[COTII- 2018] ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

Mechanical and wear performance for metal matrix composite material for bearing material application- a review

Dheeraj kumar1, Ashiwani Kumar[2] & Arun Mital[3]

[1]Department of Mechanical Engineering, Institute of Engineering and Technology, Lucknow-226021, India
[2]Department of Mechanical Engineering, Feroze Gandhi Institute of Engineering and Technology - Raebareli, Uttar Pradesh - 229316, India.

ABSTRACT

This research article summarizes the mechanical and tribological performance for aluminum metal matrix composite for bearing material application.Metal Matrix Composites are playing a progressively main role in structural applications. The aluminum metal matrix compositesare widely used for aircraft, automotive and aerospace industries because they are lightweight, high strength to weight ratio, corrosion resistance and workability. Research scholar and Authors have investigated that the addition of filler content into the Al metal matrix improves the hardness, tensile strength, creep, fatigue and tribological properties as compared to the conventional engineering materials. Although there are quitea lot of methods available to produce the particulate metal matrix composite, stir casting are widely used to fabricate the aluminum metal composites because of its useful and convenience. The wear experiments were performed on a pin on disc tribometer equipment with the different operating condition such as normal load, sliding speed and sliding distance. Surface morphological studies of worn-out surfaces are carried using scanning electron microscope (SEM). This research article presents the overview of the influence of addition of different filler materialsin Al metal matrix composites and their influence on the mechanical and tribological characteristics.

Keywords: *Aluminium matrix composites (AMCs); sliding wear, and mechanical behavior.*

I. INTRODUCTION

Aluminium can be used in same load ranges with tin-bronzes containing white metal and lead in journal bearings today Al-based bearing materials have higher fatigue strength than whitemetal bearings and can be used at higher working temperatures. The aluminium alloys have fine properties like low cost, resistance to corrosive effects, co-activation with steel shafts, high thermal conductivity, fatigue strength, lightness and workability.Aluminium alloy have been used for bearing application for many years, Al8.5Si3.5Cu and Al15Sn5Cu3Si alloys, on the other hand, have the highest

Wear resistance. Al15Pb3.7Cu1.5Si1.1Fe alloy is the most worn material; and Al15Pb3.7Cu1.5Si1.1Fe alloy has the highest wear rate[1].

They are used in main bearings of internal combustion and diesel engines, hydraulic gear pumps, reciprocating compressors and aircraft equipment's. Aluminium and its alloys have low density. That's why better serviceable bearing parts can be produced,forged and heat treated material Al-8.5Si-3.5Cu and Al-15-Pb-3.7Cu-1.5Si-1.1Fe.were investigated in oil lubricated conditions.in forging process 10%-20% strains were applied. Heat treatment process was doneon the materials. The result showed thatforgingprocess areincreased hardness of thetested materials. 10%-strained alloy has a lower hardness than 20%-strained one when the forging was applied to specimens, the mass loss (as well wear rate) of the materials increased. But a forging strain of 10%-20% has no significant effect on mass loss. The heat treatment process increased hardness of tested materials Thus, as-cast and as-cast+heat treated alloys in this study have same mass loss values. When the heat treatment is applied to forged specimens, mass loss decreases. The wear resistance performance of Al-Pb alloy is superior to Al-Si alloy under oil lubricated conditions[2].

The Composite materials are defined as the combination of two or more materials which have different physical and chemical properties and produce a new material which is having different properties from the unit materials. In a composite typically, there are two constituents. One constituent act as a matrix and other constituent acts as reinforcement. The composite materials are heterogeneous at micro scale but homogeneous at macro scale. There are mainly three types of composites according to the matrix material Polymer Matrix Composites, Metal Matrix Composites and Ceramic Matrix Composites.

Al metal matrix is one constituent is The base matrix and the other constituent are the reinforcement, the base matrix taken al7075 and al 6061, the reinforcement taken as particles of SiC is of size 20 µm and Al_2O_3Al7075 heated at 720^0 C and The particles were preheated before being introduced into thevortex and stirring done 10 minutesduration at 400 rpm. The cylindrical samples are produced size of 22mm X 210mm by casting process, composite of Al7075-SiC were obtained along with samples required for mechanical testing. Micro-hardness of the composites found increased with increased filler content and the increase in hardness of Al7075-SiC composites were found to be about 10%. The tensile strength properties of the composites are found higher than that of base matrix and Al7075-SiC composites superior tensile strength properties than that of Al7075- composites.The wear resistance of the composites are higher,further the Sic contributed significantly in improving the wear resistance of Al7075-SiC composites.From the studies in overall it can be concluded that Al7075-SiC exhibits superior mechanical and tribological properties [3].

A. Baradeswaran et al.[4] fabricatedA commercial grade aluminium alloy Al 7075 was used as the matrix material, with B4C particles as the reinforcement. The aluminium composites were manufactured with 5, 10, 15 and 20 vol% B4C particles with particle size ranging from 16 lm to 20 lm were used as the reinforcement. The base metal weighing 1000 g of aluminium was melted in a graphite crucible. The temperature control of the molten melt was taken care of, with thermocouples inserted into the melts to measure its temperature. The mixture of B4C particles and the same amount K2TiF6 flux were added into the melt within 4 minat 850^{0C} with mechanical stirring at 500 rpm. The melt was finallypoured into the preheated molds at 850^{0C} casting temperature. The cast samples were heat treated to the T6 condition. The specimens were prepared for hardness, tensile, compression, flexural strengths and wear tests to study the mechanical properties and wear behavior of the composite. the result showed that The hardness of the Al–B4C composites was found to increase on increasing the volume fraction of particulates, The ultimate tensile, compression and flexural strength have also been observed to increase on increasing the B4C particle content, and are significantly higher than the strength of the base alloy. The improved strength noticed with the addition of the B4C particles could be due to the induction of higher strength to the matrix alloy, by offering more resistance to the tensile stresses. The wear resistance of the composite metal, increased when increasingthe B4C particle content in composite metal,. The wear rate is less for the composites metals compared with pure matrix material. The wear rate at 10 vol% B4C is only about 11% of the wear rate for the pure matrix material.

SC. Sharma et al.[5] produce acomposite,ZA27 alloy is taken as base metal an reinforcement taken as graphite particles of size 80-l 20 µm were used as the reinforcement. The percentage of graphite was varied from l-5% in steps of 2% by weight the uncoated but preheated (400^{0C}) graphite particles were introduced into the vortex created In the molten alloy melt using an aluminite coated stainless steel stirrer. The coating of aluminite is necessary in order to prevent the migration of ferrous ions from the stirrer material into the zinc alloy melt and hence contamination of the same. Commercially available; pure magnesium was added in small amount to improve the wettability of the graphite particle\. The melt was thoroughly stirred, degassed subsequently by passing nitrogen at the rite of 2-3 I/min and poured into sandmoulds.the result showed that ZA-27 alloy and the graphite reinforced composite reveals that the composites bearing in the lubrication test are able to run up to the regions of boundary lubrication but under very high friction .the level of average value µ in the lubrication test is lower as compared with semidry and dry test.and it is highest in the dry test.

B.Q. Ochieze et al [6] fabricated the base alloy A356 and reinforcement are taken as cow horn particulate composite, A356-matrix/xCHp(x ¼ 0, 5, 10, 15, 20%) composites was produced using Spark Plasma Sintering (SPS). The composites were produced at a temperature of 550^{0C} and a pressure of 30 MPa with heating and cooling rate of 100^{0C}/min. All the samples were produced in a closed furnacewhere10-2 torr vacuum was maintained throughout the duration of the experiment. The result showed that the addition of cow horn particles as reinforcing materials in A356 alloy composites increased the wear resistance of the composites greatly. This paper attempts to review the studies conducted on mechanical, physical, and the tribological behavior of reinforcement filled Al metal alloy composite.

II. FABRICATION TECHNIQUE

Processing of aluminium metal matrix Nano composites) are classified into solid state and liquid state. Solid state includes Diffusion Bonding, Electroplating, Powder Metallurgy, Spray Deposition, Immersion Plating, Chemical Vapour Deposition and Physical Vapour Deposition etc. Liquid state processing includes Stir Casting, Squeeze Casting, Melt Infiltration, Compo Casting and Melt oxidation processing.

A. Stir casting method:

Stir casting is the process of fabricat a composite materials in liquid state.In which the reinforcement particles mixed with a molten metal matrix by means of mechanical stirring. Then the liquid form of composite material is cast by casting methods and conventional metal forming techniques. In last five decades the aluminium alloy based metal matrix composites are fabricated through stir casting method by reinforcing ceramic hard particles.

B. Powder metallurgy Method:

Powder metallurgy is a material fabrication technique in which particulate materials are consolidated to semi-finished and finished products.Powder metallurgy have four basic steps i.e. powders manufacturing process, blending of powders, compacting of powders in a die and sintering. In The Powder manufacturing process is suitable for a parts that are required to be easly manufactured from a single or multiple materials in powder form and minimizes the machining, scrap losses and suited to high volume production of components.

C. Spark Plasma Sintering

Spark plasma sintering is a high speed powder consolidation sintering process. Spark plasmasintering are used for conductive and nonconductive materials. The basic method of spark plasma sintering process is based on the electrical spark discharge phenomenon where low voltage pulse current momentarily generates spark plasma in fine local areas between the particles at high energy. The spark plasma sintering temperatures were lower than the conventional sintering temperatures and material processing time is 5 to 25 min.

III. LITERATURE SURVEY

A. Effect of reinforcement on mechanical properties:

The mechanical properties of composite materials depends on type of filler metal, shape, size and quantity of the reinforcement etc. The researchers investigated mechanical properties of aluminium based using with different reinforcing particles.

Zhen gang Liu†et al[7] fabricated a metal composite of pure Al, Mg, and the natural crystalline flake graphite particles with 82 μm nominal diameter were used as the raw materials. Al alloys containing 0, 0.2, 0.4,0.6, 0.8, and 1.0 wt pct of Mg were melted in a graphite crucible and maintained the temperature at 735◦C for half-hour; then, 8.0 wt pct graphite particles coated copper by electro less plating were added into the melt and stirred for 5 min; subsequently, the slurry of composites was injected into a preheated (about 450◦C) steel mould and immediately solidified by water-cooling. The size of the casting composites was 150 mm long, 100 mm wide, 35 mm thick and the wall thickness of the steel mould was 15 mm. the mechanical testing result showed that see that Vickers hardness of the composites increases by 130% with the increase of Mg content Vickers hardness is 67, the tensile strength of the compositescontaining 0.6 wt pct Mg is the highest , the tensile strength is 185 MPa.

E. Karakulak et al [8] are fabricated a metal composite of Al–Cu–SiC–xNi (x: 0, 0.5, 1, 1.5 wt.%) composites were investigated. Effect of nicke content on hardness and wear test conducted using a ball on disc wear test device. Filler metal nickel additional in to Al–Cu–SiC metal composite alloy causes development of nickel bearing intermetallic phases. intermetallics increase the hardness of the alloy with increasing nickel content.

B Adaveesha et al [9] the metal matrix composite the base alloy ZA43 is reinforced with Boron Carbide powder of 60-70 microns in size and is fabricated as ZA43-B4C metal matrix composites. Density of ZA43 is 4.2 g/cc and that of the reinforcement particle is 2.54g/cc. composites were fabricated by conventional liquid stir casting method. The composites containing 3, 6 and 9 wt. % of B4C particulates were fabricated for the study. the wear test perform on as cast ZA43 alloy specimens and 3, 6 and 9 wt. % of B4C particles at a 2kg load and 300rpm sliding speed. The result showed that The addition of B4C particles to ZA alloy base matrix enhanced the wear resistance of the composite. The wear rate was dominated by load factor and sliding distance. The increase in applied normal loads and sliding distance leads to a significant increase in the wear rate. The ZA43-9 wt. % of B4C particulates reinforced composites have shown lower rate of wear as compared to as cast ZA43 alloy matrix. SEM micrographs test perform to analysis of worn surface revealed the presence of smooth grooves in the ZA43-B4C composite compared to the base matrix.

Bekir Sadık Unlu et al [10] fabricated a composite material of pure Al (99% purity), Al based (3% Al2O3 and SiC, and 6% Al2O3 andSiC) particle reinforced casting and PM materials were used as base friction elementsand SAE 1020 steel disc materials as opposite friction elements. Specimens were manufactured by casting or PM methods. Casting composite specimens were manufactured in the state of semisolid form by mixing. PM specimens were manufacturedby pressing at 360 MPa pressure and by sintering at 600^{0C} for 0.5 h. The specimens were worn on pin-on-disc test rig at dry conditions. The wear losses were measured at dry conditions of 10 N loads, 50 rpm (0.628 m/s sliding velocity) and every 5 min for 30 min (1130 m sliding distance). The specimens were cleaned and wear losses were measured. Wear loss of particle reinforced Al specimens decreased about 1.5–2 times. of pure Al specimens were rougher than those of particle reinforced Al specimens. Consequently, tribological properties of particle reinforced Al composite specimens were improved by these methods. In addition, tribological and mechanical properties of casting specimens were about 1.5–2 times better than those of PM specimens.

Karthick E et al [11] dabricated a composite material of AZ31with 95-87 wt% used as the base metal matrix.The composition of alumina was fixed at 5% and silicon carbide varied from 0-8 wt% with corresponding composition of magnesium alloy. Green compacts were prepared using stearic acid (CH3 (CH2)16COOH (2 wt%) used as lubricant. Powder metallurgy technique was used for the synthesizing of magnesium metal matrix composites. The reinforcement powders with their weight compositions were mixed in order to ensure uniform distribution of the powder particles. Mixtures were compacted at 200 MPa for 30s different compositions. The compacted samples were subjected to heat treatment in microwave sintering sintered at 450ºC at the rate of 10°C/min for 20 min. Sintered samples are cooled at furnace itself. Reinforcing Aluminum alloys with ceramics particles has shown an appreciable increase in its mechanical properties. Hardness of Mg is increased by 16.47% with increase in Sic reinforcement.

Kalyan Kumar Singh et al [12] make a composite metal of Aluminum matrix alloy (Al7075) and silicon carbide (8% by weight) have been used to make silicon carbide aluminum metal matrix composites. The average sizes of silicon carbide are 60 microns to 70 microns which have been used as reinforcement in aluminum matrix alloy. The reinforcement of silicon carbide into aluminum matrix alloy improves the property of composites compared with aluminum matrix. Stir casting process have been used for fabricating silicon carbide based aluminum metal matrix composites. In this method, the silicon carbides were preheated at 650°C before the addition into aluminum matrix alloy (Al 7075). Preheating of reinforced materials are necessary to avoid moisture from the particles, otherwise there were chance of agglomeration. Then the molten metal were poured into permanent mould which was preheated to 350°C of 10 mm diameter and 65 mm in length. The result showed that A reduction of 30 % - 40 % are observed in values of coefficient of friction and wear rates for silicon carbide based aluminum metal matrix composite compared with aluminum matrix alloy.

Karthick E et al [13] manufactured a composite metal of AZ31with 95-87 wt% used as the base metal matrix. The composition of alumina was fixed at 5% and silicon carbide varied from 0-8 wt% with corresponding composition of magnesium alloy. Powder metallurgy technique was used for the synthesizing of magnesium metal matrix composites. The reinforcement powders with their weight compositions were mixed in order to ensure uniform distribution of the powder particles. Reinforcing Aluminum alloys with ceramics particles has shown an appreciable increase in its mechanical properties. Hardness of Mg is increased by 16.47% with increase in SiC reinforcement. Density of AZ31-Al2O3-SiC hybrid composites was found to increase with increase in Sic Hence Sic serve as a complementing reinforcement for the development of low-cost high-performance magnesium hybrid composite.

B.M. Girisha et al [14] manufactured a composite metal of ZA- 27 alloy with the chemical compositionas per ASTM B669-82 ingot specification (Al-25%, Cu-2%, Mg-0.01, Zn-% remainder) was used as the matrix material. The ZA- 27/graphite composites were prepared using the liquid metallurgy technique. The alloy is prepared using Zn (99.99%), commercially pure Mg (99.85%) and Al (99.6%). The size of the graphite particles selected was 100–150 μm graphite contents used for the preparation of the composites were 0%, 4%, 6% and 8% by weight. The addition of graphite into the molten zinc alloy melt above its liquid temperature of 500 ◦C was done by creating a vortex in the melt using a mechanical stainless steel stirrer coated with aluminates in order to prevent migration of ferrous ions from the stirrer material into the zinc alloy melt. The melt was agitated at a rotational speed of 500–600rpm to create the necessary vortex. The graphite particles heated at 400 ◦C and added in to the melt through the vortex at the rate of 0.1 kg/min. ZA-27 zinc alloy matrix improves the wear resistance of the composite, benefit of reinforcement is found more at 4–6% compared to higher values. This is a good indication that the graphite reinforcement will certainly help the designers to develop a suitable bearing material which gives better performance at elevated temperatures.

B. Effect of reinforcement on tribological properties

Mohammad Moazami- Goudarzi et al[15] fabricated a composite metal of Al 5252 alloy powder and Nano-composite powders containing 2.5, 5, and 7 wt% (respectively equivalent to 2.1,4.2 and 6 vol%) of Sic particles were produced using the in situ powder metallurgy (IPM) method. The abovementioned nano-composite powders were coldpressed in a steel die with an inner diameter of 26 mm at 600 MPa pressure using a hydraulic press. Then the resultant green compacts were extruded at 500 °C while holding the samples in the extrusion die for 45 min before extrusion to ensure a temperature balance between the composite and the die. The extrusion process was performed with a ratio of 11:1 and speed of 36 mm/min. In addition, a micro-composite sample containing 10 wt% of coarse Sic particles (63 μm), hereafter denoted by Al 5252/10 wt% Sic, was also produced using the same procedure. The hardness of the Al /10 wt% Sic micro-composite was only 29% higher than that of the matrix alloy being lower than all the investigated Nano-composites containing smaller amounts of reinforcing particles. The friction coefficient of the unreinforced alloy increased by increasing the applied stress from 0.3 to 0.9 MPa. For the micro composite, this coefficient remained constant for the applied stresses in the range of 0.3 to 0.6 MPa but increased significantly at 0.9 MPa loading.

Fei CHEN et al [16] make a composite metal of ZA27−TiB2 in situ composites were produced in thelaboratory by mixed halide salt reaction. Commercial pure aluminum (99.7%) was melted and heated to 875 °C in a graphite-clay crucible with a resistance furnace. Pre-dried K2TiF6 and KBF4 salts, weighed at a stoichiometric ratio Ti to B of 1:2, were fully blended and wrapped with aluminum foil. A small amount of KCl, CaCl2 and Na3AlF6 salts were added as the reactive assistant and covering agent. The mixed salts were then pressed into the melt and stirred thoroughly for 30 s. The melt was held at 875 °C for 45 min to allow the reaction to reach completion. Cu and Mg were added in the form of Al−Cu and Al−Mg master alloys, whilst Zn was added in the form of molten zinc. After removing the slag and degassing by refining flux and high-purity argon, the melt was poured into a preheated thin-wall permanent mold. A total of three composites (see Fig. 1(a)) were produced with different mass fractions of TiB2 (1%, 3% and 5%). The chemical composition of the composites was determined by atomic absorption analysis. Wear tests were carried out at room temperature with a computer-controlled pin-on-disc wear testing machine for the testing of mechanical the result showed that the composites exhibit a significant improvement in hardness and tensile strength, while a reduction in elongation, in comparison to the base alloy. The Brinell hardness and UTS of the composites containing 5% TiB2 are up to HB 128 and 434 MPa, respectively. In situ TiB2 particles significantly improve wear response of the zinc-based matrix alloy. Both friction coefficient and wear rate decrease dramatically with the increase in TiB2 content. Friction coefficient and worn surface analyses indicate that there is a change in the wear mechanism in the initial stage of wear test.

W. Chmura et al [17] fabricated a composite metal of As the starting materials the granulated chips of aluminium of two fractions, i.e. below 2mm and 2–4mm were mixed with different amount of reinforcing phase: 15, 22, 30 and 45%. As the reinforcing phase, the aluminium bronze containing 8% of aluminium was chosen. High-power ball mill with a horizontal axis of rotation filled with 20 mm-diameter steel balls up to 45% of its volume was used for the mixing of granulated aluminium chips with particles of reinforcing phase. The mixtures were subjected to cold compacting, hot extrusion and heat treatment. The cold compacting was performed in a device with a floating die under the constant pressure of 400MPa. The hot extrusion was applied to crushing the oxides layer and actuating diffusion processes under a high pressure and temperature. Hot extrusion was carried on in the temperature range of 500–525 ◦C. As lubricant mixture of zinc stearynian with graphite was used. The last operation was heat treatment at 545 ◦C and the sample formed for the mechanical and wear test, the result showed that by hot extrusion of the cold compacted mixture of aluminium and aluminium bronze chips and heat treatment applied after extrusion the hard phases are created ,hard phases have positive effect on the tribological properties of composites;different time, changing in the range of 0.5–10 h. Using optical and scanning electron microscopes and image analysis system VISILOG-4 the structure was investigated.Heat treatment applied after extrusion improves tribological properties and hardness of composites by increase of diffusion bonding and by creation of new phases.

Sandeep Sharma et al [18] make a composite metal of the base alloy (LM30) was melted at 750 °Cand stirred with a graphite stirrer for 2–3 min at 630 rpm. There after the stirrer speed was reduced to 250 rpm and sillimanite (Al2SiO5) was slowly added to the molten mass. This mixture was further stirred at 630 rpm for 8–10 min and was finally cast into a cast iron mould (12×12×4 cm3) followed by air cooling. Single particle size reinforced composites containing different wt.% of sillimanite (3–18 wt%, in a step size of 3 wt%) and also different particle size range (1–20 µm, 32–50 µm, and 75–106 µm respectively) was prepared by this process. In the present work, single particle size reinforced composites containing sillimanite particles of size 1–20 µm, 32–50 µm, and 75–106 µm were designated as SPS-F, SPS-M, and SPS-C respectively. the result showed that Uniform distribution of sillimanite particles in AMCs (revealed through optical micrographs) and high nan hardness values at the particle-matrix interface of AMCs (revealed through Nano indentation analysis) indicated that the methodology adopted in the present work was effective in processing of composites. Sillimanite is very cheap and abundantly available ceramics sand which can act as an effective and economical substitute for Sic, B4C, zircon etc. in AMCs. The type of wear mechanism involved during dry sliding wear of composites is mainly dependent upon applied load and sliding distance. It was observed that at low values of applied load and sliding distance, abrasive wear was predominant. However, at higher applied loads and longer sliding distance, adhesive wear was the main reason for material loss.

Biljana BOBIĆ et al [19] fabric ated a composite metal of The commercially available ZA27 alloy was used as the composite matrix Chemical composition of ZA27 alloy (mass fraction, %)Al-26.3,Cu-1.54, Mg-0.18, Zn-Bal. The ZA27 alloy was conventionally melted and cast. Sic particles with the average particle size of 40 µm were used as the reinforcement for the ZA27 alloy. The composites with 1%, 3% or 5% Sic particles were synthesized via compo casting using a suitableexperimental equipment the matrix alloy was superheated above its melting temperature. The alloy melt was then cooled down to the operating temperature (465 °C) using the cooling rate of 5 K/min, when a homogenizing mixing (450 r/min) was applied for 10 min. After homogenization, Sic particles (preheated at 450 °C to remove the moisture) were added in the semi-solid melt of the matrix alloy, with simultaneousslow mechanical mixing (450 r/min). The addition wascarried out at 465, 470 or 475 °C, for 3, 5 or 7 min, respectively, depending on the planned content of Sic particles in the ZA27/Sic composites. After the addition of particulate reinforcements, the mixing speed was increased to 1000 r/min (with isothermal mixing for 2.5 min), and then to 1500 r/min (with isothermal mixing of the composite mixture for 7.5 min). The composite mixture was cooled down to 460 °C with the cooling rate of 5 K/min and then poured into a steel mold preheated at 300 °C. Castings (20 mm × 30 mm × 120 mm) of the ZA27/Sic composites with different contents of Sic particles were cut to obtain composite samples (20 mm × 30 mm × 5.5 mm) for hot pressing. The samples were hotPressed at 350 °C, under the pressure of 250 MPa. Specimens for hardness, the result showed that Surface appearance and microstructure of the ZA27/SiCp composites have been significantly changed after their immersion in the neutral sodium chloride solution, due to the occurrence of corrosion processes in the composite matrices. Corrosion did not affect Sic particles in the composite matrices. In a sodium chloride solution, ZA27/Sic composites with a higher content of Sic particles showed lower corrosion resistance compared with the composites with a minor content of particulate reinforcements.

M.T. Abou El-khairaet al [20] fabricated a composite metal of ZA27 alloy based composites and 5 vol. % of various reinforcement particulates, namely,Sic, ZrO2 or C. The preparation of the composites was carried out using stirringroute, followed by squeeze casting, according to the following procedures. The furnace, crucibles and tools were cleaned, well coated and preheated prior to use. About 2 kg of ZA27 alloy were placed in a crucible and heated up to 50 ◦C above its liquid us temperature. After degassing with nitrogen, the surface of the melt was skimmed. When the melt temperature reached 100 ◦C above its liquid us temperature, the stainless steel stirrer was introduced into the melt and positioned just below the surface of the melt. The particles were added manually to the vortex formed using stirring speed of 600 rpm. After that, the stirring was lift until the temperature of the melt reached 600 ◦C. Just before pouring, the melt was again stirred for 1min and immediately cast into cast iron mold. The pouring temperature of the molten ZA27 based composites was setnat 580 ◦C. Squeeze casting experiments were carried out by means of hydraulic press (60 ton). In this process, the molten composite prepared by stirring method was poured into the preheated die cavity (250 ◦C) and the punch was lowered until it came into contact with liquid composite. The applied pressure was maintained at a level of 50MPa within a period of 2min and then the solidified casting was ejected. The result showed that The hardness measurements of ZA27 and composites show a remarkable increase in the squeezed specimens over the gravity cast ones. The ultimate tensile strength and ductility of the composites are markedly lower, in comparison to those of ZA27 alloy. In all the produced composites, cracks may initiate at particle–matrix interface, propagate through the matrix and link up with other cracks, leading to failure of the composites.

Yang LIU et al [21] fabricated a composite metal of the experimental ZA27 alloys were prepared from99.99% Zn, 99.99% Al, 99.99% Mg, and Al−37.41%Cu master alloys, which were charged in a graphite crucible and then melted in a resistance furnace at 700 °C. Degassing was carried out with zinc chloride. After thorough stirring, the melt was cast into a preheated mild steel mold at 550 °C. The compositions of the investigated alloys in the as-cast state are ZA27 alloy (mass fraction, %) Al-27.11, Cu-2.09, Mg-0.012, Zn-Bal. as measured by inductively coupled plasma-atomicemission spectroscopy (ICP-AES). In a high precision furnace, the experimental samples were solid-solution treated at the temperature from 300 °C to 365 °C for 1 h, followed by water quenching. Subsequently, the samples treated were aged at the temperature from 90 °C to 250 °C for 1, 3, 5, 8, 12 and 24 h, respectively. The hardness and the tensile strength both decrease with increase in aging time while aging at 140 °C gives peak ductility and the tensile elongation amounts to over 25%. The fine spheroid zed structure plays an important role in improving the strength and plasticity of the alloy.

B.K. Prasad [22] a make a composite metal of the matrix alloy used for synthesizing the composite comprised 37.5% Al, 2.5% Cu, 0.2% Mg and balance zinc. The dispersed phase was 50–100 _m silicon carbide particles. TheComposite was prepared by dispersing 10 wt. % of the Sic particles in the melt of the matrix alloy. A vortex was created in the alloy melt with a mechanical stirrer in order to facilitatethe incorporation of the dispersed particles. Cast iron moundswere used to shape the melt in the form of 20mm diameter and150mm long cylindrical castings. The matrix alloy melt wasalso processed in a similar manner. The wear rate of the zinc-based alloy and its composite containing Sic particles increased with load in dry and oil lubricated conditions. The reinforcement silicon carbide particles led to reduce the wear rate of the alloy. Increasing applied load led to higher frictional heating. Influence of the test environment on frictional heating was similar to that of wear rate. The composite experienced higher frictional heating than the matrix alloy in dry condition except at the highest load, a mixed trend was noticed during testing in the latter case.

.

Shivakumar.N et al [23] fabricated a composite metal of ZA-27 alloy has been taken as matrix material for preparation of nano composites. The chemical composition of the base alloy (weight percentage of 25-27 Al, 1-1.5 Cu, and 0.001-0.002 Mg & Bal- Zn). Alumina (Al2O3) Nano particles of average particle size (APS) of 50nm have been selected as reinforcement material for the fabrication of ZA-27/ Al2O3 Nano composites. ZA-27 alloy was placed in the graphite crucible which is melted at a temperature of 800oc in the electric resistance furnace. When the ZA-27 alloy melted completely, slag appeared on the top of molten metal was removed. Reinforcement of pre-heated Al2O3 Nano particles with the different wt % of 1, 2 and 3 in the melt and stirring was done for 10 minutes with the help of mechanical stirrer. After stirring ultrasonification of the Nano composites with ultrasonic probe for about 5 minutes was done and the Nano composite melt was poured and solidified into a mild steel die in the form of cylindrical rods. Nano composites have been prepared for different wt. % of alumina Nano particles through ultrasonic assisted stir casting. The result showed that the ZA-27/ Al2O3 Nanocomposites. The minimum wear volume loss was obtained from the combination of filler content (3 wt. %), sliding speed (1m/s), load (30N) and sliding distance (750m). The most significant factor for the wear volume loss was sliding distance is followed by filler content, sliding speed and load has the least significance. It is observed that wear volume loss decreased substantially with the increase of Al2O3 particle content in the composites.

IV. CONCLUSION

This paper presents the views about the experimental and theoretical results obtained and conclusions made by researchers in the area of Metal Matrix Composites. Mostly researcher stir casting, powder metallurgy have been used to fabricate a metal matrix composite.

- Mostly stir casting technique has been employed for fabrication of composite since it is inexpensive and easy to handle.
- Properties depend on fabrication parameters, reinforcement size, and their properties.
- Mechanical properties such as, hardness, toughness, yield strength, ultimate tensile strength, etc increase with increasing percentage of reinforcement to appropriate extent in most of the cases.
- Sliding wear behavior of composites shows better results as compared to monolithic alloys. Wear resistance increases on increasing percentage of reinforcement and is dependent on sliding velocity, load applied and sliding distance etc.

V. ACKNOWLEDGMENT

The author grate full student of iet lucknowwrite a review paperon mechanical and wear performance for metal matrixcomposite material for bearing materials,prof.Ashiwani Kumar doing help write this paper.

REFERENCES

1. *Erol Feyzullahogˇlu*,Nehir S akiroglu,"The wear of aluminium-based journal bearing materials under lubrication", Materials and Design 31 (2010) 2532–2539.*
2. *Erol FEYZULLAHOLU, Alpay Tamer ERTÜRK, Ersin Asim GÜVEN," Influence of forging and heat treatment on wear properties of Al-Si and Al-Pb bearing alloys in oil lubricated conditions",Trans. Nonferrous Met. Soc. China 23(2013) 3575-3583.*
3. *V.Balaji, N.Sateesh, M.Manzoor Hussain,"Manufacture of Aluminum Metal Matrix Composite (Al7075-SiC) by Stir Casting Technique" , Materials Today: Proceedings 2 (2015) 3403 – 3408.*
4. *A. Baradeswaran, A. Elaya Perumal,,"Influence of B4C on the tribological and mechanical properties of Al 7075–B4C composites" Composites: Part B 54 (2013) 146–152.*
5. *SC. Sharma* , B.M.G irish,R athnakaKr amath , ,"Graphite particles reinforced ZA-27alloy composite materials for journalbearing application".M.S atish,wear 2/9(1998) 162-168.*
6. *B.Q. Ochieze , C.C. Nwobi-Okoye , ,"Experimental study of the effect of wear parameters on the wear behavior of A356 alloy/cow horn particulate composites" P.N. Atamuo , Defence Technology xxx (2017) 1-6.*
7. *Zhengang Liu†, Guoyin Zu, Hongjie Luo, Yihan Liu and Guangchun Yao,,"Influence of Mg Addition on Graphite Particle Distribution in the Al Alloy Matrix Composites" J. Mater. Sci. Technol., 2010, 26(3), 244-250.*

8. *E. Karakulak , R.Yamanog˘lu , U. Erten , A. Zeren , S. Zor , M. Zeren , ,"Investigation of corrosion and mechanical properties of Al–Cu–SiC–xNi composite alloys" Materials and Design 59 (2014) 33-37.*
9. *B Adaveesha, Halesh G M, Vijay Kumar, ,"Investigations on Dry Sliding Wear Behaviour of B4C Reinforced ZA43 Alloy Composites" Materials Today: Proceedings 4 (2017) 10957–10964.*
10. *Bekir Sadık Unlu,,"Investigation of tribological and mechanical properties Al2O3–SiC reinforced Al composites manufactured by casting or P/M method" Materials and Design 29 (2008) 2002–2008.*
11. *Karthick E, Joel Mathai, Michael Tony J, Senthil Kumar Marikkannana,,"Processing, Microstructure and Mechanical Properties of Al2O3 and SiC Reinforced Magnesium Metal Matrix Hybrid Composites" Materials Today: Proceedings 4 (2017) 6750–6756.*
12. *Kalyan Kumar Singh, Saurabh Singha*, Anil Kumar Shrivastavac, ,"Comparison of Wear and Friction Behavior of Aluminum Matrix Alloy (Al 7075) and Silicon Carbide based Aluminum Metal Matrix Composite under Dry Condition at Different Sliding Distance" Materials Today: Proceedings 4 (2017) 8960–8970.*
13. *Karthick E, Joel Mathai, Michael Tony J, Senthil Kumar Marikkannana, ,"Processing, Microstructure and Mechanical Properties of Al2O3 and SiC Reinforced Magnesium Metal Matrix Hybrid Composites"Materials Today: Proceedings 4 (2017)6750–6756.*
14. *B.M. Girisha, K.R. Prakasha,∗, B.M. Satisha, P.K. Jain b, Kameshwary Devic, "need for optimization of graphite reinforcement in ZA 27 alloy composites for tribological application"Materials Science and Engineering A 530 (2011) 382–388.[15]Mohammad Moazami-Goudarzi , Farshad Akhlaghi, "Wear behavior of Al 5252 alloy reinforced with micrometric and Nano metric SiC particles" Tribology International 102 (2016)28-37.[16] Fei CHEN, Tong-min WANG, Zong-ning CHEN, Feng MAO, Qiang HAN, Zhi-qiang CAO, "Microstructure, mechanical properties and wear behaviour of Zn−Al−Cu−TiB2 in situ composites" Trans. Nonferrous Met. Soc. China 25(2015) 103−111.[17] W. Chmura, Z. Gronostajski, "Bearing composites made from aluminium and aluminium bronze chips" Journal of Materials Processing Technology 178 (2006) 188–193.*
15. *Sandeep Sharma, Tarun Nanda, O.P. Pandey, "Effect of particle size on dry sliding wear behaviour of sillimanite reinforced aluminium matrix composites" Ceramics International xxx (xxxx) xxx–xxx[19]Biljana BOBIĆ, Jelena BAJAT, Ilija BOBIĆ, Bore JEGDIĆ1, "Corrosion influence on surface appearance and microstructure of compo cast ZA27/SiCp composites in sodium chloride solution" Trans. Nonferrous Met. Soc. China 26(2016) 1512−1521[20] M.T. Abou El-khaira,∗, A. Lotfya, A. Daouda, A.M. El-Shei, "Microstructure, thermal behavior and mechanical properties of squeeze cast SiC, ZrO2 or C reinforced ZA27 composit" Materials Science and Engineering A 528 (2011) 2353–2362[21]Yang LIU, Hong-ying LI, Hao-fan JIANG, Xiao-chao LU, "Effects of heat treatment on microstructure and mechanical properties of ZA27 alloy" Trans. Nonferrous Met. Soc. China 23(2013)642−649.[22] B.K. Prasad,"Investigation into sliding wear performance of zinc-based alloy reinforced with SiC particles in dry and lubricated conditions"Wear262(2007)262–273.[23]Shivakumar.N*, Vasu. V, Narasaiah N, "Processing and dry sliding wear behavior of Al2O3 nanoparticles reinforced ZA-27 composites" Materials Today: Proceedings 4 (2017) 4006–4012.*