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HYBRID METAL MATRIX COMPOSITES – REVIEW

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ABSTRACT

Hybrid Metal Matrix Composites made up of two or more composties, which is used for reinforcement with the combination of various materials such as Aluminium, Titanium and Mica. This paper will be concentrating on the classification of composites and introduction to stir casting method. Intensive review has been carried out on the behaviour of various composites. It also demonstrates the importance of composites usage and its application there off.

KEYWORDS: Composite, Metal Matrix composite, Types of Composites, Advantages and Disadvantages of Composites.

INTRODUCTION

Metalmatrix composites (MMCs) possess significantly improved properties including high specific strength; specific modules, damping capacity and good wear resistance compared to unreinforced alloys. Hybrid metal matrix composites are advanced materials used for light weight high strength applications in aerospace and automobile sector. Most Composites have been created to improve combinations of mechanical characteristics such as toughness, stiffness and ambient and high-temperature strength. Composites are materials made from two or more constituent materials (Metal, polymers or ceramics) with significantly different physical or chemical properties.

COMPOSITES

The combination of two or more substances with different physical properties of the material is called Composites. In Composites, the constituents are retaining because they do not dissolve into each other and act as a concert. Composites are mainly used for their workability to any situations and combination with other materials to serve specific purposes and express desirable properties. The application of these materials is had special property while using a composite material.

The advantages of composite materials are high strength and stiffness, low density compared with heavy materials. The combining materials of metal, ceramic, non-metal gives an unlimited variation and the properties of these materials are determined by the properties of their single components. The composite elements are shown in figure (1).

Composites are also known as Fiber Reinforced Polymer Composites (FRP). These are made from a polymer matrix by reinforced with an engineered, natural fiber and other reinforcing materials. The reinforcement of materials is having different purposes. Because of using reinforcement, the applications of these materials in areas are reduce weight of light metals. In this the materials are preconditioning, so it will improve the component properties.

Fig (1) Composite formation

Most of the composites are multifunctional materials that have unprecedented mechanical and physical properties. Composites are mainly used in Aerospace industry, but now their materials are also used in mechanical applications like a internal combustion engines, machine components, electronic packaging and thermal managements. Also used in automobile industry, trains, aircraft structures with their mechanical components like brakes, drive shafts, flywheels, pressure vessels etc., Also used in Industries for oil exploration and Marine structures for making ships, boats and biomedical devices.

Composites are also a biological structural material that occurs in nature such as weed, bamboo, bone, teeth, shell etc., Composites materials are classified also as organic fiber reinforced ceramic matrix composites.

Classification of Composites

Composites are generally classified into two constituents such as Matrix and Reinforcement. Matrix based composites are classified as Polymers, Metal, Ceramic and Carbon and Graphite (also known as solid materials).

Polymers are having two major categories such as Thermosets (Epoxy, Polyester) and Thermoplastics (Polystyrene, Nylons). Metals are formed by Alloys such as Steels, Aluminums etc. Ceramics are having three categories for a material such as Glass, Semiconductors and Carmets, Cements.

There are having four classification of composites such as Metal matrix composites (MMCs), Polymer matrix composites (PMCs), Ceramic matrix composites (CMCs), and Carbon matrix composites (CAMCs)which are classified by the type of the material that used for the matrix. Fig.(2) shows the classification of composite in flowchart model.

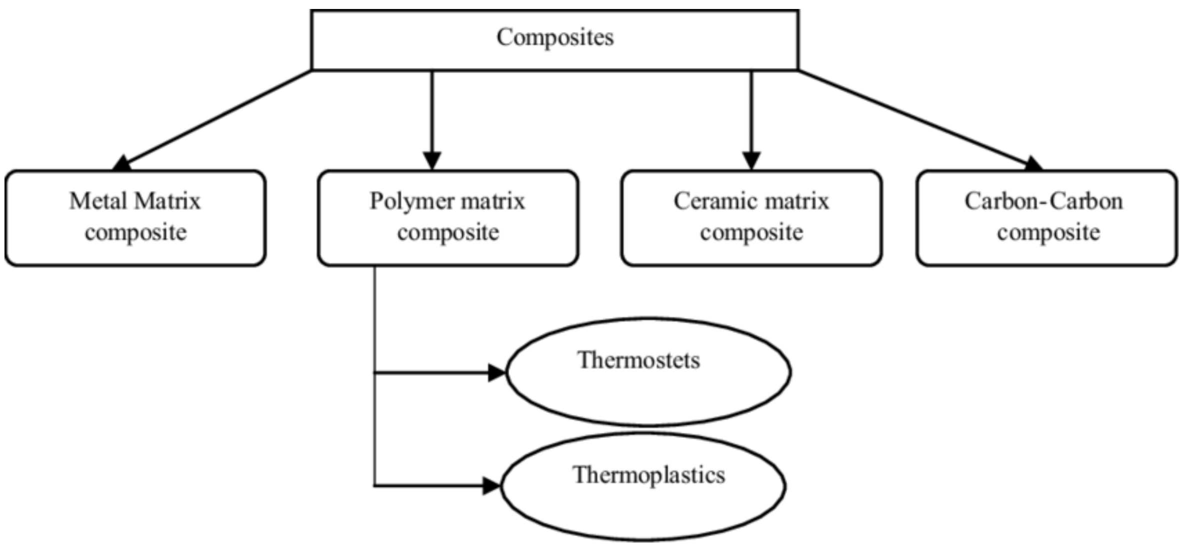

Fig (2) Classification of composites

Reinforcements

Continuous fibers, discontinuous fibers, whiskers (single crystal) and particles are the four key types of reinforcements that used in composites and these keys are mono dimensional factor. Continuous fibers are widely used in reinforcements for high performance applications. In textile technology, continuous fibers are used as fabrications to achieve specific properties such as impact resistance etc., Keys have two-dimensional factor known as fabrics and three dimensional known as braids.

Reinforcement is a constituent of a composite material which increases the composite's stiffness and tensile strength.

The functions are

- It increases the mechanical properties of the composite.
- It provides strength and stiffness to the composite in one direction as reinforcement carries the load along the length of the fiber.

The types of reinforcements are Fiber reinforcement and Particle reinforcement. The fibre reinforcement can be also called as Fibre-reinforced plastic made up of polymer matrix with fibres. Glass, carbon, aramind and other various fibres such as wood, papers are known as fibre materials. Particle reinforcement adds a similar effect to precipitation hardening in metals and ceramics. Large particles prevent dislocation movement and crack propagation as well as contribute to the composite's Young's Modulus.

Methodology for Reinforcement

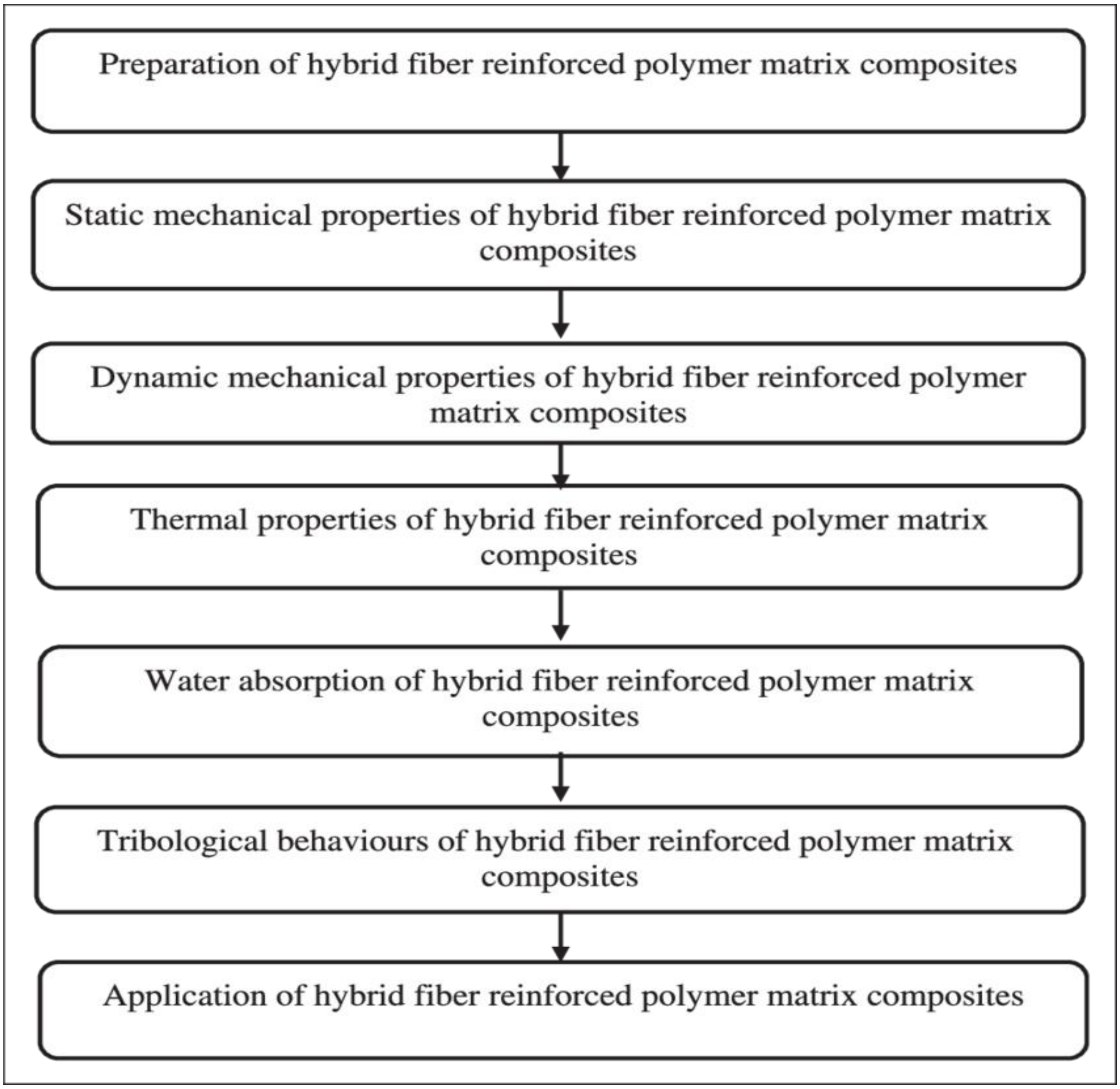

Fig (3) Procedure for Reinforcement

Figure (3) shows that the methodology procedure for Reinforcement.

SELECTION OF MATRIX MATERIALS

As we see in above session, the matrix materials are considered as four classes such as polymers, metals, ceramics and carbon.

Types of Composites

There are having four different types of composites such as Metal Matrix Composites, Polymer Matrix Composites, Ceramic Matrix Composites and Carbon-Carbon Matrix Composites. The Composite types are shown in figure (4).

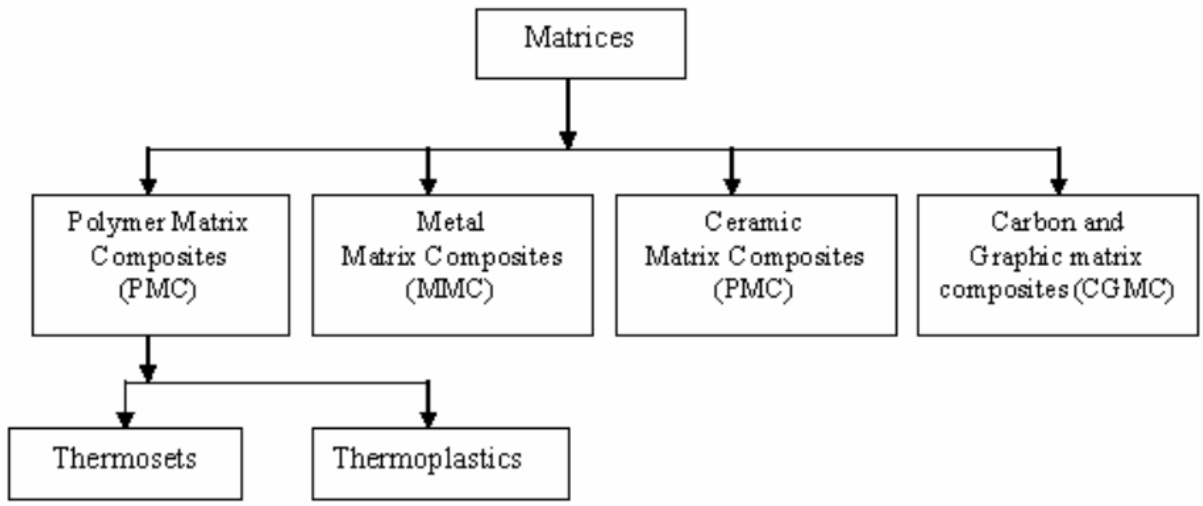

Fig (4) Types of Composites

METAL MATRIX COMPOSITES

A **Metal Matrix Composites (MMC)** is a composite material which have the combination of two constituent parts. One part is being metal and other part may be different metal (for example ceramics or another compound). Materials like tungsten carbides consist of carbides and metallic blinders, cast iron with graphite are the part of composite materials. In Automobile industry, Metal matrix composites are used for making a fiber reinforced pistons with strengthened cylinder surfaces and also a particle strengthened brake drums and disks. The main purpose of using metal matrix composites is for weight reduction for reinforcement. These materials are more competition with the powder metallurgy. MMCs are mostly used in engineering applications with the operating temperature of 250^0C – 750^0C. The material which has at least three parts is called a Hybrid Metal Matrix Composites (HMMC).

Metal matrix materialconsist of hard reinforcing particles has embedded within a metal matrix phase and it is a low-density alloy (for example magnesium, aluminum, titanium, copper, steel).

Figure (5) shows that the metal matrix composite fully manufactured products.

Fig (5) Metal Matrix Composites

Objectives of Metal Matrix Composites

- Low density with High strength to weight ratio,
- It provides ductility and protects the fibers from surface damage,
- High temperature strength for retention, fatigue, wear resistance and has an excellent creep,
- Composites have the prospects for replacing the cast iron and other materials in engines and brakes,
- Corrosion resistance are improved,
- Increase in fatigue strength at high temperature,
- Young's modulus increased,
- Reduction of thermal elongation,
- Production of magnetic materials,
- Creep resistance are increased at higher temperature when compared to conventional alloys.

Classification of Metal Matrix Composites

Metal matrix composites are classified in several ways. One is the consideration of type with their contribution of reinforcement components in particle layer, penetration materials. For Fiber composite, materials can be classified into a continuous (single and multi-filament) and short fibers materials.

Basically, Metal Matrix Composites having five types of classifications such as Powder Metallurgy, Melting and Solidification, Thermal Spray, Electrochemical Deposition and Other Novel Techniques. The classification of Metal Matrix Composite can be shown in figure (6) and (7).

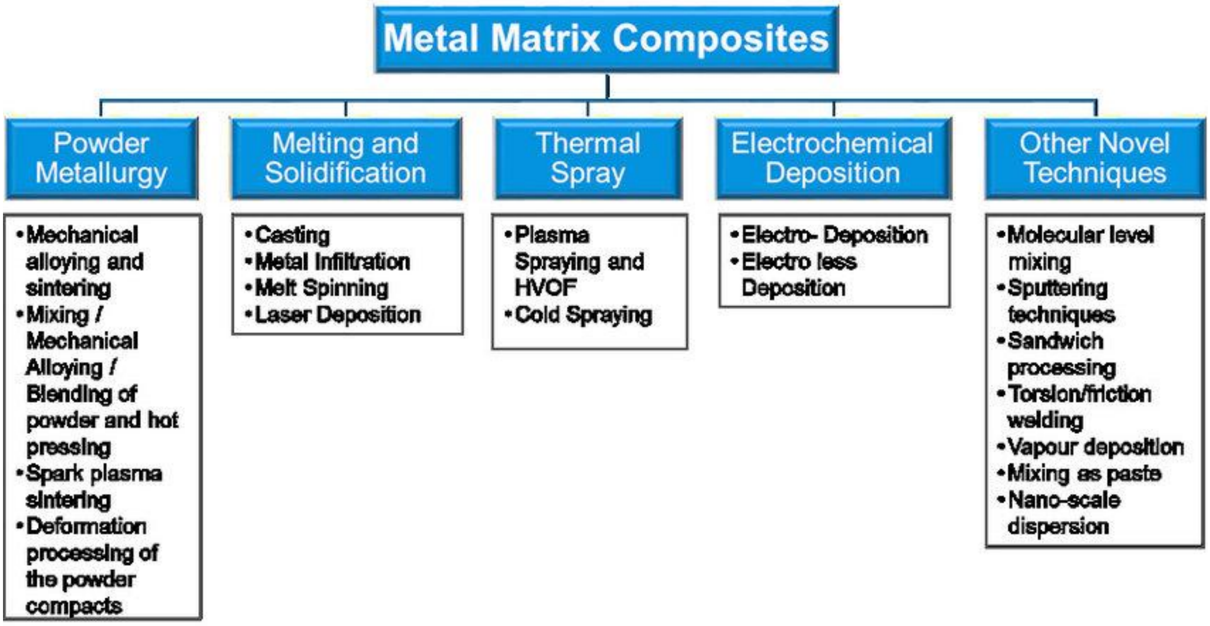

Fig (6) Classification of Metal Matrix Composites (1)

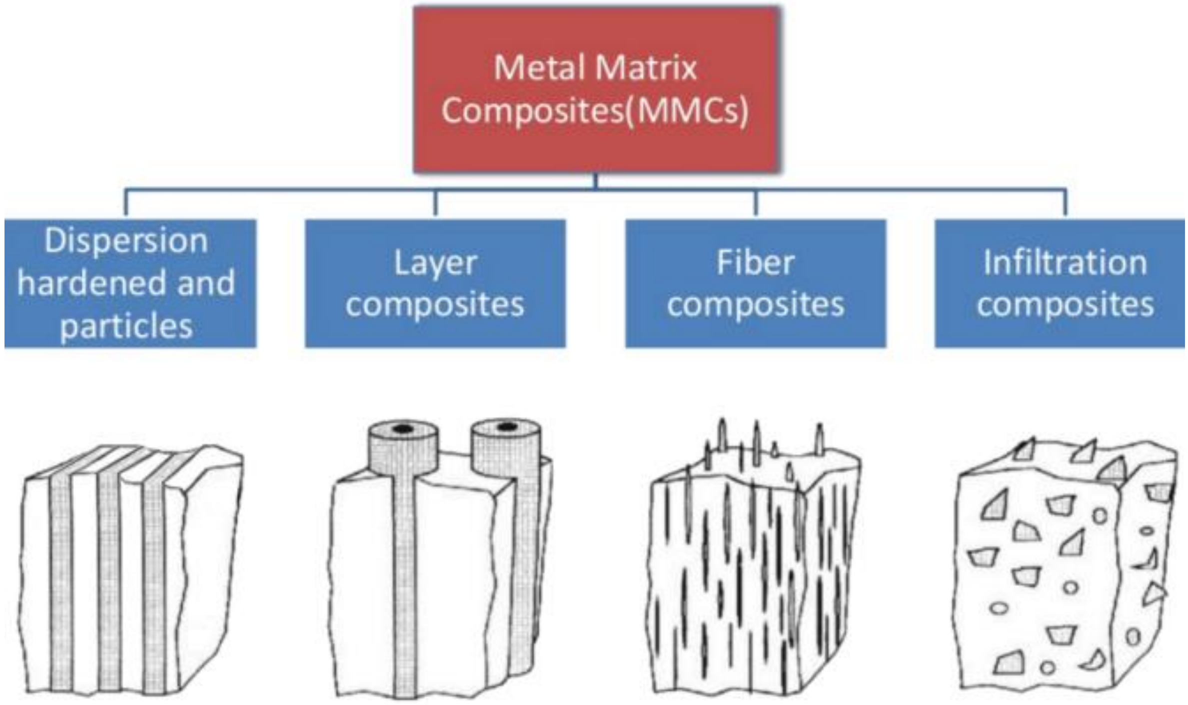

Fig (7) Classification of Metal Matrix Composites (2)

Manufacturing of Metal Matrix Composites

The process of dispersing a reinforcing material into a metal matrix and the reinforcement surface can be covered to stop a chemical reaction with the matrix is known as a Manufacturing of Metal Matrix Composites.

In this, most of the common methods of manufacturing for solid state are powder blending, consolidation, physical vapor deposition and strengthening of the MMCs. This method is generally used for the manufacturing of aluminum and magnesium MMCs.

Some of the other processes are used for manufacturing in metal matrix composites like Liquid fabrication methods, Solid state fabrication methods, etc.,

Advantages of Metal Matrix Composites

- Low cost.
- Moisture absorption is low.
- Thermal and electrical conductivities are high.
- Temperature capability is high.
- Stiffness of the material is high.
- High strength.

- Increase wear resistance.
- Thermal ductility is low.
- Losses are less.
- Light weight and perform at high temperatures.
- Frequency is low.
- High reliability.

Applications of Metal Matrix Composites

- Metal matrix composites are used in space shuttle orbiter by using boron fibre reinforced aluminium materials.
- For industrial applications, Titanium carbide have been used for making cutting blades, tools, dies etc.,
- For mechanical engineering, MMCs are used to make a piston, reinforced cylinders in engines.
- Light alloy materials are used in automobile engineering that the potential in engine area such as valves, cylinder head, crankshaft, engine blocks etc.,
- In automobile, Titanium boride particles are used in engine valves.
- Aerospace technology used MMCs for engine fins, helicopter blade sleeves by using Silicon carbide.
- Boron carbide used in nuclear fuel containers.
- Silicon aluminium have been used in electronic packaging.
- Sports equipment’s like mechanical parts such as connecting rods, baseball bats are used for stiffness.
- Silicon reinforced aluminium is used in automobile for engine cylinder for wear resistance.

Limitations of Metal Matrix Composites

- High porosity.
- Burning of powder is spontaneous.
- Manufacturing of materials are difficult.
- Material and Manufacturing cost is high.
- Impact damages are not visible.
- Moment of inertia is large.

POLYMER MATRIX COMPOSITES

The number of different types of organic polymers to form a continuous phase with reinforced fibers in dispersed phase is known as Polymer matrix composites (PMC). The continuous phase acts as a matrix to attach the fibers for load transfer. The matrix is dispersing the fibers to the structures. Polymer matrix are week and have low stiffness, so the strength and stiffness are coming under reinforcing fibers.

Generally, PMCs are use two types of matrix class materials such as Thermosets and Thermoplastics. Thermosets are used matrix for structural applications to make steady gains for the materials. Thermosets are having more resistant and have more corrosive than thermoplastics. Thermosets are work under curing process during fabrication and thermoplastics are repeatedly softened and reformed by heat. Both types are numerous.

Thermosets are having high quality in various ways such as multi-dimensional molecular structures after curing. Hardening of material has melt when they are decomposed. Thermoplastics are having one- or two-dimensional molecular structures which tends to raise the temperature. This high temperature is regaining during cooling. Figure (8) shows the classification of Polymer Matrix Composites.

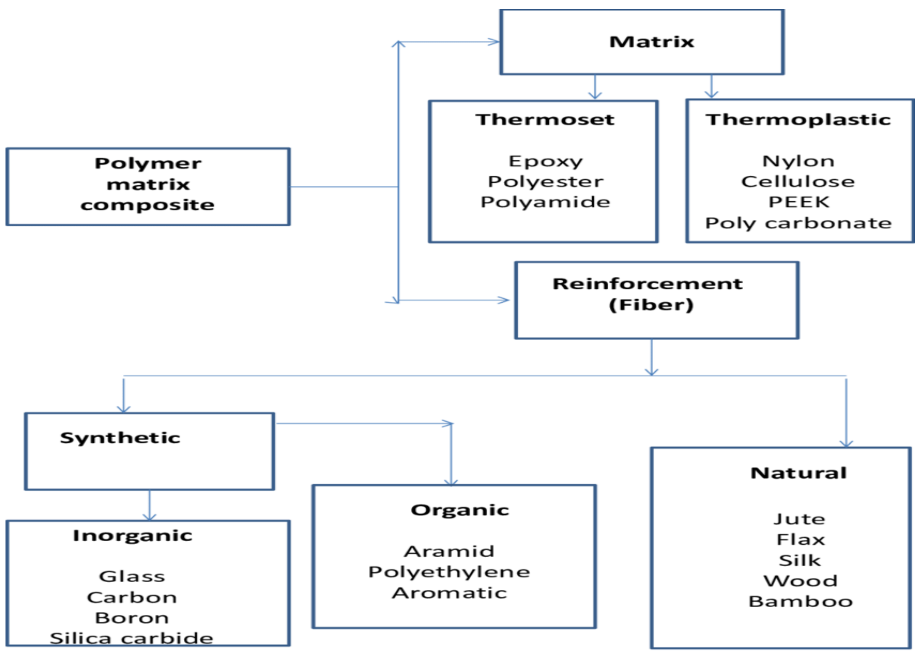

Fig (8) Classification of PMC

Resin

In polymer matrix composite, there are having two major categories of resins such as Thermosetting resin and Thermoplastics resin.

Thermosetting Resin

Polyesters, vinyl esters, epoxies, bismaleimides and polyamides are major materials used in Thermosetting resins. The polyesters are majorly used in fiber reinforced plastics and make a current market for advanced composites resins. Therefore, the initial velocity will be low and undergoes chemical reaction which are connected in multi-dimensional network. This process in known as curing. Figure (9) shows the Manufacturing model of Resin.

- High dimensional stability.
- High temperature resistance.
- Better resistance to solvents.
- Increase toughness and obtain maximum temperature for operations.

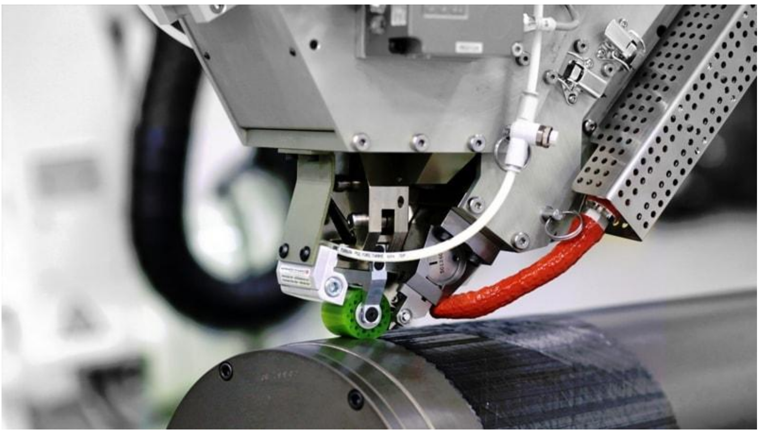

Fig (9) Thermosetting Resin

THERMOPLASTIC RESIN

Materials like polyesters, polyetherimide, polyamide imide, polyphenylene sulfide, polyether ketone and liquid crystal polymers are used in Thermoplastic resin. The molecules consist of these materials are melt to the viscous liquid at the temperature of 260^0C to 3710^oC forma amorphous and semicrystalline solid. It is also called as Engineering plastics. Thermoplastic Resin are shown in figure (10).

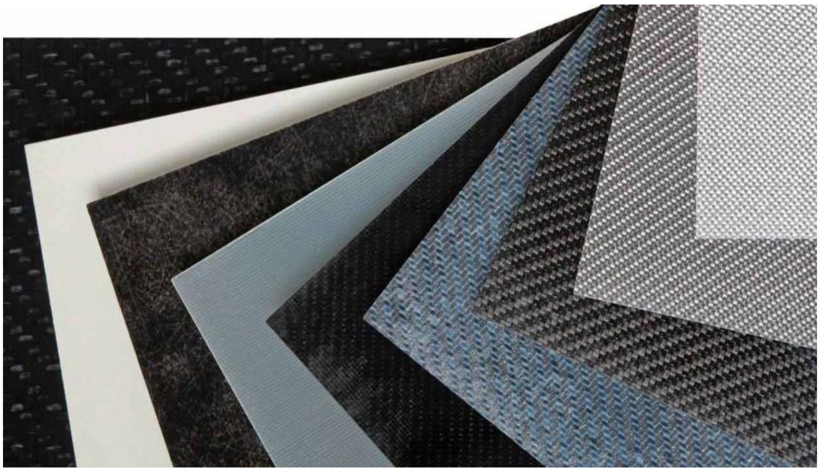

Fig (10) Thermoplastic Resin

Objectives of Polymer Matrix Composites

- To develop high performance fiber with reinforced composites.
- To improve resin for wear resistance, impact etc.,
- To decrease shrinkage.

Operations Performed in Polymer Matrix Composites

- Spray up Moulding
- Prepreg method
- Pultrusion
- Filament winding
- Resin transfer moulding
- Vacuum bagging
- Sheet moulding

Advantages of Polymer Matrix Composites

- Electrical and thermal insulation are good.
- Material stability is high against corrosion.
- Low density.
- Stiffness and strength are high.
- High corrosion resistance.
- Light weight.
- Low-cost process.

Applications of Polymer Matrix Composites

- Polymer matrix materials are used in aerospace industries.
- In automotive industry, PMCs are used to make a body panel, leaf springs, driveshaft, bumpers etc.,
- Construction of army aircraft, space shuttles, satellite systems.
- Medical devices as MRI scanners, X-ray couches, surgical tools, wheel chairs and mammography plates.
- For industrial, chemical storage tanks, pressure vessels, pump housing and valves are made.
- Some of the electrical products such as panels, insulators, connecters are made.

Limitations of Polymer Matrix Composites

- Absorption increases at high temperature.
- Thermal resistance is low.
- High coefficient of thermal expansion.

CERAMIC MATRIX COMPOSITES

The composite material which has both the reinforcement fibers and matrix materials are together is known as ceramic matrix composites. The materials can exhibit ionic bonding and covalent bonding. It can withstand with high temperature compare to other composites, which has more resistant to wear and tear than other materials. Ceramic materials are operating with high temperature between 800^{o}C to 1650^{o}C. Figure (11) shown the Ceramic matrix Composites.

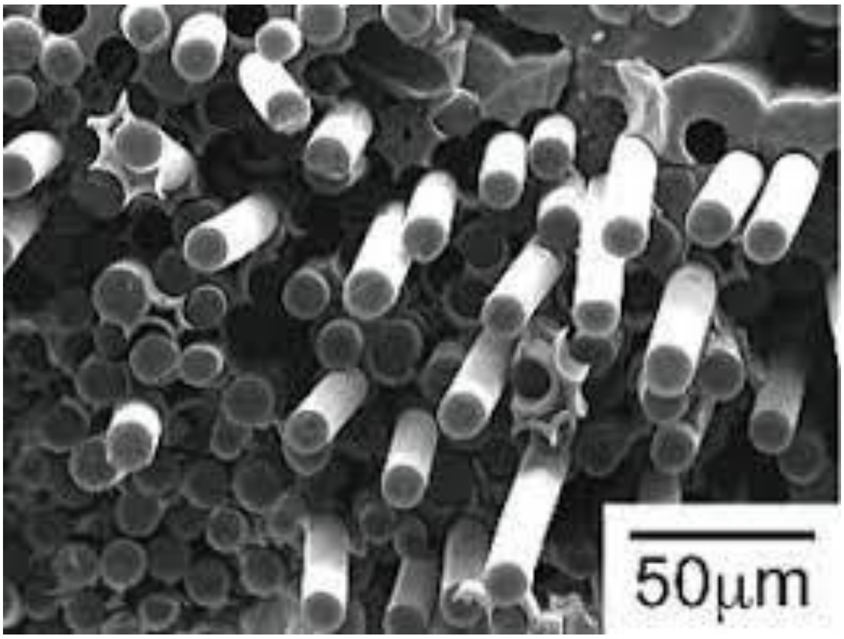

Fig (11) Ceramic Matrix Composites

It has high corrosion resistance, high melting points and stability, and have high compressive strength. It has very low fracture toughness to make sensitive for the small flaws. So, the result can be greater strength but have poor resistance to thermal and mechanical shock. In other methods, CMC, fibers, whiskers, and some particles are combined with the ceramic materials which ca improve toughness, thermal and mechanical shock resistance, but it can reduce the strength of the material.

For reinforcement, the composite has a volume fraction of 40%, density=2.5g/cm^3, coefficient of thermal expansion is 3ppm/K, thermal conductivity is 19W/m-K and have thickness value of 9.5W/m-K.

Manufacturing of Ceramic Matrix Composites

Generally, manufacture of ceramic matrix composites are followed by several process such as

- Lay-up and fixation of the fibers, shaped like the desired component.
- Final machining and, further treatments like coating or impregnation of the intrinsic porosity, if required.
- Infiltration of the matrix material.

Figure (12) shows the Manufacturing of Ceramic Matrix Composites.

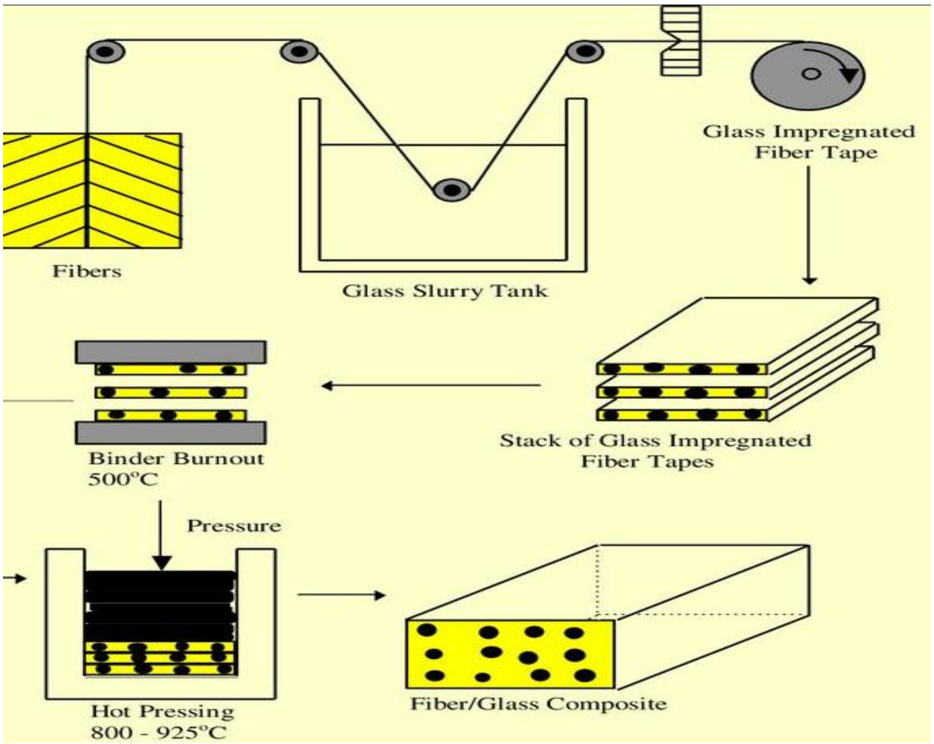

Fig (12) Manufacturing of Ceramic Matrix Composites

Procedure for Manufacturing

• For 1 and 2, The fibres and roving's are arranged then fixed by using fibre reinforced plastic materials include lay-up, filament winding, braiding and knotting.

• For 3, fibres to be act as a deposition out of gas mixture with pyrolysis of pre ceramic polymer and chemical reaction. Sintering process act at a temperature of 1000°C- 1200°C then Electrophoretic deposition of a ceramic powders.

Advantages of Ceramic Matrix Composites

• Higher chemical stability.

• Hardness is high.

• Light weight.

• High strength retention at raised temperature.

• Corrosion resistance and wear resistance are good.

• Cycle cost is low.

Applications of Ceramic Matrix Composites

- Carbon and Silicon carbide are used in spacecraft optical systems.
- Glass ceramic reinforced with C/SiC fibres are used in aerospace and its applications.
- Aircraft and F1 braking.
- Thermal protection systems.
- Rocket motor nozzle throats and exit cones.
- Heat exchangers.
- Gas fired burner parts.
- High performance braking systems.
- Stator vanes.
- Turbine blades.

Limitations of Ceramic Matrix Composites

- Strain intolerance is low.
- Inherent brittleness of ceramics.
- Material cost is high.
- Repair can be difficult.
- Inspection and testing are typically more complex.

CARBON-CARBON MATRIX COMPOSITES

The composite that consists of carbon fibers embedded in a carbonaceous matrix is known as carbon matrix composites. It is mainly developed for the operating parts which are working in high temperature. Carbon matrix reinforced with carbon fibers such as 3-D woven fabric and 3-D braiding, etc. It is also called as Carbon Fiber-Reinforced Carbon Composite (CFRCC). Figure (13) shows the Carbon Matrix Composites.

Fig (13) Carbon Matrix Composites

Carbon matrix composites are reinforced by graphite carbon fibers. These are special composites in which both the reinforcing fibers and the matrix materials are pure carbon and they are woven mesh of carbon fibers. It can operate by a temperature up to 3000^{o}C.

Properties of Carbon Matrix Composites

- Excellent thermal shock resistance.
- Low Density.
- High Strength.
- High Thermal conductivity.
- High Modulus of Elasticity.
- Low coefficient of thermal expansion.
- High electrical conductivity.
- Thermal resistance in non-oxidizing atmosphere.
- High Abrasion resistance.
- Non-Brittle failure.

Advantages of Carbon Matrix Composites

- Light weight.
- High strength at high temperature.
- High intensity.

- Temperature resistance is high.
- Good strength to weight ratio.
- Great corrosion resistance.
- Durability of high temperature is good.
- Low creep at high temperature.
- High fatigue resistance.
- High coefficient of friction.

Applications of Carbon Matrix Composites

- Used in aerospace applications.
- Vehicle nose tips, rocket nozzles.
- Space shuttle orbiter include nose cap.
- Aircraft brakes.
- Glass making equipment.
- Heat treatment racks.
- Wafer-heating elements.
- Turbo jet engine components.
- Engine pistons.
- Biomedical implants.
- Automotive and motorcycle bodies.

Limitations of Carbon Matrix Composites

- Fabrication cost is high.
- Porosity is high.
- Inter laminar is poor.
- Poor oxidation resistance.
- Low shear strength.

CASTING

The process of melt the liquid or solid materials is poured to mold, which obtains a hollow cavity of the desired shape and to solidify is called casting. The solidified part is ejected from the mold is known as casting. Figure (14) shows that the classification of Casting process.

Classification of Casting

There are having three major classifications of casting. They are

1. Expendable casting
2. Non-expandable casting

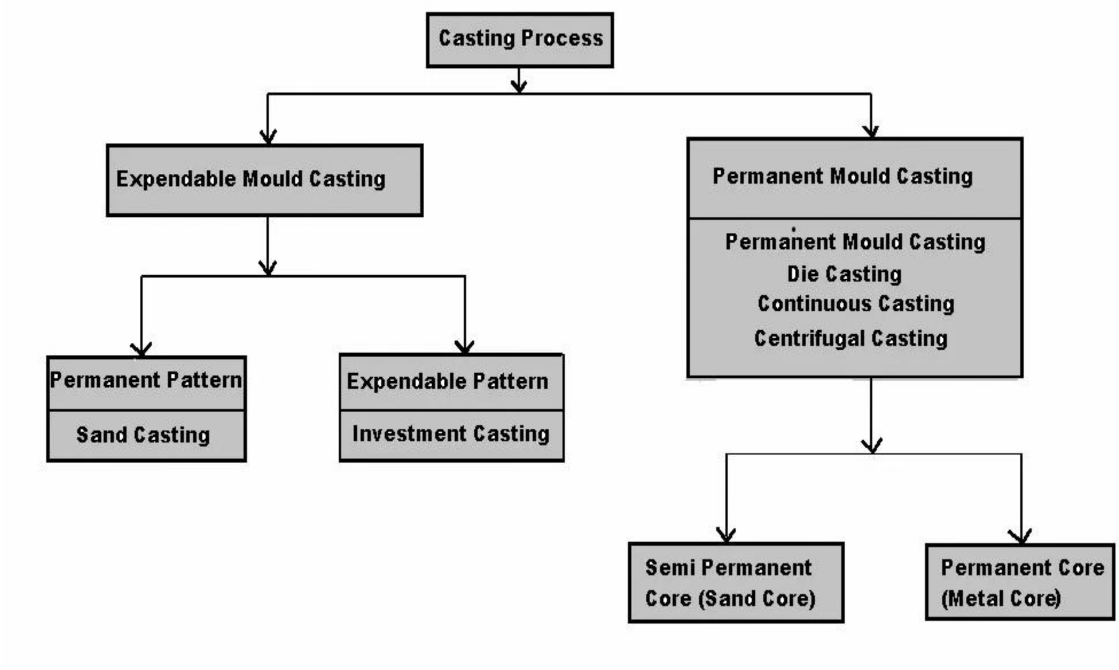

Fig (14) Classification of Casting

Expendable Casting

Expendable casting includes Sand casting, Shell casting, Plaster mold casting, Investment casting and evaporative pattern casting.

Non-expendable Casting

Non-expendable casting includes permanent mold casting, dies casting, semi solid casting, centrifugal casting and continuous casting.

Stir Casting

The stir casting is used for material formation by melting metals and with casting into desired shapes and sizes by pouring into cavities. Metal alloys and Metal Matrix Composites are the major metals used for this casting. This method is also called as Liquid metallurgy.

Casting Machine

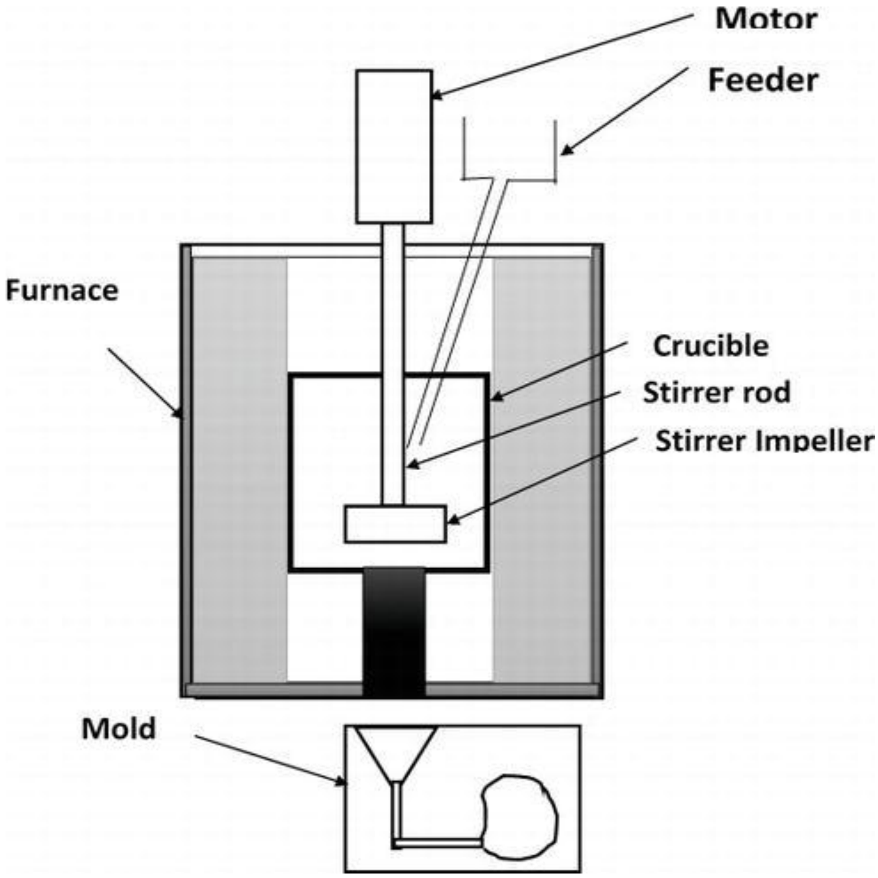

Fig (15) Casting Machine Model

This machine consists of furnace, reinforcement feeder and mechanical stirrer. It is used to heat and melting of the materials. The stirrer is used to mix the reinforcement materials to form a vortex for melt. It consists of stirrer rod and impeller blade. The bottom poring furnace is used to avoid the settling of the solid particles in under of the crucible after stir casting. The impeller blade is the form of various number of blades. The stirrer is connected with the speed motors which rotate the stirrer and it can be controlled by the motor. Feeder is used to feed the reinforcement powder in melt which is attached with the furnace. The mold material is pouring under the furnace with desired shape mold. Fig (15) shows the Casting Machine Model.

Steps Involved in Stir Casting

1) Fig shows that various steps involved in stir casting.

2) In furnace, the matrix material is kept in the bottom pouring for melting.

3) Reinforcement materials are preheated in furnace at certain temperature for remove the impurities, moisture etc.,

4) After melting, the materials at certain temperature the stirrer is rotating to form a vortex in that time period and it can be poured be the feeder with constant feed rate at centre of the vertex.

5) The poured material is preheated for solidification.

6) After that, the mould material is ready for testing, machining, inspecting etc.

Procedure for Casting Process

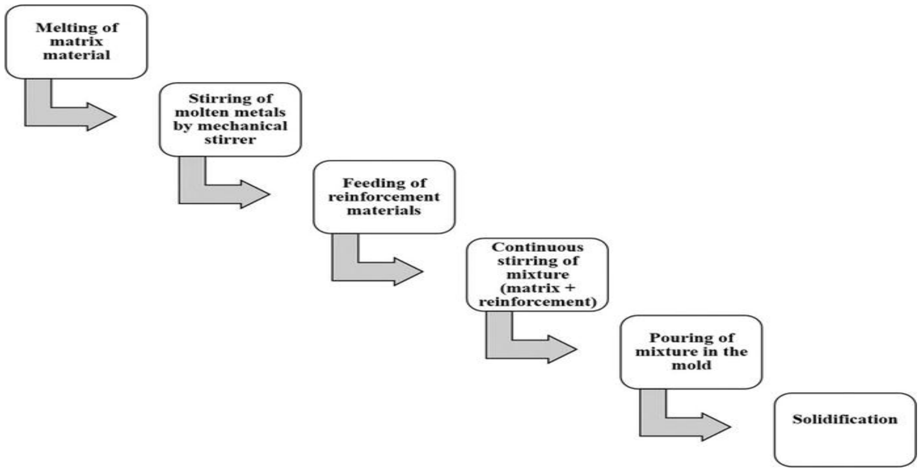

Fig (16) Procedure for stir casting

Fig 1.16 shows that the various process involved in Casting Process.

Advantages of Stir Casting

- Economical process for the manufacture of the Aluminium matrix composites.
- No limit for dimension and weight.
- It is simple, flexible and suitable for mass production.
- Good matrix-reinforcement interface and near the shapes.
- This process is capable of producing complex shapes.
- Good surface finish and close tolerance.

Disadvantages of Stir Casting

- Difficult to achieve homogeneity and high porosity.
- Possibility of reaction between matrix and reinforcement and poor welting due to high temperature.
- Difficulties with geometry of mechanical stirrer in melt.
- It is difficult to distribute and dispersion of ball milled nano particles uniformly in metal melts. Fig (17) shows the Casting Machine.

Fig (17) Casting Machine

Fig 1.16 shows that the various process involved in Casting Process

SuhaelAhmed et al [1]. In Aluminum 7075 based hybrid MMCs using graphite and Titanium di Boride as reinforcements by stir casting method.The graphite content has been varied between 2 and 8 wt% in step of 2 wt%, whereas Titanium di-boride particle has been fixed with 5 wt%. The developed hybrid composites have been subjected to mechanical characteristics such as hardness, Ultimate Tensile Strength (UTS) and ductility , Hardness ASTM-A370 standard test procedure. In case of composites, the tensile strength wasfound AL7075 to increase with the increase in both TiB_2 (5%) and Gr (2-8%)combination, the tensile strength was found to increase. Maximum tensile strength increases 74% and improvement of 68.5%. micro hardness is increased.Ductility increases. problem is raised due to the porosity.

Palanikumar, Natarajanet al [2]. Hybrid aluminum metal matrixcomposites it has conventional metals. Aluminum is used as base metal inmany metal matrix composites, as it is widely used in industries and researches.The low density that is obtained after alloying is the major advantages of hybridcomposite. Al6061/B4C/Mica hybrid metal matrix composite using stir castingmethod by mica particles as 3, 4, 5, 6wt.%, while maintaining 10wt.% of boroncarbide, mechanical properties aretensile strength, hardness, impact strength, sem, EDAX. Tensile strength slightly increase wear resistance also increase. solid lubricant in AL6061 matrix and found that the abrasion is reduced with increase in addition of ceramic. Low impact strength for composite (AA6061).

Periasamy et al [3]. In hybrid metal matrix composites (HMMCs) aluminium alloy (AA7075) reinforcement with Tantalum Carbide (TaC), Silicon Nitride (Si3N4) and Titanium (Ti),ByStir casting method.Such as Scanning Electron Microscope (SEM), X-ray Diffraction (XRD) and Optical Microscope (OM). Mechanical characteristics like compression strength, density and porosity TaC / Si3N4 / Ti reinforcements with AA7075 automatically enhanced the mechanical properties. Theoretical and experimental densities were found to be 3.11 g/cm3 & 3.09 g/cm3 when compared to the density of base alloy. the highest compression strength was 634 MPa at 1 wt% of TaC and 8 wt% of Si3N4 and 2 wt% of Ti in hybrid composite. It has low wear rate .it has high corrosion strength.

Soundararajan, Muthu Vel et al [4] to fabricate Aluminium Alloy (AA8011) reinforcement such as 5wt% of Zirconium Oxide (ZrO2) and 5 wt% of Aluminium Oxide (Al2O3) particles by stir casting method and then strength ened through Uni – direction During the stir casting process, the ZrO2 and Al2O3 reinforcements get incorporated within the matrix and are homogeneously dispersed to obtain Aluminum Matrix Hybrid Composites (AMHC). Further it was taken for uni, bi, multi - directional forging process, which enhances the mechanical and metallurgical behaviour of the Forged Aluminum Matrix Hybrid Composites (FAMHC). In which the mechanical properties like hardness, tensile and impact strength reveals that the multi-direction forged hybrid composite has preferably improved performance than the unidirectional and bi-directional forging. In metallurgical study the Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD) analysis for the FAMHC samples. It used application automobile and aeronautical application. hardness strength also increase due dropped to forging impact strength also increase.Tensile strength also increase.

Pradeep Kumar et al [5]. hybrid metal matrix composites (HMMCs) depending upon aluminium alloy (AA)7075 assisted with Tantalum Carbide (TaC), Silicon Nitride (Si3N4) and Titanium (Ti). Composite developed stir casting method. Scanning Electron Microscope (SEM), X-ray Diffraction (XRD) and Optical Microscope (OM). Mechanical characteristics like compression strength, density and porosity. Pin on disc method for the wear test. The combination of TaC / Si3N4 / Tirein forcements with AA7075 automatically enhanced the mechanical properties. Theoretical and experimental densities were found to be 3.11 g/cm3 & 3.09 g/cm3 when compared to the density of base alloy. the highest compression strength was 634 MPa at 1 wt % of TaC and 8 wt% of Si3N4 and 2 wt% of Ti in hybrid composite. Aluminium based light weight composite materials has industries like automobile, aircraft, marine, defence and armor through weight diminution of internal parts and body components MMCs ,it has combined properties toughness and strength lead composite. Porosity also increase. Corrosion strength also increase. Wear resistance increase in certain percentages.

Fayomiin et al [6]. AA8011 alloy high – grade reinforcement that have better Performance characteristics. In this investigation, AA8011 properties are improved by ZrB2 inclusion a two-step stir casting process to enhance the thermal and corrosion resistance without significantly affecting the electrical properties. The thermal behaviour was analyzed using athermo gravimetric analyzer (TGA) and differential thermal analyzer (DTA) scanning electron microscope (SEM), and the electrical performance was carried out on the four-point probe meter. From the experiments, a decrease in the composite mass loss; improved melting temperature of about 674.4 C in the presence of ZrB2 addition as a function of the temperature rise was achieved by TGA and DTA respectively. The high corrosion resistance of 7831.7 U and low corrosion rate of 0.5017 mm/yr at AA8011-20 wt% ZrB2 was obtained .thermal stability also increase, electrical resistance also increase. It used cooking application. Hence the lesser the micro – defect. Higher porosity in a material, the lower the resistivity. AA8011 – ZrB25 % of wt %, 10% of wt % ,15 % of wt % tensile and wear strength increased.

Muthu Velet al [7]. To fabricate Aluminium Alloy 7075 grade mixed with TiC at different portions. The specimens were stir casted to ASTM G99 standard. Wear Test was conducted in DOCOM pin on disk machine. Al – 4.5 % Cu –5 % metal matrix composite. The hardness of the material can be improved by mixing boron carbide and silicon Carbide with aluminium TiC particles significantly influenced the area of the composite, dispersion, grain size of matrix, microhardness, UTS and sliding wear behaviour. Impact strength of Al –

15 wt% TiC mmc increases from 4 J to 13 J due to the presence of high modulus TiC particles. The fracture surface of the composites shows TiC particles receive multiple cracks before the fracture. The process parameters significantly influence the tensile strength of weld joints. The process parameters were optimized using GRG method. The parameter are 4% of TiC, 1000 rpm of speed and 40 N load. Pits and scratches are identified on the surface of tested specimen.Wear rate are also increase.

Dinesh, Loganathan et al [8]. In Al6063 alloy mechanical properties enhancement by mixing the Silicon (Si), Graphite (Gr) and Fly ash. Composite developed by stir casting method. The Al – hybrid composites post better mechanical properties than the base material and conventional composite. In this investigation depend on composites of Al6063 alloy mechanical properties enhancement by mixing the Silicon (Si), Graphite(Gr) and Fly ash 90% of Al6063 alloy and 5% of Silicon maintained for all the specimens. Graphite used from 1% to 4% with one percentage of incremental and Fly ash from thermal power stations added from 4 % to 1 % with on percentage composite decrement. The hardness of the hybrid composite has been increased by 11 % due to addition of the steel particles in proportions of weight ranging between 4 % and 8 %. tensile strength, yield strength, percentage of elongation increase certain percentage of reinforecement vice versa also decrease.

Fayomi et al [10]. In AA8011 alloy, high – grade reinforcement that have better Performance characteristics. In this investigation, AA8011 properties are improved by ZrB2 inclusion a two-step stir casting process to enhance the thermal and corrosion resistance with out significantly affecting the electrical properties. The thermal behaviour was analyzed using a thermo gravi metric analyzer (TGA) and differential thermal analyzer (DTA) scanning electron microscope (SEM), and the electrical performance was carried out on the four – point probe meter. From the experiments, a decrease in the composite mass loss ; improved melting temperature of about 674.4 C in the presence of ZrB2 addition as a function of the temperature rise was achieved by TGA and DTA respectively. The high corrosion resistance of 7831.7 U and low corrosion rate of 0.5017 mm/yr at AA8011 – 20 wt % ZrB2 was obtained. Thermal stability also increase, electrical resistance also increase. it used cooking application. Hence the lesser the micro – defect. Higher porosity in material, the lower the resistivity. AA8011 – ZrB25 % of wt %, 10 % of wt % ,15 % of wt % tensile and wear strength increased. The thermal analyses were carried out using Perk in Elmer Thermal gravimetric analyzer (TGA 4000) in a nitrogen environment from 30^0 C to 900^0C .the thermal stability is reduced.

SaravanaKumar et al[11]. To fabricate hybrid composite of hybrid composite of high strength and yield strength, low density. It used application automotive. aluminium alloy Al -Mg -Si -T6 was initially reinforcement with industrial waste fly ash particles at five different weight fraction of 0 %, 5 %, 10 %, 15 %, 20 % composite developed by stir casting method. the mechanical properties such as tensile, compression, hardness and density. The Al - Mg - Si - T6– 5 % of fly ash was further reinforcement with boron carbide – 2.5 %, 5 % and 7.5 %. the microstructural analysis SEM and EDS carried out. Hardness increased by 12% of B4C and 3% of fly ash and tensile strength is increased by 66% with addition of 9% of B4C. wear parameter with help of dry sliding, adding the B4C 10 % and fly ash 5 %, wear resistance is increased. To enhance the mechanical property B4C, graphite, fly ash were reinforcement using different weight percentage (0 %, 5 %, 10 %, 15 %). themicrostructure evolution and hardness of Al7075 reinforced by of B4C and fly ash. The various weight percentage of B4C and fly ash in Al7075 distributed uniformly allows to enhance the hardness of the composite and prove to be better than the aluminium alloy (Al7075). Tensile strength and compression strength certain percentage increase and decrease.

RajaRahul et al [12]. The aluminium matrix composite (AMC) has been used for most advanced engineering applications. The AMCs fabricated using different casting method has improved microstructural, corrosion and mechanical properties.There are various elements which are useful for various purposes like aluminium was used in aerospace, Military Engineering and transportation industries etc. MMCs are fabricated by stir casting method. Fabricated MMC over come the challenges that comes in manufacturing of modern materials for many engineering purposes. The properties of aluminium like mechanical, microstructural and corrosion resistance properties. It is used in cutting tools, jewellery, automobile parts andstructural material. It isvery difficult to give shape and size to composites during machining due to excessive hardness from addition of ceramic particles. But in Powder Metallurgy and Additive metallurgy it is expensive, limited fabrication of small sizes, large size product lack material strength. In casting process, during fabrication of Aluminium alloys magnesium was added with molten composite to encouraged ampability between composites and matrix.

PradeepKumar et al [13]. The aluminium based hybrid composites with micro / nano reinforced particulates are comprehensively utilized in various manufacturing and engineering sectors because of better fracture toughness, superior strength – to – weight proportion, enriched fatigue, wear and tensile behaviour, light - weight, upgraded corrosion resistance to unaesthetic ambience, etc. The collective effect of reinforcements on aluminium MMCs with individual and numer ous particulate reinforcements like Hybrid MMCs are finding increased applications in transportation, space, aerospace, automobile, underwater, defenceandmilitary. Eventually, aplenty of ground work has materialized in aluminium based composites with inclusion ot it aniumand carbides liable to particulate reinforcement it echo friendly system. like wear resistance, specifics trength, corrosion resistance, fracture toughness, hardness, stiffness, fatigue and creep, remarkably at higher working temperatures stir casting technique. Composite with 5 wt % fly ash and 5 wt % Al2O3 shows higher hardness of 100 BHN when compared toother composites. 2 wt % SiC and 2 wt % of B4C proved to have higher tensile, hardness ad flexural strength. the tribological & mechanical aspects of Al2014 mixed with ZrO2 (2, 4 & 6 wt %) and magnesium (1 wt %) processed via stir casting technique. Due to proper mechanical stirring, interfacial integrity betwixt the reinforcement and matrix material was achieved. Addition of ZrO2 improves the tensile, compression and impact behaviour of the material due to particle strengthening mechanism with grain refinement. the micro and macro hardness up to 160 VHN and 130 BHN. UTS improved by 11 %, when compared to the strength of un reinforced alloy. Certain percentage tensile strength, impact strength, micro hardness increase or decrease and certain percentage remain constant.

JenniferPhilip et al [14]. the various metal matrix composites, aluminium - based hybrid composites have been gaining popularity in the past decade. the materials used in automobile, and aircraft industries etc. the metal matrix composites gives a better result, and longer life in place of using a single alloy for various components. Aluminium Metal Matrix composite (AMCs) using Bagasse Ash as the reinforcement in order to improve its mechanical and tribological properties. three specimen having different compositions Al – 0 % Bagasse, Al – 2 % Bagasse and Al – 5 % Bagasse were prepared by stir casting method. The Aluminium used in the composite was of the grade Al6262. The prepared composite was subjected to Tensile test, Vickers hardness test, and Wear test. That the addition of BA Powder enhances the tribological and mechanical properties of there in forced Al alloyowing to its uniform distribution on the base metal. The commonly used non - metallic reinforcements are ceramics like – Silicon Carbide (SiC), Aluminium Oxide (Al2O3). The main reason for this is the property of light - weight, along with the metal matrix phase consisting of hard reinforcing particles which provide better resistance to fatigue, higher strength at elevated temperatures, lower creep rate, higher ratio so strength to density and stiffness to density. Tensile strength specimen prepared astm standard 370. The ultimate tensile strength (UTS) for the specimen with out reinforcement was found to be around 99.89 MPa. On increasing the bagasse content to 5 %, tensile strength increases to 134.3 MPa. The main cause of this increase was the uniform dispersion of Bagasse Ash particles in the matrix. As a result, when the load was applied, the matrix transferred the load to the dispersed hard Bagasse Ash particles and delayed the fracture. The graph shown in Figs. 6 and 7 indicates how the tensile strength increases with the increase in the percentage of Bagasse Ash in the Aluminium Metal Matrix Composite he Vickers's Hardness Test was performed on three separate specimens having different proportions of Bagasse Ash in accordance with the ASTM E-384. The specifications of the testing machine used for the process . The specimen used for this particular test . A load of 200 g was applied individually on each of the three specimens for 10 s at three different locations. that the hardness of the material increases with the addition of reinforcement and consequently with the increase in the proportion of the reinforcement. The composite with 2 % Bagasse Ash has a hardness value of 70.4 Hv while the composite with 5 % Bagasse Ash had a hardness Value of 69.7 Hv. The increase in the hardness value is attributed to the presence of bagasse ash particles obstructing the dislocation motion and in habiting the deformation during indentation. Wear test conducted pin on disc method . The pin – on - disc test for the Aluminium Metal Matrix Composite was performed at room temperature under dry friction condition. Two different loading conditions of 20 N and 40 N was applied for each of the three specimens. The pin was made to slide on the disc at the radius of 30 mm for an overall distance of 1017 m at a constant speed of 360 rpm. Wear resistance decrease in certain percentage.

Srinivasanet al [15]. Aluminium hybrid metal matrix composites (HMMCs) is fabricated through stir cum squeeze casting process. Zir conium Di – oxide (ZrO_2) and graphite (C) is used as reinforcement. ZrO_2 ceramic particles are used to increase the tensile strength of aluminium. Where as improves heat transfer properties that increases reliability of the product. Aluminium HMMCs used in this investigation with the following weight proportions 100 % AA6063; 95 % AA6063, 3 % C, 2 % ZrO_2; 91 % AA6063, 3 % C, 4 % ZrO_2; 86 % AA6063, 3 % C, 6 % ZrO_2 were fabricated using squeeze casting process. Microstructural study and mechanical behaviour are characterized for different percentage of reinforcement on the squeeze cast metal matrix composite specimen fabricated as per ASTM standard. Aluminium light application like aerospace, automobile etc. The commonly used reinforcements for AMMCs include silicon carbide (SiC), titanium carbide (TiC), alumina (Al_2O_3), graphite (C), and boron carbide (B_4C). On the other hand, due to shrinkage, gas pore and cold shut a lot of defects were caused in castings during solidification. Due to these defects in the casting components, because of the deterioration in the mechanical properties the light - weight alloys application is limited. Squeeze casting is an emerging casting technique used to eliminate the above mentioned defects. Near net shape, removal of porosities, reducing material wastage due to absence of gating system, high dimensional accuracy, and the improvement in mechanical properties are the most important benefits of squeeze casting process. Compared to other casting process, squeeze casting provides better mechanical proterties High integrity, fine grain size, and superior mechanical properties can be obtained using squeeze casting, that has received more and more attention. Squeeze cast composite sex hibits better results in mechanical and tribological properties when compared to gravity diecasting . The properties of the composites were enhanced by addition of there inforcements and increase with the increase of reinforcements. 100 MPa pressure was sufficient to obtain refinement in the microstructure and minimize the level of porosity hardness strength also increase. Tensile strength also increase certain portion and then remain constant.

Asanthakumar Pandian et al [16]. the method of modified bottom pouring stir casting furnace integrated with mechanical supersonic vibration squeeze in filtration to develop aluminium alloy 7075 and the hybrid composite. Silicon carbide (SiC) and graphite reinforcement percentages are Journal Pre – proof 8 varied, and their effects on the aluminium 7075 alloy matrix was evaluated through material characterization, mechanical testing, wear, and corrosion analysis. Distribution of reinforcement particles and their presence in the composite were examined by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS) with elemental mapping and X-ray diffraction (XRD). the conventional stir casting furnace used by researchers for mono and hybrid composite preparations and the reinforcement content increased above 10 – 30 % are (i) uniform dispersion, the formation due to differences in density between the matrix and reinforcement (ii) increased porosity levels (iii) stirrer blade erosionandrate of reinforcement flow to molten metal (iv) proper bonding between matrix and reinforcement influenced by wettability and use of quality additives. The presence of hard ceramic SiC particles in the matrix improves hardness, wear, corrosion resistance, and reduces ductility, toughness, forming, and machinability. This researchers to develop aluminium composites for different field of application like aerospace, marine, defense, and automotive sectors. The industry needs cost - effective, high volume, and straight for ward method stof abricate aluminium composites for varieties of mechanical, electrical, and electronic components.

Milind et al [17]. The effect of reinforcement material and manufacturing process on the mechanical properties of non asbestos material has been studied. Metal matrix composites (MMCs) good properties from the combination of as of material like aluminium or magnesium with hard reinforcement material such as silicon carbide (SiC) or graphite. Mechanical

properties and microstructural analysis of Al - SiC Composites produced under different process conditions were investigated in this work to understand their process structure – property relation ships through the optimization method. The addition of silicon carbide particles to base material aluminium has improved mechanical properties Aluminium matrix composites (AMCs) are one of the important metal matrix composites (MMC), found many applications like of auto mobile and aerospace industry because of light weight, high specific strength, and low wear resistance, good ductility. AMCs can be developed using different methods like stir casting, squeeze casting, and powder metallurgy etc. For developing AMCs, ceramic particles such as silicon carbide (SiC), alumina (Al2O3), graphite etc. the hardness and tensile strength of Al - SiC composite improved significantly for the sample prepared by PM route while compression strength was increased in case of stir cast sample compared to the powder metallurgy sample. aluminium is used as a base material that is reinforced by different weight percentages with silicon carbide material of Silicon Carbide as 5 % wt, 10 % wt, 15 % wt. The composite is manufactured by stir casting method as well as powder metallurgy methods. Various mechanical properties like density, porosity, hardness, compressive strength, shear strength and tensile strength evaluated for various sample made by the different manufacturing method. At lower % of SiC, there is crack development to the specimen, but at more is the percentage of SiCi.e. 5 %, there are no cracks development on specimens.

Arun et al [18]. Metal matrix composites are being used increase for various applications in automotive, aerospace and industrial applications. The composite with net weight decreasing since density of boron carbide is less compared to aluminum. Since aluminum has better strength to weight ration compared to steel they can be proposed as the candidate material for automotive and especially drive shaft applications. Tension test and Torsion test were carried out according to ASTME 8 and ASTME 143 standards respectively. The weight percentage of reinforcement was chosen upto 7.5 percent. The prepared composite specimen’s demonstrated increase in tensile strength, young’smodulus, torsional strength and she ar modulus upto 6 percent weight percentage of reinforcement.

Consequently, there was decrease in percentage of elongation, angle of twist and Poisson's ratio with the in corporation of boron carbide. The objective of the present work is to identify the elastic properties of aluminium boron carbide metal matrix composites which can be considered as a potential material for high speed rotation applications especially the automotive drive shafts. The various ceramic reinforcements used for metal matrix composites such as silicon carbide, graphite, aluminium oxide etc. Amicro Vickers hardness test machine was used for measuring the hardness and the maximum indentation load applied was 0.5 kg. The increase in hardness is because the boron carbide particle acts a barrier for local dislocation motion and also it indicates a strong bond between matrix and there inforcement material.

PraveenKumaret al [19]. Aluminum powder reinforcing with ceramic particles makes an attractive composite material among Metal Matrix Composites (MMC). This is mainly due to its high strength to weight ratio, good corrosion and wear resistance, hight hermal and electrical conductivity properties. These properties in material has high demand in automobile, aircraft, marine andmany other applications. Blending aluminum (Al), Silicon Carbide (SiC) and Graphite (Gr) powders yield best possible composite material exceptional in unique class of innovative engineered materials developed to use in tribological applications. The powder reinforced composite samples were processed by conventional powder metallurgy (PM) method. Tribological properties like wear study done using DUCOM pin – on – ball disk equipment at controlled room temperature and dry conditions. The tribological behaviour of unreinforced Al5052 and Al7075 sample and dual amalgamation of Al5052 + Al7075 matrix along with SiC and Graphite reinforced composites were prepared upto 18 weight % and analyzed. These composite samples were prepared using single or dual sized SiC particle powders. The influence of reinforcement particle size and amount of weight fraction on dry sliding wear behaviour have been analyzed in detail by varying appliedload, sliding speed and distance.

DeepakKumar et al [20]. A heat exchanger with high thermal conductivity and less weight is needed in many applications like automotive, aerospace and fuel cells. Aluminum alloys are widely used in automotive and aero space applications due to light weight and high thermal conductivity. Reinforcement material plays an important role in enhancing the thermal properties of aluminum matrix. A wide range of materials are studied as there inforcement in aluminium MMC, but grapheme with unique thermal, mechanical and electrical properties can be a potential reinforcement in aluminium based MMC to enhance thermal conductivity. Nano size particle / metal matrix composites synthesized commonly using various casting ,Friction stir processing and powder metallurgy methods. Among all these method, powder metallurgy by stircasting method are quite success ful in producing MMC. Aluminum powder (32g) and RGO (0.1wt.%) were taken in a 500 ml beaker. 1.5 wt. % of Ethylene bis stearamide (EBS) synthetic wax, which acts as lubricant for binding between the powders was added to the above mixture. To mix above powders uniformly, sonication was done in ethanol environment for 30 min using a bath sonicator. Ethanol was made to evaporate by heating at 120°C in muffle furnace for 30 minutes. The as dried sample was ball milled for 30 min using a high speed planetary ball mill apparatus at 80rpm. Same procedure was repeated with different RGO concentrations (0.25and wt. %). Compaction was done using a 40 Ton capacity Universal Testing Machine (UTM) adopting ASTM B-925 procedure. Samples were filled in a die and force was applied to get cylindrical billets . These billets were then sintered in controlled atmosphere at 490°C in a muffle furnace for 1 hour. These specimens were extruded in the hydraulic press and tested for hardness and Thermal behaviour powder metallurgy process to synthesis reduced grapheme oxide(RGO) / aluminium metal matrix nano composites (AMMnCs) with enhanced thermal properties. RGO added in 0.1, 0.25 and 0.50 wt. % into analuminum powder matrix using ball milling. Scanning electron microscopy (SEM), Vickers hardness test, Thermo gravi metric (TGA) analysis, Thermal Contact Conductance (TCC) and Energy - Dispersive X-ray Spectroscopy (EDS) were used to the surface morphology, hardness, thermal stability, thermal conductivity and elemental percentage composition .

Kevin Mathewet al [21]. Aluminium matrix composites (AMCs) are due to their very specific set of physical, chemical and mechanical properties that are hard to obtain from amonolithic compound. The properties make Aluminium Matrix Composites a strong competitor against steel due to its adaptability towards various engineering application. Al 5056 is widely used in the structural parts of marine application owing to its increased corrosion resistance and better strength to weight ratio. Even though there is a chance forme chanical property loss for Aluminium alloys for above 200 C, AA5xxx series alloys are still used for the creation of super structure of naval ships as it reduces the overall weight because of its increased strength to weight ratio. One of the things that make AA5xxx ideal for ship building application is its cost compatibility the main problem faced by the Aluminium alloys is its lows trength and low melting point which can be cost-effectively reduced by adding SiC, Al2O3 & SiO2 as reinforcement on Aluminium matrix. The addition of the a fore mentioned materials will aid in increasing the specific elastic modulus of Aluminium & bettering it's the rmal properties HMMCs brid composite developed stir casting method. Al

5056 with constant proportions (3%) of Silicon Carbide and varying percentages (2, 4%) of sugar cane bagasse ash as reinforcement particles. increase in the wear rate and hardness value of the composites. Hardness and wear resistance increases or decreases, certain Percentage of composites will be remain absolute value of material composition.

Mohammed Thoufeeq et al [22]. engineering applications aluminium alloys are extensively used for non - ferrous materials due to their interesting properties such as easy availability, cheap, elevated strength to weight ratio, fine ductility, corrosion resistance., due to the soft nature and reduced wear resistance, the applications of aluminum alloys have been limited. Ceramic particles is reinforced to fabricate a metal matrix composites (MMCs). MMCs is increased stiffness together with higher strength, it is used in applications in the automotive, aerospace and transport industries. Hybrid MMCs (HMMCs) possess attractive properties such as elevated specific modulus, high wear resistance, good abrasion resistance properties, eletronic substrates, space crafts, automobiles and airliners. HMMCs can be fabricated through variety of casting process such as squeeze casting, stir casting, compo casting, spray forming, mechanical alloying and powder metallurgy process. (i) no shrinkage or gasporosity (ii) no metal wastage due to absence of risers and feeders (iii) good castability. Squeeze casting is well suited for manufacturing aluminium HMMC's as they displays high mechanical and trobological properties because of the absence of above mentioned defects the sliding wear behavior of Al6063/TiB2 in situ composites at higher temperatures. They revealed that at the room temperature wear resistance increases due to the addition of TiB2 particles. Due to the higher wear resistance of the TiB2 particulates, the wear resistance of the composite material is superior than that of the as cast Al 6063 alloys. the mechanical and wear characteristics of Al 6063 / TiC MMCs. Wear resistance decreases based on load and then wear loss is more. In certain percentage wear resistance increased or remain constant certain percentage of chemical composition of the specimen or alloy.

Ashiwani Kumar et al [23]. AA7075 matrix composites have been used as superior materials as several potential applications in automotive, space, aircraft, defense and various engineering sectors because of their more specific strength and rigidity, higher wear resistance as compared to the alloy irrespective of applied loadandslidingspeed.Suchalloycompositesareconstantlyreplacingconvention due to the irparticular properties like wear resistance, lightness, higher stiffness and hardness. The effect of reinforcement on wear resistance of aluminium matrix composites. the sliding tribological and friction behaviour of Al2O3 and carbon short fibers reinforced filled such alloy composites. They found that coefficient of friction and wear resistance improves with enhance in reinforced content (Al_2O_3) in metal matrix composites and are efficient in improving the coefficient friction and wear resistance. Yi - qi and Jung - il the Dry sliding wear behavior of Al_2O_3 fiber and SiC particle reinforced aluminium based MMCs fabricated by squeeze casting method. It observed that wear resistance is decreased with increasing the filler content (SiC) at room temperature while the temperature improves with reduce in the wear resistance of composites that increment in hardness, density and volume friction content while decrement in impact strength of micro TiO_2 / (Al_2O_3 particulate filled A384 alloy composite, the alloy indicates decrement in contents / density while impact energy / hardness increases with increase filler contant. In the light of aims to analyzed the physical, mechanical and sliding wear performance of AA7075 / Co alloy composite, fabricated via high vacuum casting machine.The improve overall mechanical and wear properties that made this alloy more suitable for gear application. (0 – 2 wt %. And other element weight percentage is constant) metal powder content.

Sanjay Mohan et al [24]. The initial phase is termed as matrix while the other is the reinforcement which is either in the form of a particle or fiber, the former being the more widely used. Aluminium, magnesium or titanium are light metallic materials and commonly used asmatrices. Generally, reinforcements are much stronger and stiffer than the matrix. As fore see able that by combining two types of materials, the material produced will have the finest properties. This material thus has considerably better mechanical properties than the base matrix. Aluminum matrix composite (AMMC) materials have numerous benefits such as high stiffness and low weight of produced part . These composites are mainly reinforced with hard materials like Al_2O_3, SiC, Si_3N_4, Graphene, Titanium carbide (TiC) and titanium diboride (TiB_2). Reinforcement materials for composites are selected based upon some specific property required in the base material. Reinforcements may be in the form of particulates, fibres or laminates. Such reinforcements can be either continuous or discontinuous. Short fibres or particulates in discontinuous reinforcement are isotropic in nature. In continuous reinforcement, fibres viz carbon or silicon carbide are surrounded in the matrix along a certain direction, resulting in an isotropic properties. Continuous fibre composites may be unidirectional, bidirectional, or multi-directional. Short fibre or particulate strengthened composites can have either preferred orientation or any random orientation. The aluminium metal matrix composites (AMMCs) are termed to be modern materials having applications such as race car bodies, buildings, bridges, crank shaft, satellite launch vehicles, fighter aircraft, civil transport aircraft, defense industries, automobile industries, nuclear power plants, electronics. In this paper has been carried out on the mechanical behaviour of Al7050 and Al 7075 based materials. The incorporation of various reinforcements to these matrices and their impact on the mechanical properties has been elaborated in this article. Finally, a comparison has been drawn between the mechanical properties of Al 7050 and Al 7075 based materials. Al 7075 is commonly used for highly stressed structural applications because it has good mechanical properties. Al 7075 has also been used in transport and in marine, automotive, and aviation. This alloy is mainly used in the aerospace industry. AA 7075 / SiC based material and SiC in weight percentages of 3%, 6 %, and 9 % were incorporated in the matrix using stircasting method. MoS2 with a fixed 1 % were embedded to the AA 7075. After that, the UTS and micro hardness were also increased. The composite with 9 wt % SiC and 1 wt %MoS2 exhibited the highest strength and hardness. AA7075 reinforced with silicon carbide (1 %,2 %, and 3 wt %). The composites were developed using stir casting. The UTS ofthe materials was noticed to rise with the increase in SiC, the composite with 3 wt % SiC exhibited the best mechanical properties. Al 7075 alloys reinforcedwith TiC were investigated for their mechanical properties. The composites were developed using stir casting with TiC particulates in weight percentage ranging from 2 to 10 wt %. It has been observed that the heat - treated composite has shown excellent enhancement in UTS and micro hardness than cast composites.

Ilangovanet al [25]. The effect of process parameters on the wear properties of Al 7075 alloy reinforced with Zircon and Graphite. Zircon is the major reinforcement and Graphite is the minor reinforcement. The process parameters selected are reinforcement wt % (7 %,10 %,13 %), load (20N, 30N, 40N) and sliding velocity (1m/s, 2m/s, 3m/s). The composites were stir casting method based on the compositions of Wear test by the microstructural examination using SEM was conducted to understand the wear behaviour. it can be observed that the wear increases with an increase in the applied load. The wear rate increases with increase in velocity upto the transitional velocity but decreases beyond that limit. Reinforcement wt % has a positive effect on the wear rate upto a there shold limit. Metal Matrix Composites find tremendous applications in the industries owing to their superior properties compared to the base alloy. The widely used particulate reinforcements like SiC, Flyash, Boron Carbide etc. not only provides strength to the alloy, but the particulate blend reduces the directionality that occurs on the usage of fiber reinforcements. The particulate reinforced composite is gaining more popularity now a days. Instead of conventional reinforcing elements such as carbides and nitrides which are very costly, the usage of low cost particulate is highly appreciable. The sliding wear test of the prepared composites is performedusing Pin – on - Disc apparatus. For this, the pin is mounted and made to contact the rotating steel disc. The disc is made up of stainless steel. Before proceeding to the test, the pins are well polished. The disc is polished periodically. The pins are made with a dimension of 45 mm and 12 mm. An electric motor rotates the disc at a controlled speed. The specimens are prepared according to ATM G – 99 standards. Pins are polished with fine emery papers of various grades.

OmarAlejandroVelazquez-Carrilloet al [26]. Accumulative roll bonding (ARB) is a severe plastic deformation (SPD) technique that has been extensively used in a wide range of metals to improve their mechanical properties. In particular, ARB processed materials display an increase in both yield and ultimate tensile strength, since the SPD processing induces are mark able grain refinement. In precipitation hardened alloys, such as aluminium 7075, this leads to a synergistic effect which further enhances strength. Although the reported results are promising for high - strength applications, the rmalstability of the microstructure after processing remains an open question. In this paper, we present an investigation of the thermal stability of the texture, microstructure, and mechanical properties of Al - 7075 samples processed by ARB to an equivalent V on Mises strain of 240 %. After processing, yield and tensile strength displayed improvements of 30% and 20% respectively over the T6 condition. Crystallographic texture was found to depart from the rotated cube component to Dillamore / Taylor and Goss components. Several annealing heat treatments ranging from 373 to 673 K (100e400 C) were carried out mechanical properties are stable up to 423 K (150 C). The texture was found to slowly revert to a rotated cube with increasing temperature. Tensile strength increase certain compostion and again decrease. Micro hardness increase.

Murali Kumaret al [27]. Modern technologies need materials with an uncommon and unusual combination of properties that traditional metal alloys, ceramics, and polymeric materials cannot produce. Specific types of materials with extraordinary properties are particularly needed for aerospace, under water, and transportation applications. For example, aircraft engineers are searching for structural materials with low density, stiffness, high strength, resistance to abrasion, resistance to impact, and corrosion resistance. In traditional materials, such a combination of properties is difficult to achieve since materials with high density and stiffness typically decrease impact strength. We need a specific form of material to meet the demand for new technology . This demand for unique material types with different combinations of properties contributes to the creation of composite materials. Composite materials may be defined as any multi - phase materials that exhibit substantial property ranges than the individual components added in that material. metal matrix composites are highly recommended for high - tech engineering applications. Thanks to their mechanical properties,light weight, low thermal expansion coefficient, and more significant corrosion and wear resistance compared too there metals and alloys,composites play a critical role in composite material aluminium - based metal matrix composites in the automotive industry, ship yards, and aircraft applications. Wear and micro hardness increases certain percentage of composites, it may decrease or remain constant tensile strength increases 10%.

Fayomiet al [28]. aluminium alloy has distinguished itself to be the major primary material for most industrial and engineering applications due to its excellent intrinsic properties There are various alloys of aluminium ranging from 1xxx to 8xxx depending on the alloying constituents, these alloys possess different properties with diverse industrial applications. Recently, AA8011containing Al – Fe alloys has emerged as a basic structural

material in modern engineering applications which cut across transportation, construction, and the building where improved tensile strength, higher hardness, and good wear resistance materials are extremely required poor tribology, low hardness, and tensile strength its wide range of applications. The effect of ZrB2 - Si3N4 particle reinforcement on the tribological behaviour and microstructure of AA8011 alloy has been studied. ZrB2 - Si3N4 particles were varied from 0 wt% to 20 wt% with an interval of 5 wt% composite developed by stir casting method. Wear rate increase certain percentage composite, wear rate decreases silicon nitrate adding more percentage it will remain same.

Senthil Kumar et al [29]. Metal matrix composites MMC of materials and are quickly replacing conventional materials in different engineering applications such as the aerospace and automobile industries. Some of the characteristic applications are bearings, automobile pistons, cylinder liners, piston rings, connecting rods etc. The composite materials are widely used in applications like dry sliding concerned with situations to enhance the tribological performance of it. In several applications, the generally selected base alloy for Metal Matrix Composites MMCs is aluminium because of its high strength to weight ratio, environmental conflict and high stiffness. They are poor resistant to wear; mainly at partial or boundary lubricating conditions. Through the solid lubricant, particle dispersal in the matrix of aluminium alloy can exhibition good prospective for wear resistance. Graphite is the commonly used solid lubricant because of its favourable combination of properties like low friction. The addition of an appropriate level of the graphite particulate with Aluminium Matrix Composites (AMCs) can reduce the wear rate of the AMCs. Matrix and reinforcement phase work together to produce a combination of material properties that cannot be met by a conventional material. Boron carbide B4C is one of the most favour able ceramic materials due to its high strength, low density 2.52g/cm3, high hardness and good chemical stability.

The addition of B4C, fly ash, TiB2 with the aluminium alloy AA 8011, AA 7075 and AA 6061 will enhance the wear resistance of the base alloy with an best amount of ceramic content alsousage of aluminium matrix can provide good potential of mechanical and wear properties. The dry sliding wear loss behavior of AA 8011 matrix composite manufactured by stir casting method. The wear test was steered with pin – on – disc apparatus with the controlling three - factor, three – level central composite rotatable design matrix was used to minimize the parameters were, applied load of 5, 10, 15N and sliding velocity of 1.5 , 3, 4.5m/s with interval of 5, 10, 15 min a trunning time and Wear rate increases.

Pandey et al [30]. AA7075 + 6% B4C + 3% ZrC nano hybrid composite was fabricated, with nano reinforcements composition in AA7075 alloy selected. To achieve better mechanical performance. Micro structural was performed with the help of W - SEM. Tensile, compression, and hardness were measured with the help of UTM and Vickers microhardness machine. Porosity was calculated by using Archimedes principle. Composites processed by micro waves intering excellent mechanical properties compared to the conventionally sintered composites. No inter metallic compounds were detected in micro wave sintered composites through XRD analysis, indicating strong and clean interface bonds between matrix and reinforcement particles. High strain to fracture value of 12.24% was noted in micro waves intered nano hybrid composite, while it was 6.12 % for conventional sintere done. Fracto graphy revealed no peeling action of reinforcements from the matrix material, and the mode of failure was brittle. It was concluded that, while fabricating nano range hybrid composites, the implementation of advanced sintering technique (microwave sintering) with low sintering temperatures and low sintering times with internal heat generations, helps in eliminating defects that may develop because of high surface energies of nano range reinforcements. Composite materials are one of the most demanding materials in application fields like automobile, aerospace, defense, and industrial sectors. Ductile metal alloys are most preferable matrix materials, and hard ceramic materials are chosen as reinforcement particles. There are different matrix materials available like aluminium (Al), magnesium (Mg), titanium (Ti) and copper (Cu). Available matrix materials, Al is the most preferred matrix material because of its exceptional properties like high strength to weight ratio, corrosion resistance, high toughness, low melting point, and economical. The majorly used reinforcement particles are B4C, SiC, graphite, graphene, CNT, Al2O3, BN,Si3N4, ZrC, ZrO2, WC, etc. To fabricate Metal Matrix Composites (MMC), either liquid processing methods, such as stir casting, compocasting, squeeze casting, pressure less infiltration, etc. In composite materials, adding hard ceramic materials with low thermal conductivities (B4C – 30 W/mK,ZrC – 20.5 W/mK) to the matrix materials (thermal conductivity – Al – 239 W/mK) acts as obstacles to the heat propagation and uniform heat distribution.

Raja Sekhar Singampalliet al [31]. the Al - Alloys has been to a great extent in many Industries, since it replaces most of them assive machine parts made of steel and cast iron. Its special characteristic of light weight to strength ratio is more benificial at operating conditions, would lead to greater economy. Favourable mechanical and Tribological characteristics in Al - alloys were not only be achieved by reinforcement composition, but also by means of the process of synthesizing at various conditions. In this context an Aluminiu alloy AA7075 has been reinforced with Silicon carbide, Fly ashand Graphite. Three different composites were fabricated at different weight ratios as 6, 9 and 12% by wieght. Initial composite of AA7075 is formed with 2% of each alloying element and percentage of alloying has been enhanced by one for the rest composites.The entire process of fabrication was accomplished through stir casting method under vortex route. The fabricated copmosites were titled as AA7075 – 6 MMC, AA7075 – 9 MMC and AA7075 – 12 MMC. The main objective of the present work is to investigate the plastic properties of AA7075 and their composites using a renowned finite element analysis tool ANSYS. From the simulation process were validated with the analytical one, and found to be in good concurrence. Two different aspect ratios (H/D as 1.0 and H/D as 1.5) are considered for these composites along with the pure AA7075, to analyse the axial, hoop and hydro static stresses under the influence of compression. In AA7075 – 9 MMC composite exhibited good ductile properties compared to the rest and the base alloy. The Hoop stress value found to be increased to great extent, for the AA7075 – 9 MMC and AA7075 – 12 MMC, compared to rest in the case of aspect ratio 1.5 (H/D), which indicates better plastic characteristics. Aluminium and its composites (Aluminium metal matrix composites – AMCs) have got wide spread in various industrial applications, such as Aerospace, marine and Automotive components, like engine, cylinder blocks, piston and piston rings, due to its favourable characteristics as high specific strength, good thermal conductivity, high corrosion resistance, low electrical resistivity and high damping capacity. Al – Cu composites (5 – 15 wt%) are prepared by vortex method by dispersing copper powder in molten A2024 alloy. Results are compared with the alloy having same concerto. Composites with 5, 10, 15% by weight were also compared.

Kumaresh Babuet al [32]. the reinforced AA7075 CuCNT / CuGrP Hybrid nano Composite. To find the corrosion resistance of such an alloy composites, was made by compo casting (Stir- Squeeze) are commonly usedfor the production of components, such as cylinders, pistons, pumps, valves and combustion chambers, which in service may experience a corrosion phenomenon. Initially different percentage of microstructure, hardness, and mechanical properties were measured. Corrosion tests were carried out according to different mass fraction of copper coated CNTs and copper coated GrP was added to the AA7075 casting and the composition is optimised. The electro chemical corrosion behaviour of CuGrP and CuCNT reinforced AA7075 were studied using Electro chemical Polarization Technique (ACMGill) and Electro chemical Impedance Spectroscopy Technique. The phase analysis of the composites wered one by XRD, microstructure by optical microscope even severity of corrosion is measured optical microscope. The corrosion behaviour of the composites and the possible mechanism for the effect of CuCNT and CuGrP in the properties. these materials maintain good strength at good rigid structural capability, with stand high temperature, dimensional stability and high strength to mass ratio. These properties of MMCs especially AlMMC, enhance their use in automobile engine parts such as drive shafts, cylinders, pistons and brake rotors, which work particularly at high temperature and pressure environments. The corrosion behaviour of AA7075 alloy reinforced with varying percentage combination of MWCNT / GrP in 3.5 wt% NaCl Solution as electrolyte.

Mishraet al [33]. Friction stir processing and post process artificial ageing was success fully carried out on AA7075 with and with out reinforcement of SiC particles producing defect free processed zone with uniform distribution of filler material. Effect of SiC particle reinforcement and artificial ageing times on the microstructural modifications was characterized using optical and electron microscopy, electron back scattered diffraction and X-Ray diffraction. Hardness, impact and wear tests were carried out to investigate mechanical behaviour before and after processing. Reinforcement of SiC particles during FSP and subsequent age hardening treatment brought about nearly two fold increase in hardness and impact toughness values by the combined effect of grain refinement, Zener pinning, dispersion strengthening and precipitation hardening. Significant improvement in wear resistance in terms of wear loss was also observed after processing compared to the reference material AA7075 - T6. Fractured surface of post FSP age hardened AA7075 alloy exhibited features of ductile fracture during Charpy impact test. Aluminium metal matrix composites (AMMCs) or simply Aluminium Matrix composites (AMC) are very much in demand for aerospace, defence and transportation applications pertaining to its high specific strength, better stiffness and improved wear resistance. Liquid metal processes like Stir Casting, Compocasting, Squeeze Casting, Spray Forming, Liquid Metal Infiltration and solid state processes like High Energy Ball Milling, Diffusion Bonding, and Powder Metallurgy are the techniques which are used to produce AMC. Pertaining to this, numerous researchers are trying to explore diverse ways to enhance the toughness of 7XXX series precipitation hardenable aluminium alloys without compromising on strength 4 and hardness. Fabricated hybrid surface composite (50% Al2O3 and 50% SiC) using FSP reported superior wear resistance compared to base metal AA5083 [29]. It was observed that, though considerable research is being carried out to enhance toughness of7XXX series aluminium alloys without compromising strength and hardness by exploring various techniques, FSP can be used as a tool.

Ajay Kumar et al [34]. Aluminium alloy (AA7075) is largely used in various fields of transport applications, including marine, automotive and aviation and aerospace due to their high strength – to – density ratio. The present work deals with the influence of TiC on the mechanical properties of AA7075 Metal Matrix Composites (MMCs). TiC is particularly attractive as it offers high hardness and elastic modulus, low density, good wet ability yet low chemical reactivity with aluminium melts. The aluminium metal matrix composites (AMMCs) are produced as AA7075 matrix metal and TiC particulates of an average size of 40µm as reinforced particles through stir casting, Magnesium added to the melt to over come the wetting problem betweenTiCand liquid AA7075 metal. AMMCs are produced in different % weight of TiC ranging between 3 to 7%. In this study, an attempt is made to predict hardness using micro Vickers hardness tester. Also ultimate tensile strength (UTS) of the composite are characterized. The increasing hardness and ultimate tensile strength of the composites compared with matrix (AA7075) because of the presence of the increased reinforced material (TiC). Micro hardness and tensile strength increased. the areas of aerospace and automotive industries had led to a rapid development of metal matrix composites. Metal matrix composites (MMCs), a metal / alloy as matrix with ceramic reinforcements, are known for their high specific strength, modulus and hardness properties the development of light weight composites with the improved properties like high strength, hardness, fatigue and wear resistance. light weight, environment friend liness, low cost, quality, and performance. Metals are very useful in making different composites and their properties can be improved by adding reinforcement like SiC, B4C, Al2O3, TiB, BiC and TiC etc. These materials have to be able to support heavy load with out undue distortion, deformation or fracture during performance and maintain controlled friction and wear over long periods without severe surface damages. Aluminium alloys have high strength at room temperature. The strength and other mechanical properties are reduced when the aluminium alloy is used at high temperatures. characteristics in molten aluminum. To fabricate Al 7075 / TiC composites with different weight fractions ranging between 3 to 7%. Also characterization and evaluation of Mechanical properties of AMCs reinforced with TiC.

Kumar et al [35]. The dry sliding wear behaviour of AA7075 aluminium / SiCp composites fabricated by powder metallurgy technique. The wear test has been conducted in a pin – on - roller wear testing machine, under constant sliding distance of 1 km). The effects of volume percentage of reinforcement, particle size of reinforcement, applied load, sliding speed and hardness of counter part materials on dry sliding wear behaviour of AA7075 aluminium / SiCp. Aluminium alloys are widely used in many automobile, aerospace and mineral processing components because of their excellent combination of low density and high thermal conductivity the poor tribological properties. this hard reinforcement phases, such as particulates, fibre or whiskers are well known for their high - specific strength, have been uniformly distributed. In most cases, hard ceramic particulates such as zirconia, alumina and silicon carbide (SiC), have been introduced into aluminium - based matrix in order to increase the strength, stiffness, wear resistance, corrosion resistance, fatigue resistance and elevated temperature resistance. Wear rate is increase.

John,Olayinkaet al [36]. Aluminium composites with reinforcements in the form of whiskers, particulates or continuous / discontinuous fibres are referred to as aluminium metal matrix composites (Al MMCs). These form of composites can be engineered to effectively provide tail ored property combinations such as high strength to weight ratio, specific strength, specific stiffness, creep resistance and low density compared to conventional engineering materials. AlMMCs have become choice materials in applications such as aerospace, construction, marine and automotive. Dry sliding wear predominantly occurs. Aluminium metal matrix composites (AlMMCs) account for about 69% by mass of metal matrix composites (MMCs) produced annually and used for industrial purposes. It was concluded from the work that wear rate of the silicon carbide based Al MMC was less than that of the aluminium matrix alloy by 30 – 40%. At 600 rpm, volume loss reduced by 39% on addition of 2.5% reinforcement. The volume loss decreased by 46% when the reinforcement increased to 5% by weight and 92% when increased to 7.5%. Specific wear rates of the composite specimen were also observed to be less in comparison to that of the base alloy at various loads and speeds. Wear loss and coefficient.

Kang Yang et al [37]. the feasibility of employing friction stir processing (FSP) as a post - spray method to augment the corrosion resistance of cold sprayed (CS) AA2024 / Al2O3 metal matrix composites (MMCs). The effect of the FSP passeson the electro chemical properties of composites in a 3.5 wt% NaCl solution was studied with cyclic polarization and electro chemical impedance spectro scopy (EIS). Microstructural evolution were employed to analyze and identify the corrosion mechanisms of the CSed and FSPed composites. improvement of the corrosion resistance of the AA2024 / Al2O3 coatings for the low pass number FSP (1 and 2 passes), with the best corrosion performance occurring at 2 – pass FSP. The improved surface condition is the main improvement mechanism of corrosion resistance. the high pass number FSP (4 passes), the corrosion resistance was reduced due to the combined effect of the improved surface condition and deteriorated interfaces of inside coatings. Al - based metal matrix composites (AMMCs) are widely used in many industries like aerospace, transportation and several structural applications because of their high strength, highYoung's modulus, improved resistance to wear. AMMCs, fabricated with conventional methods like liquid metallurgy casting, powder metallurgy and thermal spray are often accompanied with defects such as porosity, largergrain size, clustering of particles, poor bonding and undesirable interface reaction product. It is that corrosion resistance would increase at the beginning to lower later as ceramic contents increase. It was found that a ratio of 70% Al and 30% Al2O3 provided the best corrosion resistance. The optimization of the ratios or size of ceramic particles could improve the corrosion performance of AMMCs. The AA2024 powder has Cu, Mg and Mn compositions of 4.7 wt %, 1.5 wt % and 0.2 wt %, respectively 2.5mm thick AA2024 - T3 plates were used as substrates. Before spraying, the substrates were ground with abrasive papers up to 1000 grit, cleaned with acetone, and then sand blastedusing alumina. The composite coatings were performed with a high pressure CS system under the process parameters. spraying, the thickness produced of AA2024 / Al2O3 MMCs coatings was about 4mm.

Boseet al [38]. Metal matrix composites the various manufacturing industries such as automotive, aerospace, marine etc. due to its excellent properties i.e., high strength to weight ratio, good wear resistance, high strength and toughness. The properties of metal matrix composites are enhanced with reinforcing materials. Reinforcing materials play avital role in the strengthening of the mechanical properties of metal matrix composites. Wear is one of the most important parameters that can be improved by enhancing the hardness of the work material. Manufacturing techniques also play an important role for better and improved properties of metal matrix composites. The effect of reinforcing materials and wear behavior of metal matrix composites. Metal matrix composites possess these properties and are very much demanding these days. The metal matrix consists of a metal and other constituents may be metal or any other materials in the form of reinforcement. Reinforcement may be in the form of particulates, fibers or whiskers according to the requirement of the manufacturing industries. The reinforcing materials play an important role in improving mechanical as well as tribological properties of the metal matrix composites. The reinforced various types of reinforcing materials such as TiO2, SiC, TiB2, WC, B4C, AlN, fly ash, carbon nano tubes in metal matrix and analyzed the effect of these reinforcing materials on the properties of work materials i.e., tensile strength, yield strength, hardness. the ultimate tensile strength at 400C achieved the value of 154 MPa. The value of microhardness, as well as tensile strength, increased and there was a significant improvement of 132% in microhardness and 56.95% in ultimate tensile strength compared to the unreinforced material. The effect of Al – 7 Si - 0.35 Mg / Fly ash metal matrix composite fabricated by various stir casting method and it was observed that separation of fly ash particulates and their dispersions were more productive in compocasting method compared to liquid stir casting method due to shear phenomena of fly ash particulates by solid primary phases already present in the semi - solid slurry. AA6061 - B4C metal matrix composite using stir casting method B4C has increased the value of tensile strength from 185 MPa to 215 MPa. AA6061 metal matrix composite less wear rate for 6% and 9% B4C at a loading of 4 kg and 2 kg. the hardness was optimum at 9 % B4C and the value of the coefficient offriction ranging from 0.40 to 0.86 at different loadings of 2 kg, 3 kg and 4 kg. strength and hardness when 3 wt% of nano - Al2O3 and 5% micro Al2O3 particles for compocasting and 2 wt% nano Al2O3 and 5% micro for stircasting method.

Rajkumar Et Al [39]. Wear performance of aluminium metal matrix composites have reached essential for the application of tribo components or products. To fabricate the aluminium alloy composite with various combinations of Nano Graphite (NG) and boron carbide particles and superior wear resistance composite in relation to the wear rate and surface characteristics. A two step stir casting method was adopted for the production of AA6061 - B4C – nano graphite hybrid composites. Tested in a pin – on – disctribometer with consideration of constant parameter of sliding distance, speed, and normal load. combination of 10 vol % of nano graphite and boron carbide particles exhibited a superior wear performance due to the synergetic effect of both particles existed at the contact zone. These developed materials will be used in brake pad, automotive brake rotor, and sliding member of light machine tools. Three different types of reinforcement particles such as B4C, SiC and Al2O3 in the aluminium metal matrix composites, and manufactured with the stir - casting followed by hot extrusion method. The relative importance of 5 and 10 wt % B4C particles in the aluminium matrix. A higher 10 wt % composites howed a higher wear resistance with an outstanding improvement of 40% when compared to the 5 wt % B4C composites. The conducted tribo experiments with the ASTM G99 standard. Fabricated composites were machined to pin cylindrical form of diameter 8 mm and height 50 mm. Pin surface was grounded with 1000 grade SiC paper followed cleaning with acetone. The pin just positioned perpendicular to the disk steel surface which has EN 30 – 63 HRC hardness. The tribo experiments were done with parameters of sliding speed of 1.4 m/s, a normal load of 25 N and a sliding distance of 1000 m and a temperature of 150 C. Pin heating is done by a resistance heating coil set up which mounted on the periphery of the pin surface. The mass loss of pin after wear testing was found from an electronic balance with an accuracy of 0.0001 g. Mass loss was converted into a volumetric wear rate.

Ankush Raina et al [40]. Alumunium alloys are increasingly becoming important for industrial applications. The addition of reinforcement particles improves the mechanical and tribological properties of these alloys considerably. Such as grain refinement resulting in improvement of mechanical and tribological properties. The effect of titanium diboride (TiB2) on the various aluminium alloys. Metal matrix composite have wide range of application due to their superior strength to weight and superior strength to cost ratio. They are being increasingly used in aerospace, automotive, marine, defence sector. Aluminium being one of the most abundant material on earth with its superior properties is one of the most extensively used base metal in MMCs. Aluminium MMCs are light weight high performance material due to their low density, high specific strength, good corrosion resistance, high electrical conductivity. The industries are moving toward energy conservation so light weight materials which fulfil other desirable mechanical and tribological properties are the need of the hour. The properties of AMCs can be modified suitably by combinations of matrix, reinforcement and processing route. Different reinforcements are borides, nitrides, carbides and their combination. Among the various reinforcements titanium diboride (TiB2) has excellent properties. TiB2 exhibits high hardness, high elastic modulus, high melting point, high young modulus, good thermal conductivity, high wear resistance and low specific gravity. method is master alloy technique. The two matrix alloy Al - x % Ti and Al – y % B are added into the molten alloy matrix as per stoichio metric ration to form the composite. It has advantage over salt reaction method such as less reaction time, low reaction temperature and fine distribution of reinforcement. Sr addition of 0.03 wt % is sufficient for full modification of A356 – 3 wt%. TiB2 composite beyond this addition of Sr will decrease the tensile strength and ductility. The ageing time comes down from 12 h in the base alloy to 4 h in the composite with 10 wt% TiB2. At higher weight % of reinforcement reduced the particle size of Si leads to easier spheroidisation of Si particles during heat treatment and improvement ductility was obtained. Hybrid composite of A356 alloy reinforced TiB2 and ZrSiO4 in significant improvement in mechanical properties. By adding TiB2 in A356 the wear rate was increased but less effect on the friction. The COF was lowered when TiB2 content was 2.5 wt%. An increasein hardness and tensile strength was reported when AA6351 reinforced with TiB2 (1, 3 and 5 wt %) synthesised by salt reaction method. Decrease in ductility withincrease in reinforcement. Al 6063 reinforced TiB2 composite fabricated via chemical reaction between Al – 10% Ti and Al – 3% B master alloys in Al6063 matrix alloy. Mechanical properties such as microhardness, ultimate tensile strength and modulus of elasticity have been improved. Increasing the content of Al – 3% B master alloy increased the ductility by 368% when compared with the base alloy. This may be due to grain refinement of the composite Materials. The hybrid composite of AA6061 alloy reinforced with TiB2 and ZrB2 improvement in mechanical properties.The grain refinement of AA6082 was observed with addition of grain refiner master alloy (Al - Ti5 - B1) [41]. The hybrid composite of AA6082 reinforced (TiB2 + BN) improvement in wear resistance. Friction stir processing method used for fabrication process of composite.

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