



Brief Review on Al6351 Composite

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ABSTRACT

For the past few years there has been a rapid growth in the utilisation of aluminium alloys, particularly in streams like aerospace and automobile industries. The versatility of aluminium makes it widely used metal. It is due to its low weight, density, high strength, wear resistance etc. Al6351 has high strength good mechanical and tribological properties when compare to other alloys. AL6351 can be seen in forms of extruded rods, wire and shapes which are easily machinable and can have a wide variety of surface finishes.

Keywords: *aluminium alloys, high strength, weight, density*

INTRODUCTION:

Aluminium is the third most common element and the most abundant element comprising 8% of the earth's crust. Aluminium is one of the lightest engineering metals having high strength and low weight. Pure aluminium is soft, ductile and corrosion resistant and has a high electrical conductivity.

Aluminium and many of its alloys can be worked into any form and readily accept a wide variety of surface finishes. Aluminium alloys typically have an elastic modulus which is one third of the elastic modulus of most kinds of steel alloys. Therefore for a given load a component or unit made of an aluminium alloy will experience a greater deformation in the elastic regime than a steel part of identical shape and size. Aluminium alloy have higher tensile strengths than the commonly used kinds of steel. Aluminium and most of its alloys have good electrical and thermal

conductivities and high reflectivity to both heat and light. Aluminium alloys are used mainly in applications where the combination of high strength and low weight is attractive. The different series of aluminium are 1xxx, 2xxx, 3xxx, 4xxx, 5xxx, 6xxx, 7xxx and 8xxx. Among these 6xxx series is versatile which is heat treatable, highly formable, and weld able and have moderately high strength coupled with excellent corrosion resistance aluminium based composites have higher properties than pure aluminium Composite materials are the combination of two or more materials that results in better properties than those of the individual composites used alone. The main advantages of composite materials are high strength and stiffness, combined with low density. When compared with bulk materials, composites contribute to weight reduction in the finished part. Composites are classified in to three types namely metal matrix composites, ceramic composites and polymer composites.

In the metal matrix composites there will be a base metal like aluminium, Magnesium, Copper and other are reinforcement like silicon carbide, Aluminium oxide, Graphite, Boron carbide, fly ash and so on. Among all, aluminium 6xxx series is mostly used. Aluminium 6xxx series have high heat treatable, good corrosion resistance, excellent extrudibility and moderate strength. Al6351 has superior strength and have wide applications in construction of ship, rail & road transport, column, rod, mould, pipe, tube, vehicle, bridge, crane roof. It also has application in aerospace, manufacturing in tubes and pipes, pressure vessels etc. It is due to its light weight, superior

oxidisation, excellent surface finish and its thermal, electrical conductivity is four times greater than steel. Al6351 is also known as a structural alloy and is more

frequently used for manufacturing purpose. Al6351 compositions are as shown in the table.

Element	Al	Si	Mg	Mn	Fe	Zn	Ti	Cu
Percentage	96-98.5	0.7-1.3	0.4-0.8	0.4-0.8	0-0.5	0-0.2	0-0.2	0-0.1

The properties of Al6351 are Tensile strength, Yield strength, Shear strength, Fatigue strength, Elastic modulus, Poissons ratio, Elongation, Hardness, Thermal conductivity

LITERATURE REVIEW:

In this review we are discussing about mechanical and tribological properties of Al6351

1. WEAR PROPERTIES

Pradeep G et.al[1] investigated the tribological behaviour of Aluminium metal matrix composite with base metal as Al6351 reinforced with SiC fabricated by stir casting method and the wear resistance enhanced with increasing of SiC((10% & 15%)on pin on disc wear tester..S.ThirumalaiKumaranet.al [2] investigated wear properties of aluminium matrix alloy reinforced with 5 wt% of SiC and 5 wt% of B4C particles, prepared by stir casting route and wear resistance properties are enhanced due to addition of SiC & B4C particles at 60N load and 1-3 m/s range of sliding velocity.

V. Mohanavel et.al [3] carried out an investigation on mechanical and tribological behaviour of Al6351 with SiC (0 to 12 weight percentage) particulate reinforcement by stir casting method. The wear resistance, tensile strength and hardness of composites have significantly improved with increasing of SiC Uthayakumaret.al [4].investigated on dry sliding wear system of stir cast Al6351 with 5, 10 and 15wt% Fly ash reinforced metal matrix composites. Grey relational analysis on a pin on disc machine is carried out on the effects of parameters such as load, sliding speed, percentage of fly ash on the sliding wear, specific wear rate and friction coefficient. Analysis of variance (ANOVA) investigate which design parameters significantly affect the wear behaviour of the composite with greatest effect on the dry sliding wear due to applied load followed by sliding velocity. Pradeep et.al [5] observed the tribological behaviour of Al 6351 reinforced with SiC fabricated by stir

casting process, wear test on pin on disc wear tester is conducted and experimentation conducted through

ANOVA software. The wear and frictional properties of metal matrix composites were studied and sliding distance has the highest influence followed by load and sliding speed. Regression equation for each response were developed for both 7%, 14% & 21% SiC reinforced Al6351 MMCs chosen as 'smaller the better' characteristic.

SThirumalai Kumaran et.al [6] investigated the effect of wear test parameters on dry sliding wear behaviour of aluminium matrix alloy (Al6351) with 5 wt% SiC& B4C.The wear resistance was enhanced with addition of small amount of silicon carbide and boron carbide reinforcement particles with aluminium matrix alloy.SThirumalaiKumaran et.al[15].explored the tribological & mechanical properties of Aluminium matrix alloy (Al6351) with 5 wt% silicon carbide (SiC), 5 wt% and 10 wt% of boron carbide (B4C) hybrid composite by Stir casting method. On pin-on-disc type wear machine tribological experiments were carried out. Using grey relational analysis (GRA), the effects of parameters frictional coefficient were reported. To investigate the influence of parameters, the orthogonal array with L9 layout and analysis of variance were used. It is observed that the dry sliding friction & wear behaviour of the composites were influenced by the applied load, sliding velocity and w% of B4C with contribution.

2. HARDNESS

V. Mohanavel et.al [3]. Carried out an investigation on mechanical and tribological behaviour of Al6351 with SiC (0 to 12 weight percentage) particulate reinforcement by stir casting method. The wear resistance, tensile strength and hardness of composites have significantly improved with increasing of SiC R. B. Yashonantsai et.al [7]. Investigated the fabrication and characterization of Aluminium alloy-egg shell component. Hardness increases with ductility due to reinforcement of egg shell particles in Al6351. Density of composite decreases. Gopala Krishna et.al

[8]. Studied the mechanical behaviour of friction Stir welding joints of Aluminium alloy of Al6351 with Al6351 and Al6351 with Al5083. The results show that there is increase in hardness of welded joint with increase in speed of the tool. Patel Gaurang D et.al [9]. Study was carried out on Al6351 with SiC particles and Methanol paste. These were incorporated using Friction stir processing (FSP) to form particulate composite materials. The optimum combination of parameters obtained were 1000rpm tool Rotation rate, 50mm/min transverse speed and 3 degree tool tilt angle and four number of passes has been predicted to give the best micro hardness values.

3. TENSILE STRENGTH

M. V. Niranjan Reddy et.al [10]. Investigated the tensile strength of Al6351 on UTM. The tensile strength 250MPa and 20% elongation is observed for pure Al6351 which is nearer to the required strength for aerospace structures. G. Gopala Krishna et.al [8]. Compare the mechanical behaviour of Aluminium alloy of Al6351 with Al6351 and 6351 with Al5083 by using friction Stir welding joint. Yield strength, Tensile strength and percentage of elongation of the joint decreases with increase in speed of the tool and after reaching optimum values at 1300rpm speed. V. Murali Krishna G et.al [11]. Studied over mechanical properties of Aluminium Silicon Carbide MMC which is multi pass friction stir processed. This reduced the tensile properties of specimens, probably due to grain soften and non-uniform distribution of SiC in the base alloy matrix. For Al6351 SiC composite with single pass, the hardness is found to increase compared to Al 6351 base alloy with single pass. It is due to inclusion of hard SiC particles into Al matrix. However the effect of multi pass FSP on hardness of both Al6351 base alloy and Al6351-SiC composite is found to be decreasing due to heat input and grain softening during multi passes FSP.

Pradeep Kundu et.al [12] observed the shear strength, yield strength and ultimate tensile strength of three different grades of AL alloys were found in ascending order of Al6063, Aland resistance resistance enhanced with Al6351. The fracture mode was found to be ductile nature of all three grades. In addition, the shear strength, yield strength and Ultimate tensile strength were found to be increasing with SiCwt%. During tensile test, the elongation of the material was found to decrease from 7% to 9% SiC w% increment.

Sanjeev Kumar et.al [13]. Investigated mechanical properties of casting of Al6351. The casting is a mixture of tamarind powder, starch powder and coal dust. Sand used for casting has silica 78-80%, bentonite 14-15% and moisture 6-7%. Due to this casting enhanced the hardness of aluminium alloy. Starch powder affects the hardness of Al to great extent than any other additive. On other hand, addition of additives in sand decreases tensile tension. According to test results, only starch having a percentage of 1% in sand mould gives the highest value of tensile tension. Mathesharmila et.al [14]. The study is carried out to determine micro structure and mechanical properties of Aluminium boron carbide using friction stir machining process. The effect of multi pass FSP on hardness of Al6351 B4C composite is found to be decreasing. It is due to heat input and grain softening during multi passes FSP.

CONCLUSIONS

- Al6351 with B4C composite has reduced the wear rate significantly. Thus, the increased wt. % of B4C particles in the composite exhibits a good wear resistance behaviour at higher load and sliding velocity conditions
- Al6351 with fly ash showed that the applied load exerted the greatest effect on the dry sliding wear followed by the sliding velocity.
- AL6351 with Egg shell particle composite, the hardness increases with ductility also and there is a decrease in density of composite.
- The Tensile strength of Al6351 on UTM, found that 250MPa tensile strength and 20% elongation of Al 6351 is nearer to the required strength for aerospace structures.
- The shear strength, yield strength and ultimate tensile strength of three different grades of Al alloys were calculated. All three properties of Al/SiC MMC were found in ascending order of Al 6063, Al6066 and Al 6351.

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