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Experimental Investigation of Wear Rate Using Alternating Material for Food Mixer Bushing

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Abstract - *Bearing contributes very essential part in an area of rotating machines. The plain bearing usually referred as bush used in many motor of home appliances subjected to different loading conditions and speeds. The effect of this aspect on bush or plain bearing subjected to wear, friction etc. This research or experimentation is to find out the better substitute for gunmetal bush used in food mixer application. Composites of various materials are quite good in all parameters like mechanical as well as tribological. As the wear rate is focused response parameter to reduce it the new proposed material is composite of brass and a sample percentage of MoS2. Some best anti wear properties are given by MoS2.*

Key Words: **Wear, Gunmetal, Brass and composites.**

1. INTRODUCTION

As the gunmetal used in manufacturing area widely containing higher percentages of copper while studying the small application of gunmetal as a bush used in household mixer & grinder. Plain bearing is usually refer as bush assuming generally used copper alloy for its good properties. On the other hand large density and low mechanical strength are the drawbacks of copper alloy.

Friction and wear always occur at machine parts which having relative motion. Hence the efficiency of machines get affected negatively. Wear due to relative motion between components surfaces is one of the primary modes of failure for many engineered systems. Unfortunately, it is hard to exactly find component life due to wear as reported wear rates generally exhibit large scatter. This is an attempt made to analyze the effect of wear parameters like load, speed, type of lubricant used, temperature, and viscosity of lubricant. The main objective of the study is to evaluate the wear rate of different journal bearing materials.

1.1 .Wear

Wear is defined as removal of material or from one or progressive loss both the surfaces in contact as the result of relative motion between them .Wear is the single most influencing factor which shortens the effective life of machine or its components. Different factors of the working environment like loads, unidirectional sliding, reciprocating, rolling, and impact loads, speed, temperature will affect the wear rate. Also different types of counter-bodies such as solid, liquid or gas and type of contact ranging between single phase or multiphase, in which the last multiphase may combine liquid with solid particles and gas bubbles.

1.2. Types of Wear

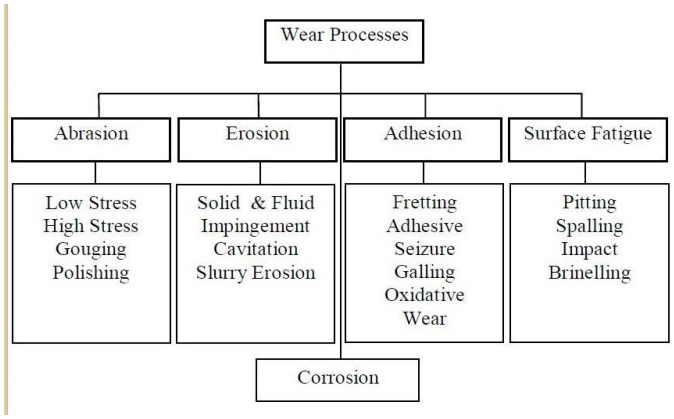


Fig 1.Types of wear

Household mixer is used on daily basis in kitchen. The bush present in this mixer subjected to wear. In these paper going to focus on to invent a new composition with reduced wear rate. Another composition with lesser wear rate is analyzed experimentally so existing gun metal material and proposed brass & molybdenum disulphide materials tribological characteristics to be studied.

The purpose of this chapter is to present a comprehensive literature review summarizing the previous published work relevant to research work. Considering power losses, wear gives almost 26% of the total loss. Thus, referring the literature intends to study the behavior of bearing at different operating conditions and also its tribological properties of different bearing material at different parameters.

2. PROBLEM STATEMENT

Red brass or gunmetal is existing material having lower higher wear rate and mechanical strength.

It is required to find out the alternative composition of material having lower wear rate than existing one for its efficient performance.

2.1 Objectives

1. To find out the alternative material for the same bearing to reduce wear rate.

2. Evaluation of wear rate for existing and proposed material of bush.

3. MEHODOLOGY

3.1 Wear rate of existing material:

Existing material: Existing bush is of material as red brass or gunmetal due to its high containt of percentage of copper. To lower the wear rate brass is one of the best substitutes for gun metal with MoS2.

Fig2: Existing bush of mixer

The wear rate of existing material is experimentally investigated and analyzed with pin on disc tribometer. Gun metal is existing material. Pin of existing material withØ10×30mm.So the pin required for tribotester are as shown in fig below

Fig3: Existing material pin

3.2Experimental Setup:

The materials are experimentally investigated to analyze the possible consequences of wear and friction under two conditions, i.e. dry and lubricated condition. The diameter and the length of the pins are 10 mm and 30 mm respectively. The wear rate will be relatively small in most of the machinery and engineering tool. Lubrication is provided to tackle the friction and wear when there is metal to metal contact present during the relative motion of moving parts in some engineering applications. Considering design aspects the friction and wear are quite important parameters. Using pin-on-disc tribo-meter readings will be taken.

Fig4: Pin- on- disc tribometer

Table1: Specification of test rig on which test will be taken

Specimen pin size	3,6,8,10,12mm, Dia. 25 to 30mm long
Ball	Spherical,10mm Dia
Specimen holder	Collet for 3,6,8,10,12mm Dia cylindrical pins for temperature condito test
Wear disc size	165mm dia.,8mm thick
Wear track dia	Min 50mm Max.100mm
Disc rotation	Min 200 rpm Max 2000 rpm
Sliding speed	0.5 to 10 m/s
Normal load	Min 5 N, Max 200 N
Frictional force	Min 0 N, Max 200 N
Wear	Min 2000 micrometer, Max 2000 micrometer
Temperature	Min Ambient, Max 400° C
AC induction motor	1.5 HP, 1415 rpm, 50 Hz, 3.3 A

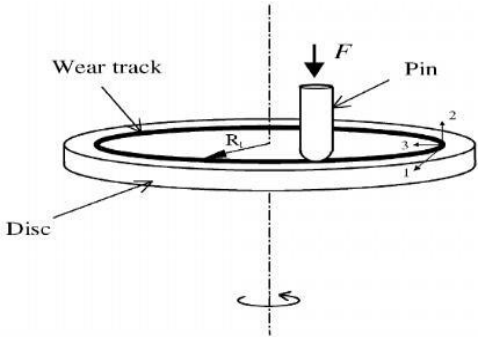


Fig 5: Pin and disc view

3.3 Fabrication of proposed material:

Proposed Composite:

Brass & MoS2: Wear rate in white metal higher as compared with brass metal. Additionally the brass mixed with Molybdenum disulphide is quite good option for wear resistance.

MoS2 with 5% gives results such that it is suitable material for bearing.

Table 2: Sample preparation on %MoS2 basis

Sample	Composition
1	Brass+5 % MoS2

3.4 Preparation of sample:

For making the sample the brass powder (CuZn30) brought from the PometonIndia pvt. Ltd. And Molybdenum disulphide (MoS2).

Fig7: Powder of Brass

Fig8: Powder of MoS2

3.5 Wear rate analysis of proposed material:

The proposed composite pin for our experimentation will be manufactured by powder metallurgy technique which is used further for experimentation purpose. To analyze the wear rate on pin on disc apparatus is prime objective of this study. All specifications of machines are same as mentioned in previous subtitle.

Table 3: Mixer motor specification and capacity

Sr No.	Parameter	Description
1	Application	Food application
2	Power	1.5HP
3	Diameter of Shaft	12mm
4	RPM	2800
5	Capacity	6lit

4. EXPERIMENTATION

4.1 Experimentation of existing bush material:

Part name: Gunmetal

Application: Used in all food mixer jar

Preparation of specimen:

For testing of tribo-mechanical properties of existing bush material, it is required to prepare the sample in required dimensions. For that specimen of required size are cut from brake pad and grinded and polished to correct dimensions as requirement of testing equipment.

Existing material: Existing bush is of gunmetal also referred as red brass as it contains higher percentage of copper.

Testing's are carried in At different load and RPM conditions.

Sliding Speed=V= (π* D * N) / 60 = 1759.2mm/sec

Conditions: For V= 1759.2mm/sec

1. At D=20, N=1680
2. At D=50, N=672
3. At D=80, N=420

4.2 Experimentation of Proposed Bush Material:

Preparation of specimen:

The proposed bush specimens were produced in a compositions having percentage of MoS2 like 5% through route of powder metallurgy (P/M) for the development of MoS2 composed with brass. For uniform mixing ball mill mixer was used for uniform distribution. The powder of Brass(CuZn30) alloy (97.5%,95% and 92.5%) and MoS2(5%) was compacted in die under load of 200KN using compression testing machine for 20 min. Sintering was done in tubular sintering furnace at 650°C. The prepared specimen is then turned on lathe machine up to the required dimension.

5. RESULTS OF WEAR TEST

Table 4: Tribological wear testing of existing Bush material

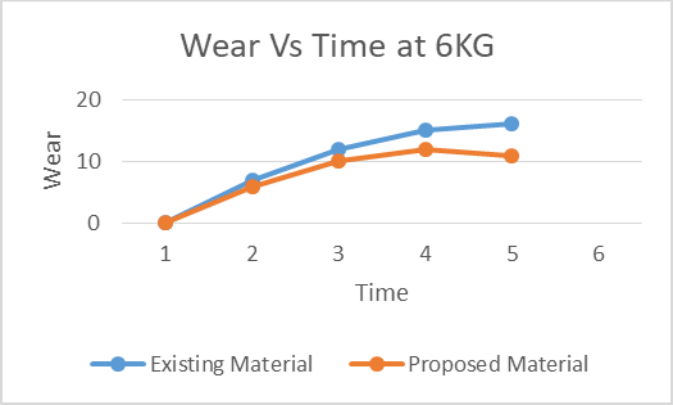
Sr No.	Normal Load(N)	Track Dia.(mm)	RPM	Wear (micron)
1	6	20	1680	16
2	4	50	672	15
3	2	80	420	12

Table 5: Tribological wear testing of proposed Bush specimen

Sr No.	Normal Load(N)	RPM	MoS2	Wear (micron)
1	6	1680	5	11
2	4	672	5	7
3	2	420	5	4

Existing and proposed material obtained by the process of selection of material and fabrication. So to summarize the data of work and to study all results before concluding, here in this chapter collection of all test results on the basis of loading conditions for all three proposed sample as well as existing that physically carried out on tribotester.

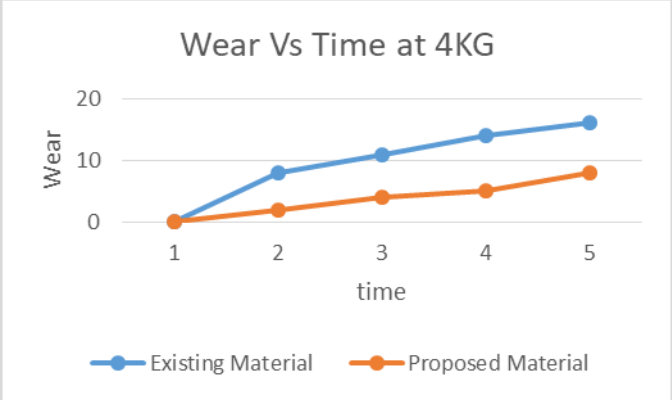
5.1 Wear at 6KG load:



Above graph plot shows wear on ordinate and time on abscissa.

A sample of proposed material and existing material is compared in the graph. From above graph it is observed that proposed sample 5% of MoS2 having lower wear at 6kg load.

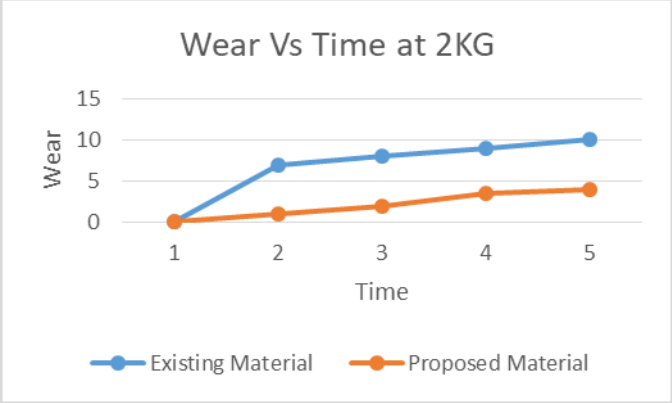
5.2 Wear at 4KG load:



Above graph plot shows wear on ordinate and time on abscissa.

A sample of proposed material and existing material is compared in the graph. From above graph it is observed that proposed sample 5% of MoS2 having lower wear at 4kg load.

5.3 Wear at 2KG load:



Above graph plot shows wear on ordinate and time on abscissa.

A sample of proposed material and existing material is compared in the graph. From above graph it is observed that proposed sample 5% of MoS2 having lower wear at 2kg load.

6. CONCLUSION:

Based on the above experimentation following conclusions are drawn.

•Experimentally observed that proposed material sample having lower wear rate as compared to existing.

•From the all experimental condition it is clear that presence of MoS2 as a solid lubricant reduces wear and the brass is a good alternative for gunmetal

•The optimum tribological combinations for reduced wear A (MoS2)5, B (RPM) 672, C (Load) 6.

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