A review on comparison of Aluminium alloy LM-25 with Al/Sic

Rahul Ushir[1] , Kunal Gandhi[2], Gaurav Dahe[3], Vijay Bidgar[4], Prof. Vishal Thakre[5].

[1,2,3,4] BE student Mechanical, SND COE & RC, YEOLA, Maharashtra, India
[5]Prof. Mechanical, SND COE & RC, YEOLA, Maharashtra, India

---***---

Abstract- *Many industries suffered a great loss of manufacturing process due to collapse of manufacturing machines due to wear and fail of lubrication. Friction is main cause of wear and energy dissipation. Improving friction can make substantial saving. It is obvious that enormous amount of the worlds resources are used to overcome friction in the form or another. Lubrication is an effective means of controlling wear and reducing friction. Hence, for the survival of machine wear and friction must be decreased and/controlled carefully.*

Key words: Silicon Carbide(Sic) , aluminium LM25,scanning electron microscope (SEM) , metal matrix composite (MMCs) .

1.1INTRODUCTION

A composite material is a 'material framework' made out of a blend of at least two small scale or large scale constituents that vary in shape, concoction arrangement and which are basically insoluble in each other. The advancement of metal network composites has been one of the real developments in materials in the previous 25 years. Particle reinforced light metals are already attracting the attention of materials producers and end users because of their outstanding mechanical and physical properties. The principal attractions for the use of MMCs in the automotive industry can be summarized as follows: reduction in mass, especially in engine parts, improved wear resistance or lubrication characteristics, improved material properties, particularly stiffness and strength, providing either increased component durability or permitting more extreme service conditions, reduced thermal expansion coefficient. The increasing demand for light weight, inexpensive, energy saving, stiff and strong material in aircraft, space, defense and Automotive applications has stimulated a steadily growing effort to developed composite material. Like all composites, aluminum-lattice composites are not a solitary material but rather a group of materials whose firmness, quality, thickness, warm and electrical properties can be custom fitted. The network compound, support material, volume and state of the fortification, area of the fortification and creation strategy would all be able to be changed to accomplish required properties.

Wear is a standout amongst the most regularly experienced mechanical issues prompting the substitution of parts and congregations in designing. Along these lines, numerous endeavors have been made to deliver more sturdy materials and procedures to decrease the wear of devices and designing segments. These incorporate change of mass properties of the materials, surface medications and utilization of covering, and so on. In the course of the most recent couple of years, numerous endeavors have been made to comprehend the wear conduct of the surfaces in sliding contact and the instrument, which prompts wear. The applications of aluminium and its alloys for the machine parts are increasing day to day in the industry. However, little has been reported on the wear behaviour of aluminium and its alloys with the addition of grain refiner and modifier.

PROBLEM DEFINITION:

To improve tribological properties of Aluminium LM25 alloy by adding Sic in varying proportions and testing prepared alloy on pin-on-disc machine under dry condition `and comparing the results to conclude the best proportion of alloy.LM25 alloy is mainly used where good mechanical properties are required in castings of a shape or dimensions requiring an alloy of excellent castability in order to achieve the desired standard of soundness. The compound is likewise utilized where protection from erosion is an imperative thought especially where high quality is additionally required.

1.2 OBJECTIVES OF THE PRESENT WORK

1. To Study the wear behavior of the selected materials and the effect of various sliding speeds, loads and sliding distance on wear.
2. To study the relationship between coefficient of friction, velocity, sliding distance and wear.
3. To find the effect of various alloy on wear rate and coefficient of friction.
4. To develop regression model to find out the mathematical relationship between sliding velocity, sliding time / sliding distance and amount of wear for all materials.
5. To study the main interaction and 3D surface plot for all the materials.

1.3 Application

1. Cylinder blocks and heads.
2. Automobile brake drum.
3. The food, chemical, marine, electrical industries.

1.4 Experimental procedure

1.4.1.Manoj Singla, Lakhvir Singh, Vikas Chawla , examined the Al– Sic composites containing four diverse weight rates 5%, 10%, 20% and 25% of Sic have been created by fluid metallurgy strategy. Erosion and wear qualities of Al– Sic composites have been examined under dry sliding conditions and contrasted and those saw in unadulterated aluminum. Dry sliding wear tests have been done utilizing pin-on-plate wear test rate ordinary heaps of 5, 7, 9 and 11 Kgf and at consistent sliding speed of 1.0m/s. Weight reduction of tests was estimated and the variety of total wear misfortune with sliding separation has been observed to be direct for both unadulterated aluminum and the composites. It was likewise watched that the wear rate shifts directly with typical load yet bring down in composites when contrasted with that in base material. The wear component gives off an impression of being oxidative for both unadulterated aluminum and composites under the given states of load and sliding speed as showed by examining electron magnifying instrument (SEM) of the well used surfaces. Further, it was found from the experimentation that the wear rate diminishes straightly with expanding weight portion of silicon carbide and normal coefficient of grating reductions directly with expanding ordinary load and weight division of Sic The best outcomes have been gotten at 20% weight portion of 320 coarseness estimate Sic particles for least wear.

.

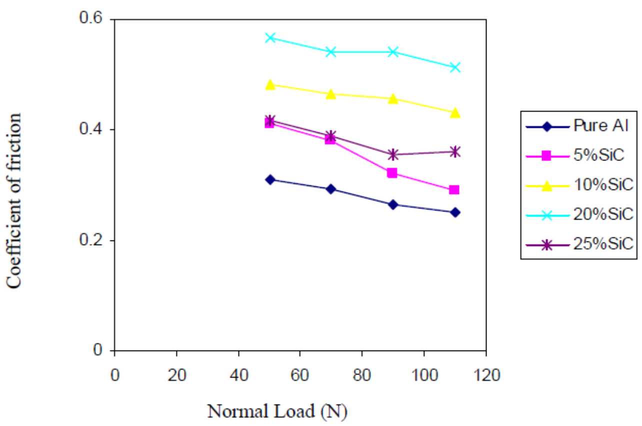

Fig.1 average coefficient of friction Vs load

Fig.1 shows the graph average coefficient of friction Vs load as normal load increases the coefficient of friction usually decreases in different percentages of Sic.[1]

1.4.2. Manoj Singla, D. Deepak Dwivedi, Lakhvir Singh, Vikas Chawla investigated the Metal Matrix Composites (MMCs) have evoked a keen interest in recent times for potential applications in aerospace and automotive industries owing to their superior strength to weight ratio and high temperature resistance. The across the board reception of particulate metal grid composites for designing applications has been obstructed by the high cost of delivering segments. Albeit a few specialized difficulties exist with throwing innovation yet it can be utilized to conquer this issue. Accomplishing a uniform appropriation of support inside the network is one such test, which influences specifically on the properties and nature of composite material. In the present examination a humble endeavor has been made to create aluminum based silicon carbide particulate MMCs with a target to build up a traditional ease strategy for delivering MMCs and to get homogenous scattering of clay material. To accomplish these destinations two stage blending strategy for mix throwing method has been received and ensuing property investigation has been made. Aluminum (98.41% C.P) and Sic (320-coarseness) has been picked as grid and support material individually. Trials have been directed by differing weight portion of Sic (5%, 10%, 15%, 20%, 25%, and 30%), while keeping every other parameter consistent. The outcomes demonstrated that the 'created strategy' is very effective to get uniform scattering of fortification in the lattice. An expanding pattern of hardness and effect quality with increment in weight level of Sic has been watched. The best results (maximum hardness 45.5 BHN & maximum impact strength of 36 N-m.) have been obtained at 25% weight fraction of Sic. The results were further justified by comparing with other investigators.[2]

1.4.3. Akul Patel, Ashwin Bhabhor, Vipul Patel investigated that, the effect of grain refiner and modifier on the wear behaviour of Al–Si alloys has been investigated using a Pin-On-Disc machine. Various parameters such as alloy composition, normal pressure, sliding speed and sliding distance were studied on Al–Si alloys. The cast ace composites (Al– Ti– B and Al– Sr) were then described by optical minute investigation. The outcomes recommend that the wear protection of Al– Si compounds increment with the expansion of grain refiner and modifier when contrasted with the nonappearance of grain refiner as well as modifier. The present outcomes likewise uncover a change in tribological properties, got because of the change in microstructure from coarse columnar dendrites to fine equiaxed dendrites and plate like eutectic Si to fine particles because of the expansion of Al-Ti– B grain refiner and modifier (Sr), individually. We are readied tests for utilizing both gravity-pass on and sand throwing and furthermore decide wear protection for this example and wear comes about contrast and each other.[3]

1.4.4K. M. Shorowordia, A.S.M.A. Haseeb , J.P. Celis examined the ragged surface of Al– SiC metal network composites (MMC) sliding against phenolic brake cushion at a direct sliding velocity of 1.62ms−1 under contact weights of 0.75–3.00MPa of every a stick on-plate mechanical assembly was researched. XPS was utilized to remove data from the main couple of nanometers of the well used surface, while filtering electron microscopy and vitality dispersive X-beam microanalysis (SEM– EDX) gave data from inside a couple of micrometers. Results uncover that the surface of Al– SiC experiences critical concoction and physical changes amid wear. The tribo-surface on Al– SiC is changed over into a blend that contains the constituents of Al– SiC and the phenolic cushion counter body and in addition oxygen from environment. The ragged surface got in the present examination is proposed to comprise of a moderately finely blended best layer of a couple of _m in thickness. The highest couple of nanometers of this finely blended layer is completely oxidized. Notwithstanding the constant best layer, a thick mechanically blended layer (MML).

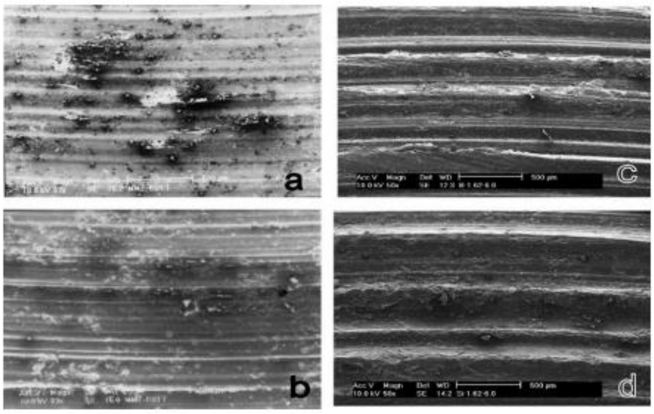

Fig. 2. SEM micrographs of the worn surfaces tested under the contact pressures of (a) Al–B4C, 0.75MPa (b) Al–SiC, 0.75MPa (c) Al–B4C, 3.00MPa and (d)Al–SiC, 3.00MPa [micrographs (a) and (b) were taken without Au coating, while micrographs (c) and (d) taken with Au coating.[4]

1.4.5. Neelima Devi. C, Mahesh. V , Selvaraj investigated that the Conventional unique capacity of designing the materials to give required properties. In this paper elasticity tests have been led by differing mass portion of SiC (5%, 10%, 15%, and 20%) with Aluminum. The most extraordinary unbending nature has been gained at 15% SiC extent. Mechanical and Corrosion direct of Aluminum Silicon Carbide amalgams are in like manner studied.[5]

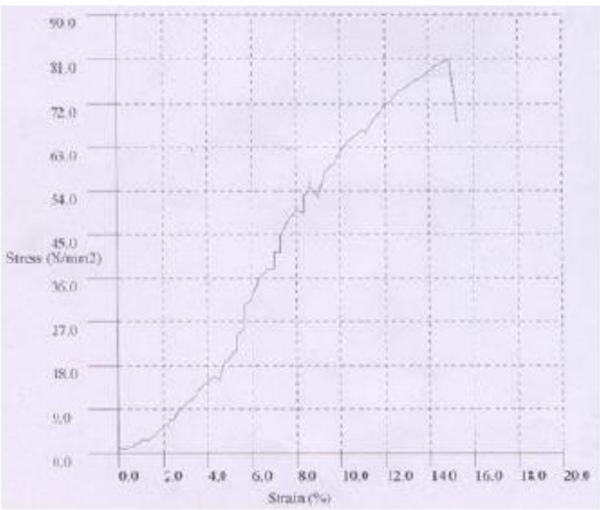

Fig. 3: Stress-Strain curve for 5 % SiC Tensile strength: 80.84N/mm^2 % Elongation: 5.42%

3. Better tensile property obtain at 15% Sic with Aluminium

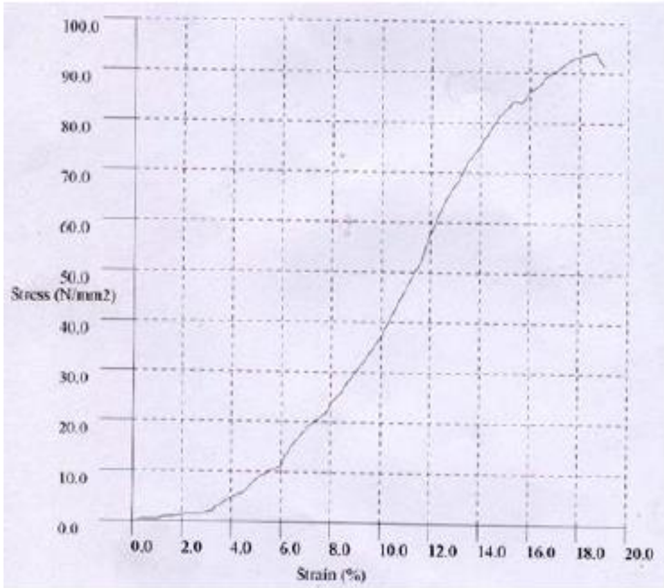

Fig.4: Stress-Strain curve for 15 % SiC Tensile strength: 94.21 N/mm^2 % Elongation: 5.57%

1.5. CONCLUSION

1. For a given load, the wear rate increases when normal load increases

2. The average coefficient of friction decreases with increasing load..

REFERENCES

[1] Manoj Singla, Lakhvir Singh, Vikas Chawla ," Study of Wear Properties of Al-Sic Composites", Journal of Minerals & Materials Characterization & Engineering, Vol. 8, No.10, pp.813-819, 2009.

[2] Manoj Singla, D. Deepak Dwivedi, Lakhvir Singh, VikasChawla," Development of Aluminium Based Silicon Carbide Particulate Metal Matrix Composite", Journal of Minerals & Materials Characterization & Engineering, Vol. 8, No.6,pp455-467,2009

[3] Akul Patel, Ashwin Bhabhor, Vipul Patel, titled "A Review on effect of grain refinement and modification on the dry sliding wear behaviour of eutectic Al– Si alloys", International Journal of Engineering Research and Applications(IJERA), Vol. 2, Issue 3, May-Jun 2012, pp.417-2421.

[4] K. M. Shorowordia, A.S.M.A. Haseeb , J.P. Celis, "Chemical and structural nature of tribo-surface of aluminium–SiC composites at nanometre and micrometre length scales", Materials Science and engineering A 425 (2006)213-218.

[5] Devi. C, Mahesh. V , Selvaraj N, "Mechnical characterization of Aluminum silicon carbide composite", International Journal Of Applied Engineering Research, Dindigul Volume 1,No 4,2011.

BIOGRAPHIES

Rahul B Ushir, SND COE Yeola, Pune University, Department of Mechanical Engineering.

Kunal V Gandhi , SND COE Yeola, Pune University, Department of Mechanical Engineering.

Gaurav R Dahe, SND COE Yeola, Pune University, Department of Mechanical Engineering.

Vijay A Bidgar, SND COE Yeola, Pune University,Department of Mechanical Engineering.

Prof. Vishal R Thakare, SND COE Yeola, Pune University, Department of Mechanical Engineering.