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A LITERATURE REVIEW ON ALUMINIUM-6061 METAL MATRIX COMPOSITE

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Abstract - *In this review paper, the individual and hybrid composites are discussed by aluminium alloy and different reinforcement material. The individual and combined reinforcement with the Aluminium 6061 as based MMCs i.e., aluminium metal composites which are used in aerospace, automobile, marine and agrarian businesses etc. The main purpose of the AMCs reduced the weight and increases the strength of the material. The addition of reinforcements in aluminium 6061 to improves the tensile and compressive strength, hardness, wear rate and fatigue properties. So many researchers were gone through different experiments with the adding of different reinforcement material to find out the different properties.*

Key Words: Aluminium Alloy, Reinforcement, Strength, Wear, Experiments, Property.

1. INTRODUCTION

Composites that forms heterogeneous structures which meet the requirements of specific design and function, imbued with desired properties which limit the scope for classification. However, this lapse is made up for, by the fact new types of composites are being innovated all the time, each with their own specific purpose like the filled, flake, particulate and laminar composites**.** Fibers or particles embedded in matrix of another material would be the best example of modern-day composite materials, which are mostly structural.

A composite fabric is characterized as an auxiliary material made artificially or misleadingly by consolidating at least two materials having divergent attributes. The ingredients stay joined at perceptible level and are not solvent in each other constitute is called network organize and the other one is called strengthening organize.

Chemical Composition of Al6061 alloy

Element	Cr	Cu	Mg	Zn	Fe	Mn	Si	Ti	Al
Wt%	0.14	0.23	0.88	0.08	0.24	0.03	0.65	0.1	97.65

Table -1: PROPERTIES OF ALUMINIUM 6061

Melting point (°C)	720
Density (g/cm^3)	2.7
Linear thermal expansion (k^{-1})	2.32*10^{-5}
Poisson's Ratio	0.33
Modulus of elasticity (GPa)	68.9
Thermal Conductivity (W/mK)	151-202

2. LITERATURE SURVEY

[1] Deepak Singla et al: He effectively created the Al 7075-fly fiery debris composites by utilizing mix casting course of action with legitimate conveyance of cinder particles all over the example. Moreover he included the Mg to make strides the wettability of fiery debris molecule by diminishing its surface pressure. He has given different conclusions from the different calculation based on the diff.exploratory testicles, he calculated the durability of the composites by utilizing izod and charpy tests. As the sum of fiery debris increments the sturdiness esteem continuously expanded up to a few level. Hardness and ductile quality of the composites moreover appeared the same comes about as like of sturdiness as the fortification was expanded. The thickness of the composites diminished with expanding cinder substance.

Form the over review paper I concluded that they are testing the durability and mechanical properties of MMCs. In the event that the particulates included for support fortified well to lattice, the sum of fly ash debris increments with expanding continuously durability esteem of support materials.

[2] S. Rama Rao et al: The aluminium composites containing distinctive sum of boron carbide particles were delivered by blend casting strategy effectively. The hardness of the composites expanded and thickness was diminished with expanding the sum of the boron carbide with in the network stage. Expanding the sum of boron carbide particles in composites caused the ultimate compression quality to extend.

From the above journal paper I concluded that they have calculated mechanical properties of metal matrix materials. The sum of boron carbide increments with the

increments extreme compression quality of fortification materials.

[3] Ravi kumar.BM et al: He effectively manufactured Al 7075 TiB composites by fluid metallurgy course utilizing Al 7075 as lattice fabric and 10% and 3%B combinations as the fortifications. He confirmed the presence of TiB and B by X-ray diffraction test. By Grain size test he indicated the heterogeneous nucleation in composite mixture. He also stated that hardness of the composite was increased in matrix alloy. He expressed that in his future work he will carry out warm treatment may be carried out to think about the mechanical properties and characteristics of the lattice and fortification and TiB is strengthen in numerous extents to the aluminium lattice to upgrade the mechanical properties. In his future work he will use different casting methods to prepare the composites.

From the above journal paper I concluded that they have calculated mechanical properties of metal matrix materials. The amount of Tib increases with increase the hardness of matrix materials.

[4] Włodarczyk Fligier et al: In this he used two methods to produce composites one by powder metallurgy technique and another by pressure infiltration method. Both aluminium matrix composites are reinforced by ceramic particles. He concluded that pressure infiltration method gives good surface quality and powder metallurgy method helps in manufacturing small elements and pressure infiltration method consumes more energy than the power metallurgy technique.

From the above journal paper I concluded that they conduct different methods one is pressure infiltration and another one is powder metallurgy method, the pressure infiltration method gives the good surface quality and another method helps in manufacture of small elements.

[5] Madhuri Deshpande et.al.[2016]: successfully fabricated Pitch based carbon fiber reinforced Al matrix composites Powder Metallurgy (PM) route. Volume % of carbon fibre are (5-50)% uncoated (UnCf) and coated milled pitch based carbon fibers (NiCf) and AA7075 as matrix with different volume contents of carbon fibers. Uncoated and Ni coated carbon fibers were mixed with AA7075 Aluminium alloy powder and subsequently hot pressed and they studied on densification and hardness. A greatest of 11% decreases in thickness is watched for 50vol% Cf composite compared to as cast Al7075. It is observed that the composites developed with uncoated carbon fibre exhibit lower values of hardness as compared with Pure Al7075 hot pressed specimen. Whereas the Ni coated carbon fibre composites show the increase in hardness up to 20Vol% and then it decreases. It is seen from the microstructures that carbon fibres are homogenously distributed in the aluminium matrix for all compositions.

From the above research paper I concluded that the electro less nickel coating on the fiber surface improves the interfacial bonding which results in increased hardness of the composite. Double action hot pressing experiences improved density and density gradient is not indicated in composite.

[6]. Niranjan K.N et al :(2017): their work was on the investigation of hybrid composites i.e, aluminium alloy 6061 as a base material and reinforced material as sic(6%) and graphite (3%,6%&9%). They calculated mechanical properties of tensile, compressive and hardness tests. They have increased the percentage of reinforcement (graphite), then the hardness will be decreased and tensile, compressive strength will be increases with the influence of sic particles.

From the above research paper I concluded that the mechanical properties of MMCs having aluminium as lattice profoundly depends on the particles utilized for fortifications, increased the percentage of reinforcement (graphite), then the hardness will be decreased and tensile, compressive strength will be increases with the influence of sic particles.

[7]. Niranjan nanjayyanamath et al(2017): This paper discuss about the composite material they have taken base material as aluminum alloy 6061 and reinforcement material as fly ash (5%, 10%&15%). The particle size ranges of fly ash were 5-20, 25-30&50-60µm. They calculated mechanical properties of tensile, compressive and hardness. They have expanded the rate of support (fly cinder), and after that the hardness and compressive quality will be increments.

From the above paper I have concluded that increase the ratio of reinforcement, and then the hardness and compressive quality will be increases.

[8]. Ajit kumar senapati, et al (2016): their work was on the study of the aluminium alloy 6061 and reinforcement as fly ash (10 and 15%wt). They have considered almost the mechanical behaviour of unreinforced combination and metal network composites. They compared the metal lattice composite arranged with 15% of fly ash debris show wat better mechanical property to unreinforced amalgam as well as MMC.

From the above paper I have concluded that they compared the metal network composite arranged with 15% of fly ash show superior mechanical property to unreinforced amalgam as well as MMC.

[9]. Miss. Laxmi, Mr. Sunil kumar(2017): They were successfully fabricated the Al 6061-SiC(10%,15%&20%wt) Composite by utilizing mix casting course of action with legitimate dispersion of particles all over the example. They ponder the mechanical properties of hardness and brief investigation of microstructure must be conducted on

checking electron magnifying lens (SEM) to verify the scattering of support within the network.

From the above paper I concluded that with the increment composition of SiC an increment of hardness has been observed.

[10] Mohan Kumar S et.al. [2014]: He carried out tests on a Al 7075-T6 and it's coated with an electro less nickel stores of 10-20µm in coating thickness. ASTM standard E399 for plane strain break sturdiness assurance was followed in this examination. Uncoated Al 7075-T6 amalgam appears a surrender quality of 559 MPa, after EN coating on combination of 10µm and 20µm abdicate quality of amalgam comes to the 569MPa and 603MPa. The uncoated aluminium basic stack is 4.44KN and K1C esteem is 22.28mpaVm. Advance for 10µm&20µm coated aluminium combination incorporates a basic stack of 6067 KN and 7.14 KN which compares to KIC values of 34.48MPa Vm individually. The coating encounters dynamic delamination and break at the most extreme stack, due to the malleable stretch, coming about in plastic misshaping.

From the above review paper I concluded that the EN covering encounters improving delamination and crack at the most high load, because of the ductile material, plastic deformation occurs. The split development is shaky because of solid attachment between EN covering and Aluminum alloy.

[11]. Daniel Jebin et al: Examined the wear behaviour of the Al 6063 combination composites fortified with alumina of diverse compositions, which are casted by stir casting method keeping a constant load of 2kg and varying the velocities and he concluded that with increase in percentage of alumina wear rate decreases. In his research he concluded that Al 6063 alloy reinforced with 8% alumina is showing higher wear resistance for all velocities tested than the 0% alumina and 4% alumina.

From the over review paper I concluded that the particulates included for support fortified well to lattice, the wear resistance increments with expanding volume division of fortification materials.

[12] Manoj Singla et al: Revels that his consider on aluminium based composites recommends that with increment in composition of silicon carbide (SiC) comes about within the increment of hardness, affect quality. He inspected that homogeneous dispersion of SiC particles within the Al framework appears an expanding nature within the tests arranged by without applying blending handle, with manual mixing and with 2-step strategy of blend casting separately.

From the above journal paper I concluded that the increase the sum of SiC with increments the hardness and affect quality of the network.

[13] G.B. Veeresh Kumar et al: investigated and concluded that fluid metallurgy strategies were effectively embraced within the arrangement of Al6061-SiC and Al 7075-Al2O3 composites containing the filler substance up to 6%. The densities of the composites are found made strides than their base framework. Hardness of the composites found expanded with expanded filler substance. The pliable quality properties of the composites are found higher than that of base network. Al6061-SiC composites have predominant pliable quality properties than that of Al7075-Al2O3 composites. Then considers in generally it can be concluded that Al6061-SiC shows predominant mechanical properties.

From the over term paper I concluded that the densities of the composites are found progressed than their base framework. Hardness of the composites found expanded with expanded filler substance.

[14] Prabhakar Kammer et al: Explored on the enhancement of mechanical properties of E-glass brief filaments and fly ash strengthened Al7075 crossbreed MMCs. He measured extreme malleable quality and compressive quality. They concluded that due to nearness of E-glass strands and fly ash debris the extreme malleable quality is expanded compare to base metal and due to nearness of these fortifications needed the compressive quality is expanded.

From the above research paper I concluded that the occurrence of E-glass fibers and fly ash the Ultimate tensile strength is improved compare to base metal and due to presence of these reinforcements even the compressive strength also increased.

[15] Syed Ahamed et.al.[2014]: successfully fabricated the Al-Si(LM-13)/kalonite/graphite carbon hybrid MMCs over stir casting method. Particles size of Kalonite/Graphite carbons are between 50-100µm.The different percentage of kolonite are 3%, 6%, 9%, 12% and graphite carbon is kept constant to 2.5%. Nickel coating on graphitic carbon particles through electroless process was given. The chilling process is incorporated to minimize the micro shrinkages in composites. Different Chill thickness ranges from (10-25mm). The tensile, hardness, fracture toughness and microstructure tests were conducted. The increased hardness, ultimate tensile strength and fracture toughness is identified for 9% wt of kolonite at 25mm chill thickness ie.,82.8 BHN, 175.837Mpa(UTS) and 11.7mpa√m respectively. Microstructure of the models containing 9 wt% and 12 wt% dispersoids Cast utilizing copper chill of 25mm thick appears that kaolinite particles were deboned from the lattice amid straining in a fragile way as an impact of well much chilling, stretch concentrations and proliferation of splits.

From the above two research paper [21], [22] I concluded that the chilling process plays important role in

manufacturing process. The chilling process is incorporated to minimize the micro shrinkages in composites

[16] Joel Hemanth et.al.[2000]: Has prepared the agitated aluminum alloy-Glass particulate compound consists dispersoids (size 20-50µm) with wt% of 3-12. Different materials for chill block (25mm) is used are Cu, steel, CI, Sic The effect of strength and fracture toughness for varying chilling rate and dispersoid content were tested. Ultimate tensile strength increased at 9% of weight i.e., 138mpa for Cu chil block. Fracture toughness of 15mpa mpa√m at 9% of weight for Cu chil block.

From the above two research paper I concluded that the effect of strength and fracture toughness for varying disturbing rate and dispersoid content has to be tested.

[17] **Ajit Bhandakkar et.al. [2014]:** Fabricated aluminium 2024 and silicon carbide and fly ash as reinforcement material particle size of 25-45 µm in 5%, and 10% by weight. The abdicate quality, malleable quality and %stretching of AA2024 fly cinder metal network composites diminishes with the increment in fortification the abdicate quality, malleable quality and % stretching of AA2024 fly cinder metal network composites diminishes with the increment in support. The break durability KIC comes about AA2024 fly cinder composite is 18Mpa√m as compared to 21Mpa√m for unreinforced and softened base amalgam. Microstructure pictures appear the uniform conveyance of fortification amalgam in aluminium metal framework composite.

From the above two research paper I concluded that the surrender quality, ductile quality %propagation of AA2024 fly cinder metal lattice composites diminishes with the increment in fortification.

[18] GOPAL KRISHNA U B et al.[2013]: By blend casting course, aluminium lattice was fortified with boron carbide particulates of 37, 44, 63, 105, 250µ sizes individually. The microstructure and mechanical properties of the manufactured AMCs was examined. Based on the results obtained from tensile strength test of the metal matrix composites of different particle sizes, 105µ size B4C was chosen and varied the wt% of B4C with 6,8,10 and 12wt%. The smaller scale Vickers hardness of AMCs was found to be greatest for the molecule measure of 250µ and found most extreme for 12wt%in case of shifting wt% of the fortification of 105µ estimate. The pliable quality of AMCs was found to be most extreme for the molecule measure of 105µ and found most extreme for 8wt% in case of changing wt% of the fortification of105µ estimate. The optical micrographic thinks about and XRD examination uncovered the nearness of B4C particles within the composite with homogeneous scattering.

From the over review paper I concluded that the extension of B4C particles within the cross section promotes more solidarity to system compound by advertising more security from flexible loads.

[19] R.Kartigeyan et.al.[2012]: Has successfully developed Al 7075 alloy and Short Basalt Fibre composite through blending casting method. The expansion of brief basalt fibre altogether increments the hardness, surrender quality and extreme malleable quality. The composite containing 6% volume division of brief basalt fiber appears higher hardness esteem of 97.1Mpa when compare to base network, 92Mpa. The extreme pliable quality of Al-7075 basalt fibre when fortified 6 vol% is expanded by 65.51%. The conveyance of fortification in metal lattice is decently uniform.

From the above research paper I concluded that the Al 7075 alloy and Little Basalt Thread composite suggestively increases the Hardness, yield strength and critical tensile strength.

[20] Tadeusz SZYMCZAX, Zbigniew L.KOWALEWSKI [2013]: Effectively manufactured 4420 casting aluminium amalgam fortified with various content of the saffilfibbers, i.e.10%,15%,20%. The basic values of the stretch concentrated calculate of the 44200 aluminium amalgam, come to the taking after levels: 12.201, 12.121, and 11.866 [MPam1/2], separately. Basic esteem of the stretch concentrated figure of the composite was three times littler than that for the 40H steel accomplished. Impact of the Al2O3 saffilfibers substance inside the extend from 10% to 20%, on the basic push concentrated figure was insignificant little. They concluded that the sturdiness of the composites tired isn't all sufficient to be utilizing particularly for the exceptionally mindful components of designing developments.

From the above research paper I concluded that the break sturdiness of the composites tested is not high enough to be used especially for the very responsible elements of engineering constructions.

[21] Prashant S D et.al. [2019]: In this paper they have done that the hardness test, think about of microstructure and mechanical properties such as pliable quality, and surrender quality % prolongation as well as % reduction by using aluminium metal matrix alloy. Then comparison between al 7075 and al 6061 and evaluate the mechanical properties. The result of % elongation as well as % reduction at fracture are performed by experimentally and compared with these result theoretically by using COSMOS works analysis tool. Comparison between al 6061 and al 7075 the almost al 7075 has a more tensile and yield strength of the other alloys.

From the above research paper I concluded that the comparison between al6061 and al 7075 for testing mechanical properties. The result of % elongation as well as % reduction at fracture are performed by experimentally

and compared with these result theoretically by using COSMOS works analysis tool.

3. CONCLUSIONS

This literature review presents the physical and mechanical properties of aluminium combinations moved forward by utilizing diverse sorts of support fabric. Reinforcement like Sic, Fly ash, $ZrSiO_4$, Al2O3 improves the physical and mechanical properties of composite. The composite of Al6061 and different reinforcements prepared by the stir casting technique. Different percentage composition compare with the base alloys. A advance consider in this regard is required especially weight rate and molecule estimate of support by utilizing fabricating of blend casting technology. This audit presents the distinctive exploratory technics, comes about gotten and conclusions made over the along time by various agents within the field of molecule strengthened Al-7075MMCs. A investigate intrigued in Al-7075 MMCs manifested by analyst from scholastics and business has made a different in conduction of different consider has improved our information approximately the physical properties, mechanical properties and tribological characteristics.

The carbon fibre or any other metal composite fabric includes a higher pliable quality and modulus of flexibility of the materials. They all break in a delicate way, as the bend is direct until breaks or breaks with in no twisting of the ben at tall loads.

The hardness of the composites was checked on and on conclusion it is found that as the fortification substance expanded within the lattice fabric, the hardness of the composites too expanded. Assist, the tests conducted to choose the same appeared the (Vickers and Brignell's hardness) extended bolster substance when compare with the base outline work. The mechanical properties were looked into with regard to quality. It is evident that the structure and properties of the fortresses control the mechanical properties of the composites.

The wear execution of difficult ceramic strengthened aluminium lattice composites was looked into with specific accentuation on the mechanical and physical variables and fabric components moreover with the impact oil, work solidifying, mechanical blended layer, warm treatment, stir casting prepare parameters etc. all the variables have significant impact on the tribological execution of Al-MMC and counter confront metal couples.

Break sturdiness parameters are concern within the field of break mechanics. Break mechanics is based on the certain presumption that there exists a break in a work component. The crack is misleadingly arranged in several shapes i.e. a gap, an indent, a space, etc. this outline of a few vital break durability parameters like basic stretch escalated calculate, split tip opening relocation (CTOD). Some researchers highlight the significance of break sturdiness in selecting designing materials.

At last there's an awesome potential, scope and openings for the analysts, within the field of forecast of mechanical and tribological properties of aluminium 7075 lattice composites by utilizing delicate computing strategies, aluminium casting strategies and prepare parameters, fortifying different difficult ceramic particulates.

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