metal on honesty of the form, break of gases with blend. Sand as a rule can withstand incredibly high temperature levels, as well as by and large permits the departure of gases.

After sand throwing is expelled from sand form it is shaken out, all sand is in any case expelled from throwing. Part then experience assembling procedure, for example, heat treatment, machining, and additionally metal shaping.



Figure 4: Aluminum filled in crucible



Figure 5: TIC Mixing



Figure 6: Stir Casting Material

B. Block Diagram

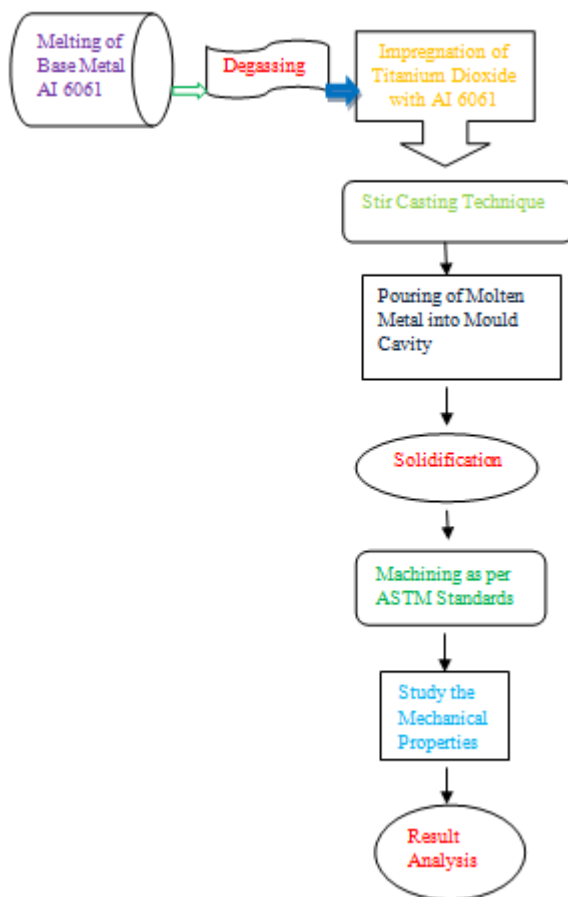


Figure 7: Architecture Diagram for Material Stir Casting

4. Result and Discussion

Details of Testing Facility:

Machine no	CL/ME/ROCK 05
Model	MSM
Ambient temp	25.3

Test Results:

S. NO	Sample ID	Observed values, HRA			Average, HRI5N
		1	2	3	
1	Al6061 - TIC	63	65	68	65

Graphs:

Tensile strength:

This test was performed to find out the yield strength and percentage of elongation of the composite. The test was performed on the UTM (Universal Testing Machine). Results are structured in table. Which clearly indicates that tensile strength of aluminum reinforced with TIC is higher than that of unreinforced aluminum.



Figure 8: Tensile Strength Material

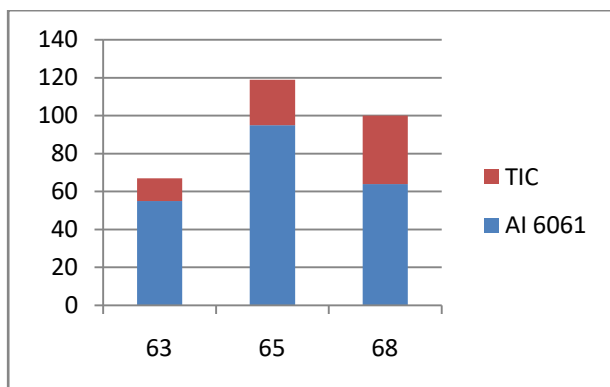


Figure 9: Tensile Test Bar Graph

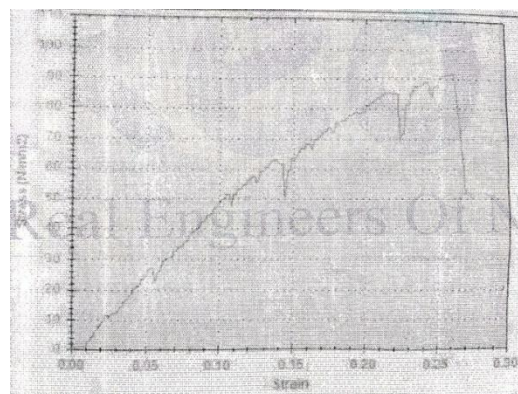


Figure 10: Tensile Strength Testing Manual Graph

Bending strength:

Twisting test was performed to decide the opposition of the examples against stuns or unexpected powers.

Test contains of breaking of specimens by blow from a swinging pendulum with the test piece scored in center as well as upheld at every end. Vitality retained is resolved in joules. This retained vitality is a proportion of the effect quality of a material. The results indicate loss of impact strength with increased concentration of TIC in the samples.



Figure 11: Bending Strength Material

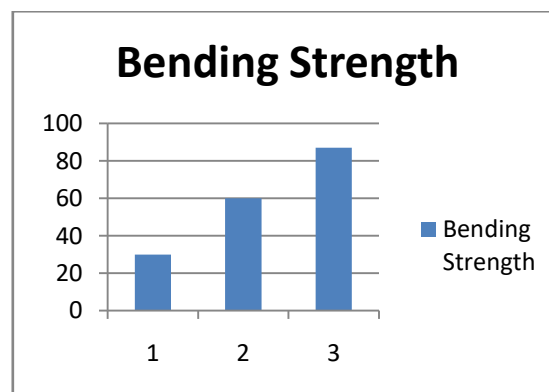


Figure 12: Bending Test Observation

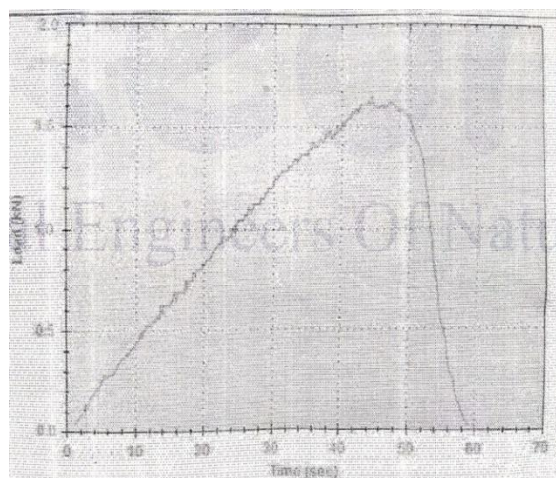


Figure 13: Bending Test

5. Conclusion

Hear at the final stage of this paper concludes that the mechanical property which we have taken that is tested by the several strength mechanisms. In that mainly Titanium Carbide will works more in that property. In stir casting method also will tells the material will be very strong. When the Aluminum 6061 is mixed with Titanium Carbide (TIC) is mixed together then the final result will be the material is very strong.

Twist testing a material takes into account assurance of that materials pliability, twist quality, crack quality as well as protection from break. The attributes that are utilized to decide if a material will bomb under tension as well as are particularly significant in any development procedure including pliable materials stacked with bowing powers. On the off chance that a material starts to break or totally cracks during a six or seven point twist test it is substantial to expect that the material will bomb under a comparable in any application, which may prompt calamitous rejection. Thus, we presume that blending of Titanium Carbide in any material is solid.

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