OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

IMPROVEMENT OF MECHANICAL PROPERTIES BY SECONDARY MANUFACTURING PROCESS

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Abstract:- Regular solid materials have limits in accomplishing great mix of solidarity, solidness, sturdiness and thickness. To beat these inadequacies and to fulfill the always expanding need of cutting edge innovation, composites are most encouraging materials of late interest. The current exploration work includes the investigation of AA 7075-B4C composite through mix projecting course. This in-situ strategy includes arrangement of fortifications inside the framework by the substance response of at least two mixtures which likewise delivers a few changes in the network material inside the area. Boron carbide(B4C) was the support in the grid of AA 7075 amalgam which can be appropriate for space, airplane and car parts at raised temperatures. The mechanical properties as far as hardness, heat treatment and wear test were done. The example of AA 7075 amalgam was additionally projected and tried for examination.

I INTRODUCTION

1.1 COMPOSITES

Composites are artificial materials comprising of at least one irregular stages having personal contact with one another, with are cognizable interface between them. These are multifunctional materials frameworks that give attributes not realistic from individual stages. Further, composites are customized to financially savvy, property compelling and application arranged. By and large, the broken stage is more earnestly and more grounded than the constant stage and is known as the 'support'. though ceaseless stage is named as the 'framework'. The network holds support to frame the ideal shape and bears the significant piece of an applied burden, while the support works on generally mechanical properties of the grid. Support builds the strength, stiffness, wear resistant and the temperature resistance capacity and lowers the density.

1.2 CLASSIFICATIONOFCOMPOSITES

As a rule, composites are characterized by the sort of network material and afterward nature of support at two particular levels. The main characterization incorporates ceramic lattice composites (CMCs), natural framework composites (OMCs) and metal network composites(MMCs). The term natural framework composite is by and large accepted to incorporate polymer Matrix composites(PMCs)and carbon matrix opposites. These Cond grouping alludes to there I n for cement form; particulate r reinforcements, whiskers, continuous fibril laminated composites and woven composites.

1.2.1Polymer Matrix Composites(PMCs)

Contain are sin framework and supporting filaments, for example, glass strands, aramid,etc. Low densities, good corrosion resistance, low thermal conductivities and low electrical conductivities are the advantages of the secomposites. Boats, hulls, channels, sporting goodsar ea not many to specify its

applications.

.Simplicity of handling and minimal expense made these composites to offer more than 90%in applications in the composite family. These composites are slacking applications requiring long haul protection from extreme climate a high temperature and low cross over strength.

1.1.1 Ceramic Matrix Composites (CMCs)

MMCs are creations during early60's, made out of baB4Cally a metallic .Matrix built up with for the most part ceramics. These are customized materials to suit to particular requirements like reduction in density or improvement in stiffness, yield strength ,extreme elasticity, which can double-cross scheduled to worked on explicit properties. Contingent upon the application, a wide scope of composites with various mixes of network materials and diaper solids are being delivered. give look at the sort so grids and vanish solids utilized for different applications

2.LITERATURE SURVEY

[1] Arunkumar D T et.al. [2018], effectively manufactured the Al-7075 composites with mica and kaolinite fortifications utilizing mix projecting method. They utilized equivalent volume parts of mica and kaolinite are [(4+2)%, (6+4)%, (9+6)%,(5+8)] and directed a wear test for different time spans at steady burden. The wear misfortune in composites with 8% volume of mica and kaolinite are seen to diminish at a more slow rate. The SEM microstructure of the composite shows a homogeneous support appropriation into frameworks Andon proof of agglomerate. From the above research paper I inferred that the presence of mica and kaolinite in the framework diminished wear misfortune by expanding wear obstruction.

[2] Pradeep P et.al.[2017], has manufactured Al 7075 and Titanium DI Boride (Tib2) by means of the mix projecting strategy. The amount part of TiB2 incited are 6%, 10% and 12% . They assessed the microstructure, wear, hardness properties. At 8% wt of TiB2 sees the most extreme hardness of 126 VHN and reinforces the base grid. Express wear rate decreases as the sliding rate augments up to revolution speed (1.6 m/s) and weight, considering work hardening of the material surface. Insignificant impact of the wear rate got from the 8 Wt. % of TiB2 sustained composite. The speed and the sliding distance are in generally outrageous with the irrelevant weight. The miniature picture demonstrates the Aluminum flotsam and jetsam are unvaryingly scattered inside the most noteworthy volume part of particulate framework of 8Wt. The Al metal network composites offer wide scope of properties suitable for a large number of engineering applications. Sufficient literatures are available on different aspects of tribology and machining of conventional metals and alloys but limited literature are available for reinforced metal matrix composites.

Aluminium-Graphite (Al- - Gr) projecting composites are the most flexible of all normal foundry cast compounds in the creation of cylinders for auto motors. Contingent upon the Si fixation in weight percent, the Al- - Si amalgam frameworks fall into three significant classifications: hypoeutectic (<12 wt % Gr), eutectic (12-13 wt % Gr) and hypereutectic (14-25 wt % Gr). Nonetheless, business applications for hypereutectic combinations are somewhat restricted in light of the fact that they are among the most troublesome Al amalgams to project and machine because of the great Si substance. At the point when high Gr content is alloyed into Al, it adds a lot of warmth limit that should be taken out from the combination to harden it during a projecting activity. Critical variety in the extents of the essential Si particles can be found between different regions of the cast article, resulting in significant variation in the mechanical properties for the cast article. In any case, the greater part of them are not appropriate for high temperature applications, for example, in the auto field, for the explanation that their mechanical properties, like rigidity, are not as high as wanted in the temperature range of500°F.- 700°F.Currentstate-of-the-arthypoeutecticandeutecticalloysareintended for applications at temperatures of not higher than about 450° F. The bothersome microstructure and stage change brings about definitely decreased mechanical properties, all the more especially a definitive rigidity and high cycle weariness qualities, for hypoeutectic an eutectic Al—Gr combinations. One methodology taken by the craftsmanship is to utilize ceramic filaments or fired particulates to build the strength of hypoeutectic and eutectic Al- - Gr amalgams. This methodology is known as the aluminum Metal Matrix Composites(MMC)technology.For model, R. Bowles has utilized artistic filaments to work on elasticity of a hypoeutectic 332.0 compound, in a paper named, "Metal Matrix Composites Aid Piston Manufacture," Manufacturing Engineering, May1987. Besides, A. Shakesheff has utilized ceramic particulate for supporting one more kind of hypoeutectic A359 compound, as portrayed in "Raised Temperature Performance of Particulate Reinforced Aluminum Alloys," Materials Science Forum, Vol. 217-222, pp. 1133-1138 (1996). In a comparative methodology, cast aluminum MMC for cylinders sin get feverishly like the 413.0 kind, has been depicted by P. Rohatgi in a paper named, "Cast Aluminum Matrix Composites for Automotive Applications," Journal of Metals, April 1991. Vikram Singh and R.C. Prasad has manufactured and examined the tensileand break conduct of 6061 Al-Gr Cp metal grid Composite by building up with 5%, 10%and15volume%Gr Cparticles. From the above research paper I assumed that wear and grating region properties of MMCs having aluminum as base material outstandingly depends upon the particulate used for filler, its size and weight division of particles. In the event that the particulates added for built up well to the cross section, the wear hindrance increases with growing volume division of help materials.

MECHANICAL PROPERTIES OF AL 7075

Aluminium 7075 Matrix material The need for engineering materials in the areas of aerospace and automotive industries had led to a rapid development of metal matrix composites(MMC). Researchers are turning to particulate-reinforced aluminium metal matrix components(AMC) because of their relatively low cost and isotropic properties. In Al 7075 one constituent is aluminium/aluminium alloy termed as matrix phase. The other constituent is embedded in this aluminium/aluminium alloy matrix and serves as reinforcement. Mostly ceramic materials such as Sic, Al2O3, B4C, etc. are used reinforcement. The major advantages of Al 7075's compared to unreinforced materials are, it gives greater strength, improved stiffness, reduced density (weight),improved high temperature properties, improved abrasion and wear resistance and enhanced and tailored electrical performance, etc. Aluminium 7075 is an aluminium alloy, with zinc as the primary alloying element. It has excellent mechanical properties and exhibits good ductility, high strength, toughness, and good resistance to fatigue

PROCESSING OF AL7075 MATRIXCOMPOSITES

Primary processing for manufacturing of AMCs can be classified into two main groups. a) Liquid state process includes stir casting, squeeze castings, and ultrasonic assisted castings, b) Solid state process include powder blending followed by consolidation (Powder metallurgy), high energy ball milling, and friction stir process.

LIQUID STATE PROCESS

Mix projecting interaction is a fluid state measure, in this cycle the aluminum combination is grid phase and ceramics are in for cement phase. The aluminium alloy is heated in liquid state and reinforce n phases(usually in powder structure) are conveyed into liquid Aluminum combination by mechanical mixing. The critical component in this cycle is Mechanical mixing in heater. Press projecting interaction is the blend of gravity bite the dust projecting and shut kick the bucket manufacturing. In this cycle, pressure is applied on the hardening fluid metal. The means engaged with this cycle are: (i)pouring of metered amount of fluid metal with sufficient super warmth in to the pass on cavity, (ii)application of strain on the fluid metal and keeping up with the equivalent till the cementing is finished and (iii) removal of the casting and preparation of the die for the next cycle. Ultrasonic cavitation can deliver transient (in the request for nanoseconds) miniature ‚hot spots' that can have temperatures of about 5000ºC, pressuresabove1000 particles, and warming and cooling ratesabove1010 K/s.

PHYSICALPROPERTIES

The Density is an actual property of issue, as every component and compound have an interesting thickness related with it. The Density is an actual property of issue, as every component and compound have an interesting thickness related with it. In a composite, the volume portion (v), which is normally utilized in property calculation. Thickness can be determined by isolating the mass of example by the volume dislodged by that is specimen in theater measuring glass

MECHANICALPROPERTIES

Mechanical properties like Tensile strength, Hardness, Wear opposition, Young's modulus is basically capacity of the assembling system. Further developing such mechanical properties is generally significant fascination of composite materials Hardness is the obstruction of a material to twisting, space, or infiltration by means like scraped spot, penetrating, sway, scratching. It estimated by hardness tests like Brunel, Knop, Rockwell, or Vickers. Since there is no standard hardness scale, each test communicates its outcomes in its one of a kind (and arbitrarily defined) measure

Aluminum 7075

1.7075 aluminums composite can be additionally improved by how it is fortifying utilizing a cycle known as warmth treatment.

2.tempering strategy can utilize high heat(300-500 C) to reconfigure metal's gem construction to fortify its by and large mechanical properties, and can in a real sense represent the moment of truth a material.

3.There are numerous techniques for treating 7075 aluminums, yet improve on this article, we will feature T6 tempered 7075 aluminum composite .

4.7075-T6 is a typical attitude for aluminums plate and bar stock.

5.However , realize that each treating interaction gives 7075 aluminum its own unmistakable qualities and attributes

Boron carbide (b4c)

However , realize that each treating interaction gives 7075 aluminum its own unmistakable qualities and attributes

Good protecting properties against neutrons), solidness to ionizing radiation and most synthetic compounds.

Its Vickers hardness (38GPa), Elastic Modulus (460GPa) and crack durability (3.5 MPa•m) approach the comparing esteems for jewel (1150 GPa and 5.3 MPa•m).

As of 2015, Boron carbide is the third hardest substance known, after jewel and cubic boron nitride, acquiring it the moniker "dark precious stone"

Semiconductor properties are Boron carbide is a semiconductor, with electronic properties overwhelmed by jumping type transport.

The energy band hole relies upon structure just as the level of request.

The band hole is assessed at 2.09 eV, with various mid-bandgap states which entangle the photoluminescence range

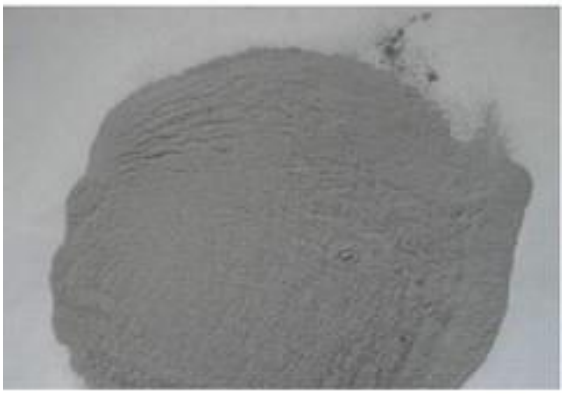
The material is ordinarily p-type.

Matrix Material

AA7075 composite was chosen on account of its low explicit weight and high solidarity to weight proportion and weakness and

furthermore its superb machinability, formability and weld capacity. This amalgam is generally utilized in auto industry, airplane industry and protection enterprises. The substance organization of the pre-owned material is given in Table. Table3 Chemical Composition ofAL7075 Al Alloy

Material	Percentage
Al	balance
Fe	0.5
Cu	1.6
Mn	0.3
Mg	2.5



Cr	0.15
Zn	5.5
Ti	0.2
Otherseach	0.05
Otherstotal	0.15
Al	Remaining

3.2MATERIAL AND MEASUREMENT:

The composite measurements are carried as given table for both composites.The al7075 – tib2 alloy which is used forms metal matrix composition and where theal7075ismixedwithB4C in the ratio of(3%,6%,9%,12%,15%) and for the hybridcomposite composition mixed with tib2 in the ratio of (97-3%,94-6%,81-9% ,88-12%,) to form composition's and this alloys are mixed thoroughly in the ball mill for 30 minutes to form the fine mixture(or) mixing inpestle motor thoroughly and the compositions are prepared. In this particular aluminium7075 as matrix and tib2asreinforcement for composite, increases mechanical properties of aluminium7075 inaluminium7075 alloy is attempted. Powders of aluminium7075 were generated through ball milling for this work. This paper focuses on further enhancement of the properties of aluminium7075 alloy through powder metallurgy process by incorporating tib2w and as hybrid reinforcement.

Al-7075(%)	B_4C(%)
98	**2**
96	**4**
94	**6**
92	**8**

4.1.2 STIR CASTIG MACHINE COMPONENTS

1. Furnace
2. Crucible
3. Stirrer rod
4. Stirrer impeller
5. Mold
6. Feeder
7. Motor

4.1.3 Bottom Pouring Type Stir Casting Machine Specifications

Capacity	:	0.7 to 2 kg
Furnace temp(max)	:	950 degree C
pre heating of reinforcement (max)	:	800 degree C
Stirrer Speed	:	100 to 1500 RPM
Die temperature (max)	:	350 degree C
Furnace chamber	:	Organ gas (pure)
Operation	:	Remote Operation With Laptop

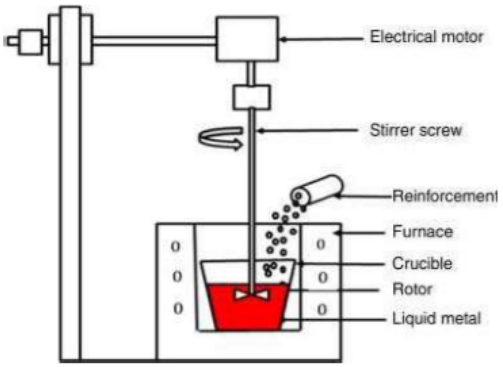
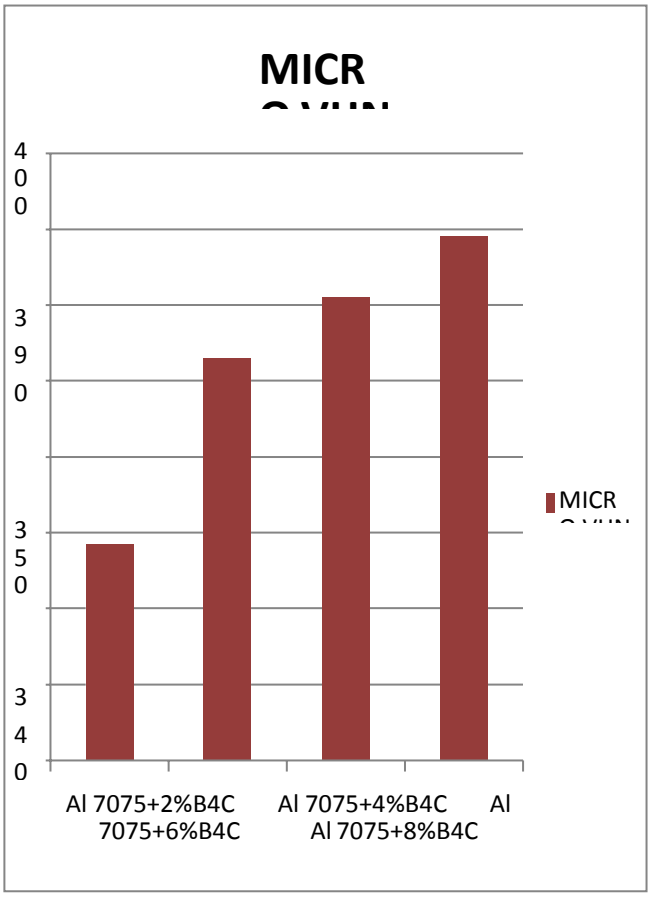


Figure 10: Stir casting procedure for Al7075/SiC MMCs

compositions	Weight in air	Weight in water	density	Avg density
Al 7075+ 2%B_4C	11.694	7.094	2.531	2.583
	7.124	4.361	2.578	
	4.329	2.698	2.641	
Al 7075+ 4%B_4C	9.865	5.985	2.542	2.568
	10.816	6.246	2.581	
	9.505	5.824	2.582	
Al 7075+ 6%B_4C	9.98	6.1	2.572	2.556
	9.58	5.83	2.554	
	10.48	6.359	2.543	
Al 7075+ 8%B_4C	10.016	7.026	2.510	2.552
	10.354	6.354	2.588	
	10.273	6.257	2.558	

RESULTS

Density, mass of a unit volume of a material substance. The formula for density is $d = M/V$, where d isdensity, M is mass, and V is volume. Density is commonly expressed in units of grams per cubic centimetre



HEAT TREATMENT

- Heat treatment is a process that is used to alter the physical properties of a material in a beneficial way. During a heat treatment process, a material is typically heated to a target temperature at which its physical properties change. It is then cooled at a controlled rateTo anneal or normalize a metal. If a metal has been hardened due to work or heat, then annealing or normalizing may be employed to bring it back to a softer, more ductile state. During the annealing process, the metal isheated above its recrystallization temperature and then cooled very slowly in a furnace or by someother heating method. Normalizing is the same as annealing, except that the metal is air cooled rather than furnace cooled. The metal being heat-treated must be considered heat treatable for any effect to occur.

To harden a material. For this process, a material is heated above a certain temperature. The material is then rapidly quenched by a media such as water or oil. This rapid quenching will create a harder, strongermaterial when performed on a frequently hardened through heat treatment to resist wear and indentation. Metals that require ductility and toughness, such as structural steels, may need to be annealed or normalized if they are subjected to cold working.

HEAT TREATED HARDNESS @ 4 hours

compositions	Trail 1			Trail 2			
	D1	D2	VHN	D1	D2	VHN	MICRO VHN
Al 7075+2%B_4C	71	70	268	68	75	268	268
Al 7075+4%B_4C	70	78	279	68	73	289	284
Al 7075+6%B_4C	68	73	295	67	74	299	297
Al 7075+8%B_4C	66	72	321	85	71	334	327.5
compositions	Trail 1			Trail 2			
	D1	D2	VHN	D1	D2	VHN	MICRO VHN
Al 7075+2%B_4C	89	88	289	78	83	301	295
Al 7075+4%B_4C	78	79	309	67	85	305	307
Al 7075+6%B_4C	67	65	324	65	67	324	324
Al 7075+8%B_4C	66	64	345	64	67	352	352
compositions	Trail 1			Trail 2			
	D1	D2	VHN	D1	D2	VHN	MICRO VHN
Al 7075+2%B_4C	87	88	345	86	76	352	348.5
Al 7075+4%B_4C	86	89	368	89	78	378	373
Al 7075+6%B_4C	83	86	376	88	77	386	381
Al 7075+8%B_4C	89	85	389	85	68	389	389

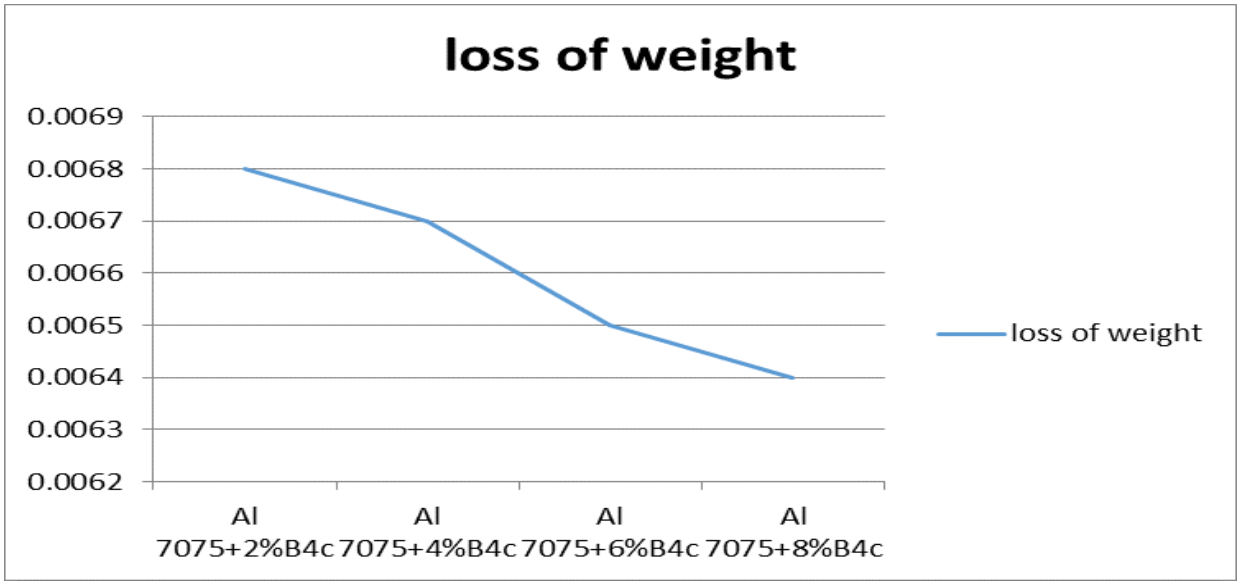
WEAR TEST

Wear test is carried out to predict the wear performance and to investigate the wear mechanism. Two specific reasons are as follows: – From a material point of view, the test is performed to evaluate

the wear property of a material so as to determine whether the material is adequate for a specific wear application.

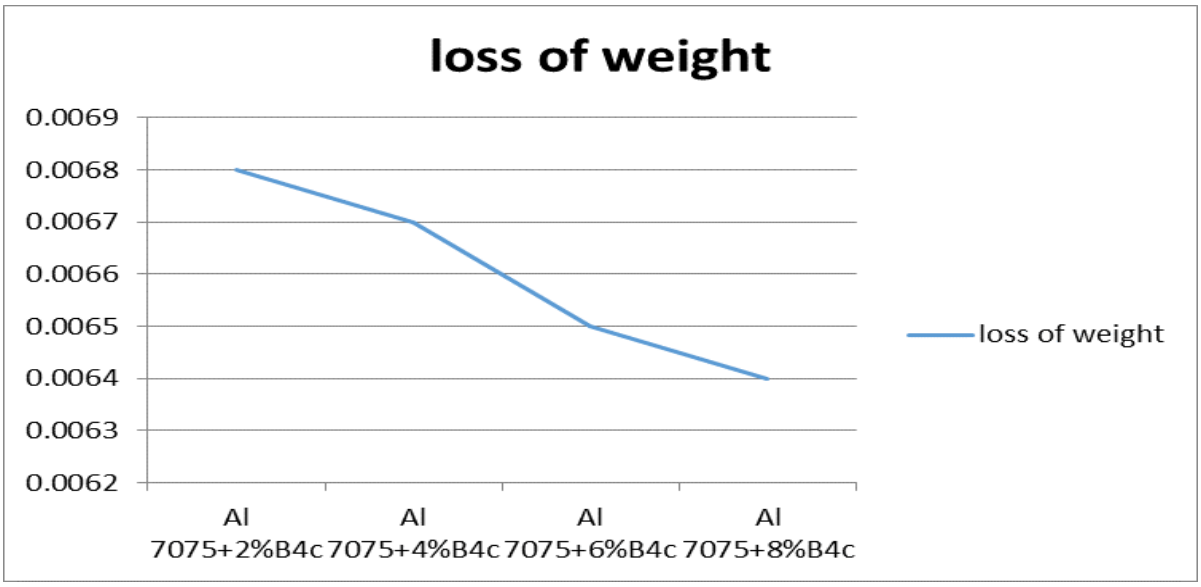
S,no	compositions	Initial weight	Final weight	Loss of weight
1	**Al 7075+2%B_4C**	11.949	11.9418	0.0072
2	**Al 7075+4%B_4C**	11.968	11.9609	0.0071
3	**Al 7075+6%B_4C**	11.468	11.4611	0.0069
4	**Al 7075+8%B_4C**	11.548	11.5412	0.0068

Wear at1kg load 200mts



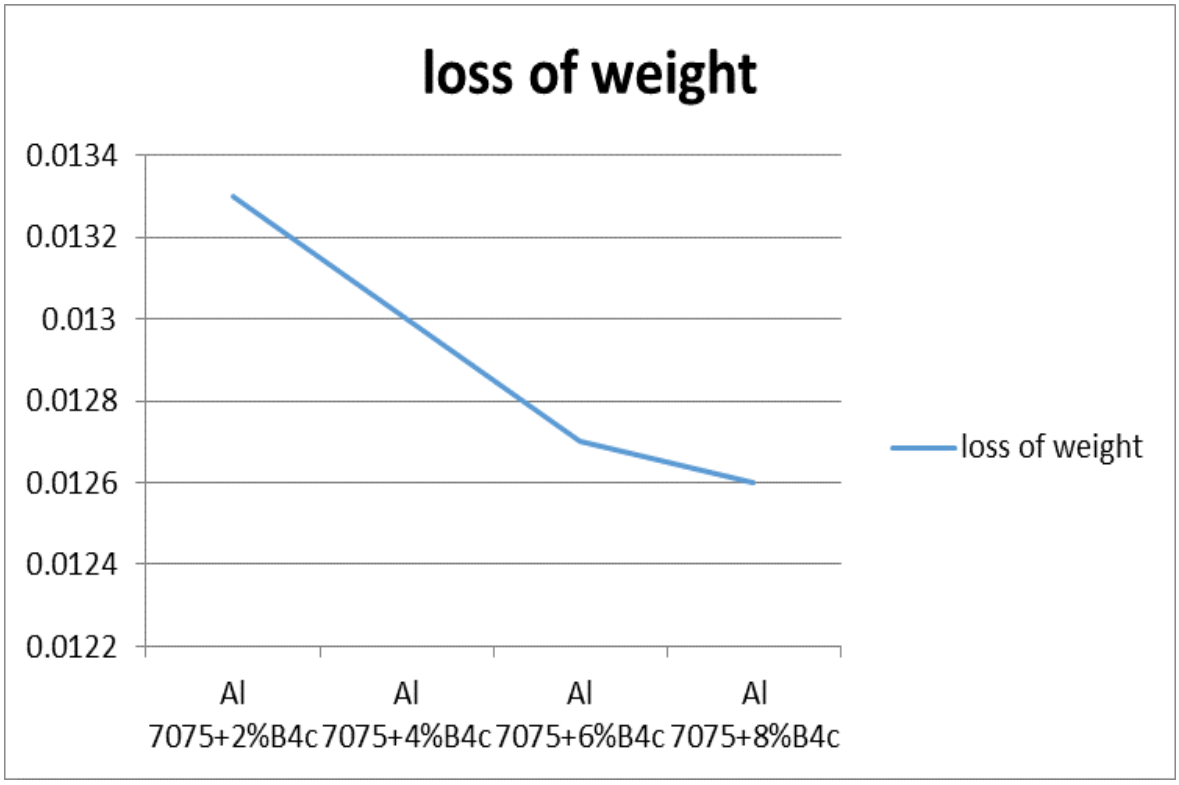
S,no	compositions	Initial weight	Final weight	Loss of weight
1	**Al 7075+2%B_4C**	11.9418	11.9350	0.0068
2	**Al 7075+4%B_4C**	11.9609	11.9542	0.0067
3	**Al 7075+6%B_4C**	11.4611	11.4546	0.0065
4	**Al 7075+8%B_4C**	11.5412	11.5348	0.0064

Wear at1kg load 400mts



S,no	compositions	Initial weight	Final weight	Loss of weight
1	**Al 7075+2%B_4C**	11.9337	11.9204	0.0133
2	**Al 7075+4%B_4C**	11.9530	11.9400	0.0130
3	**Al 7075+6%B_4C**	11.4536	11.4409	0.0127
4	**Al 7075+8%B_4C**	11.5339	11.5213	0.0126

Wear at1kg load 600 mts



CONCLUSION

The AL7075-B4C AND Sic metal matrix composite materials have been fabricated by stir casting method followed by extrusion process Fabricated process further subjected to various testing's

The B4C and sic particulates are evenly dispersed in the matrix alloy. The micro hardness of AL7075-B4C metal matrix composite material is superior than the matrix material which is less than previously fabricated AL7075-B4C

As the percentage of reinforcement increases than the hardness also increased, by the addition of graphite hardness decreased

With the results of hardness comparatively less than without graphite of same compositions

There was decreases of hardness 16% of in every composites with addition of graphite due graphite having machinability property

Further comments subjected to the heat treatment process in order improve all the properties in different mediums like water, oil and ice.

As the composites are subjected to the heating the upto 230ocin the muffle furnace and subjected to soaking for 2 hours

In order to check the frictional behavior of composites it was further subjected to load conditions by the pin on disc.to evaluate the results of thes here it self taken different speeds, rpm and load

Initially it was subjected to 200mts of distance at 1 kg load 400 rpm

From the results it was conclude that as the percentage of reinforcements were increasing there was also increases in the wear.it was very high comparatively very high than the non hybrid composites same results also for the reaming composites in the wear

All the composites were having highest wear which having ore weight loss

The compression strength increases as the fraction of reinforcement enhances in the matrix material. The 8 wt.% of B4C AND reinforced as-cast aluminium AL7075-B4C Nano composite

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