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# Evaluation of Sliding wear behavior of Glass particle reinforced Aluminum alloy 6061 Metal Matrix Composites

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***ABSTRACT.***

*In the present work, an attempt has made to evaluate the wear behaviour of Al6061- glass particulate reinforced MMCs. Melt stir casting method was used to fabricate MMCs composites. The glass particle containing (3%, 6%, 9% and 12%) of 75µm particle size was used as reinforcing material and Al6061as matrix material. The prepared samples were tested using pin-on-disc testing machine. The wear rate of the composite is increased by increasing the weight percentage of particles. The worn-out surface of composites was examined by using optical microscope to understand the wear mechanism of composites.*

***Key words**: Al6061, Glass particles, sliding wear, pin-on-disc, worn surface.*

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## 1.INTRODUCTION

Metal Matrix Composites is a most promising material when related to unreinforced matrix because of excellent wear resistance, high hardness. It has been stated that the wear resistance of metal matrix composites increases by incorporating the particle with different weight percentage. Reinforcement is added in the form of powder because the Glass particulate which is having good thermal conductivity, wear properties. In tribological applications while designing the components wear is an important role to be considered. MMCs composites are having enhanced tribological applications by adding ceramic reinforcements like silicon carbide, Boron carbide, Aluminium oxide etc.

Fabrication of MMCs composites using different methods like solid state methods (powder metallurgy) and liquid state methods (Stir casting). Among this method, stir casting is used because of uniform distribution of reinforcement in the matrix and low cost processing method.

In the present work, the aim of the study is to fabricate the Glass particulate reinforced Aluminium metal matrix composites. Effect of tribological characteristics were investigated by adding different weight percentage using pin-on-disc wear testing machine. The worn surface is examined using optical microscope [1-3].

## 2. EXPERIMENTAL WORK

**Materials.** In the present study, the Aluminium alloy 6061 is selected as matrix material in the form of billets and chemical composition of aluminium alloy 6061 is as shown in the table 1. The reinforcement as Glass particulate in the powder form of 75microns is used in the study.

**Table : 1.Shows the Chemical Composition of the Al6061 Alloy**

| Elements | Cu | Mg | Si | Fe | Mn | Cr | Zn | Al |
|---|---|---|---|---|---|---|---|---|
| Wt% | 0.4 | 1.2 | 0.8 | 0.7 | 0.15 | 0.45 | 0.25 | Bal |

### Fabrication technique.

The MMCs composites was fabricated using Stir casting method. In this process calculated amount of aluminium alloy 6061 billets were taken in the graphite crucible and placed in the furnace and heated to melting temperature. Reinforcement is also preheated in the oven. Adding degassing tablet to remove the slag in the molten metal. After removal of slag the molten metal is stirred to get vortex adding preheated reinforcement to the created vortex and stirred for 10 minutes using stirrer at constant speed. Then pouring the molten metal into the permanent mould and allowing to solidify for 10 minutes and then removing from the mould [4-5].

### Pin-on-disc wear

The pin was held against the counter face of a rotating disc (EN32 steel disc) with wear track diameter 60mm. The wear test for all specimens was conducted under the normal loads of 5kg and a fixed sliding velocity of 0.628 m/s. The pin samples were 22 mm in length and 8 mm in diameter. The surfaces of the pin samples were slides using emery paper (80 grit size) prior to test in ordered to ensure effective contact of fresh and flat surface with the steel disc. The samples and wear track were cleaned with acetone and weighed (up to an accuracy of 0.001 gm using microbalance) prior to and after each test. The wear rate was calculated from the weight loss technique. Worn out surfaces are examined by using optical microscope. The wear test parameters used in the study is load 49.05N, speed of 0.682 m/s and time of 15 mins.

## 3. RESULTS AND DISCUSSIONS

Wear. As shown in the figure.1 that variation of wear rate with the addition of wt% reinforcement to Al alloy. By adding of wt% reinforcement to Al alloy the wear rate reduces. Initially the wear rate will be more in the absence of reinforcement. The glass particulate which is hard material acts as protecting layer solid lubricating surface between composites and rubbing hard surface which reduces the wear rate [6-7].

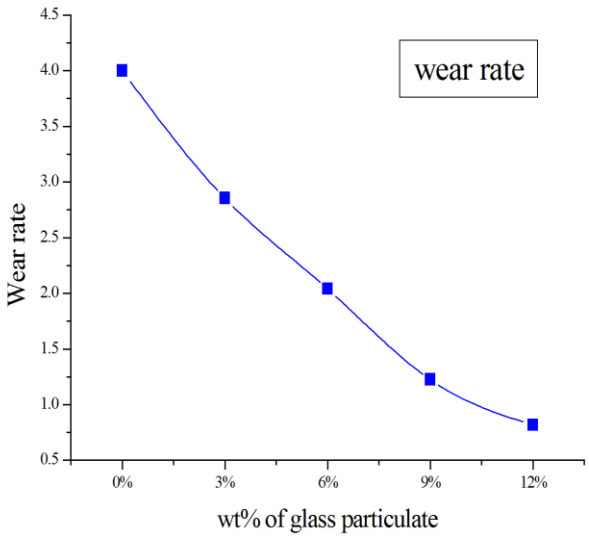


**Fig.1, variation of wear rate of composite with different weight% of glass particulate.**

### Worn surface mechanism

From the worn surface, it can be seen that the wear debris and distorted surface plays an important role on the wear. The worn-out surfaces of Al alloy as show in figure 2a that the ploughed grooves resulting from plastic deformation of matrix material indicating abrasive wear. It can be observed from the figure 2(b-e) the deep plough grooving is less because of addition of glass particulate to the matrix and thus increases the wear resistance [8].

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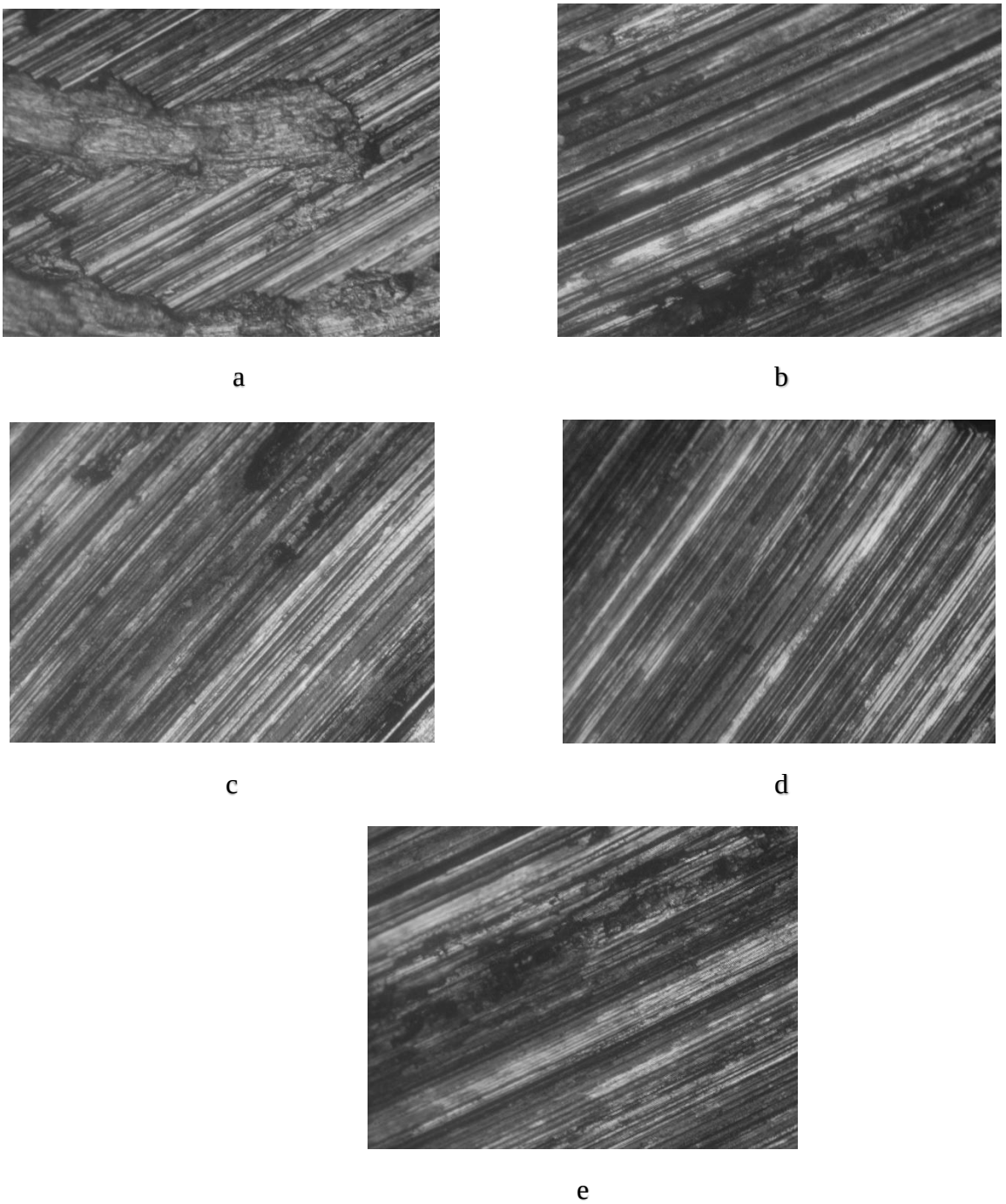


**Fig.2, worn out surface of (a) as cast 6061 Al alloy (b-e) Al 6061 with 3%,6%,9%and 12% weight percentage of glass particulate.**

## 4. CONCLUSION

Metal matrix composites have been successfully prepared by using stir casting technique with uniform distribution of glass particulate with wt% of 3to 12%. The wear resistance has increased by addition the hard reinforcement to the matrix which acts as lubricant between the pin and counter face by increasing the weight percentage. The worn surface shows the less plough and increases the wear resistance.

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