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# FRICTION & WEAR MONITORING OF SINTERED SPHERICAL IRON BUSH OF RADIATOR FAN

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## ABSTRACT

In recent years use of powder metallurgy is drastically increased. It is used in the automobiles and home appliances for weight reduction, better performance, improved characteristics and efficiencies. The PM parts such as bushes, bearings, pinions, sprockets, gears, pulleys are replacing the forging parts. These parts are used in the various applications and need the required density, hardness, wear resistance, friction resistance for the reliability in terms of the life of the parts.

## INTRODUCTION

The radiator is an important accessory of vehicle engine. Normally, it is used as a cooling system of the engine and generally water is the heat transfer medium .For this liquid-cooled system, the waste heat is removed via the circulating coolant surrounding the devices or entering the cooling channels in devices. The coolant is propelled by pumps and the heat is carried away mainly by heat exchangers. Continuous technological development in automotive industries has increased the demand for high efficiency engines. A high efficiency engine is not only based on its performance but also for better fuel economy and less emission. Reducing a vehicle weight by optimizing design and size of a radiator is a necessity for making the world green. Addition of fins is one of the approaches to increase the cooling rate of the radiator. It provides greater heat transfer area and enhances the air convective heat transfer coefficient.[1] However, a bearing of radiator fan plays an important role in an efficiency of a radiator. So there is scope for an improvement in bearing material for higher wear resistant and frictional properties.

## PROBLEM DEFINITION

It is decided to develop a material to get better wear and friction resistance for automobiles and home appliances.

## DESCRIPTION

Friction and wear always occur at machine parts which run together. This affects the efficiency of machines negatively. Sintered spherical iron bushes are expected to have several properties such as low friction coefficient, high load capacity, high heat conductivity, high wear and corrosion resistance.

## AIMS AND OBJECTIVES

A. To improve the wear resistance of the sintered spherical iron bushes
B. To reduce the coefficient of friction
C. To analyse the effect of various speeds, loads and time on wear of bush.
D. Making improved materials by changing material composition

**Table 1. Sintered Iron Materials**

| Sr. No. | Material Composition (%) | | | | | |
|---|---|---|---|---|---|---|
| | Iron | graphite | JB Wax | MN S | Cu | Zn Sterate |
| 1 | 90 | 0 | 0.8 | 0 | 10 | 0 |
| 2 | 89.2 | 0.5 | 0.2 | 0.3 | 10 | 0.6 |


**Figure 1. Manufacturing Process of Sintered Parts**

## APPLICATIONS OF SINTERED SPHERICAL BUSH

Spherical bushes are used in motors of home appliances as well industrial applications such as mixer, grinder, fan, desert coolers etc.to guide the motor shaft in the motor housing.

## METHODOLOGY

- Finding out the materials for the practical applications of the cylindrical bushes.
- Inspecting the microstucture of the materials
- Making testing pins (Ø 12 x 25 mm) by compaction
- Sintering at the appropriate conditions and belt speeds
- Inspecting for cracks, pores and microstrctures
- Checking hardness for sintering testing pin
- Take trials on the Friction and Wear monitoring setup at various sliding velocities
- Data collection
- Data Analysis
- Addition/deductions in the material composition for better results in terms of friction and wear rates
- Repeating above procedure Comparing the before and after data
- Noting the results of practical application in terms of strength,PV factor, temperatures, wear rate, friction rate
- Data analysis

**Using the improved material composition for practcal application**

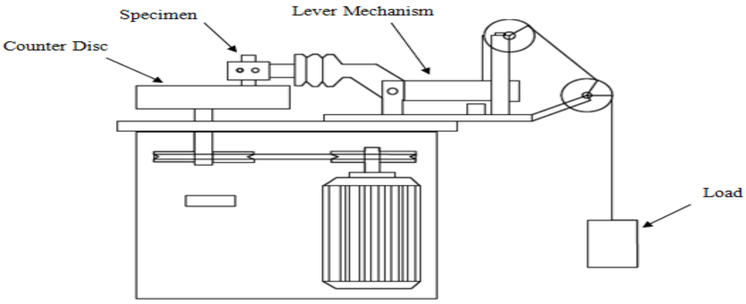



**Figure 2. Experimental setup for Friction and Wear Monitoring**

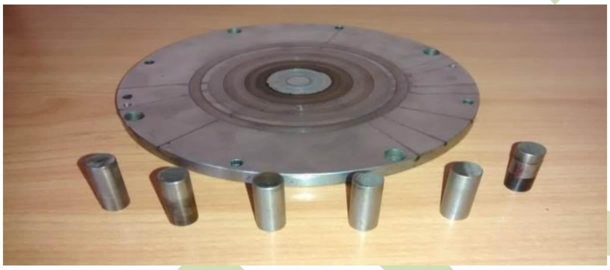


**Figure 3. Testing apparatus pin and disc**

## COMPARISON OF WEAR AND FRICTION PROPERTIES

The material stated in table 1, were tested on Friction and Wear Monitor. The mating part for bearing in radiator is shaft of EN8 grade. So the material of the dick is chosen as EN8. The pin and disk used in the testing are as shown in the figure 3.The specification of the radiator fan motor is as follows:

**Table 2. Radiator Fan Motor Specification**

| Sr. No. | Parameter | Description |
|---|---|---|
| 1 | Application | Automotive radiator cooling fan |
| 2 | Rated Capacity | 160 W |
| 3 | Outer Diameter | 385 mm |
| 4 | Voltage | 12 V |

## CALCULATIONS

Sliding Velocity = (D N) / 60
Data from motor specification:
Diameter of Shaft: 8 mm
RPM: 3300

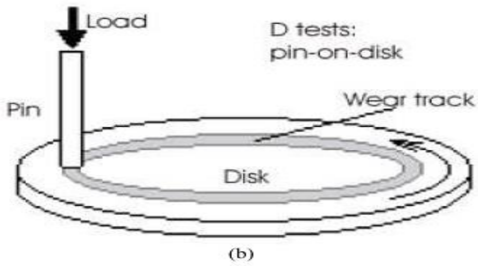



**Figure 4. Geometric Configuration of the tribosystems used in the sliding tests**

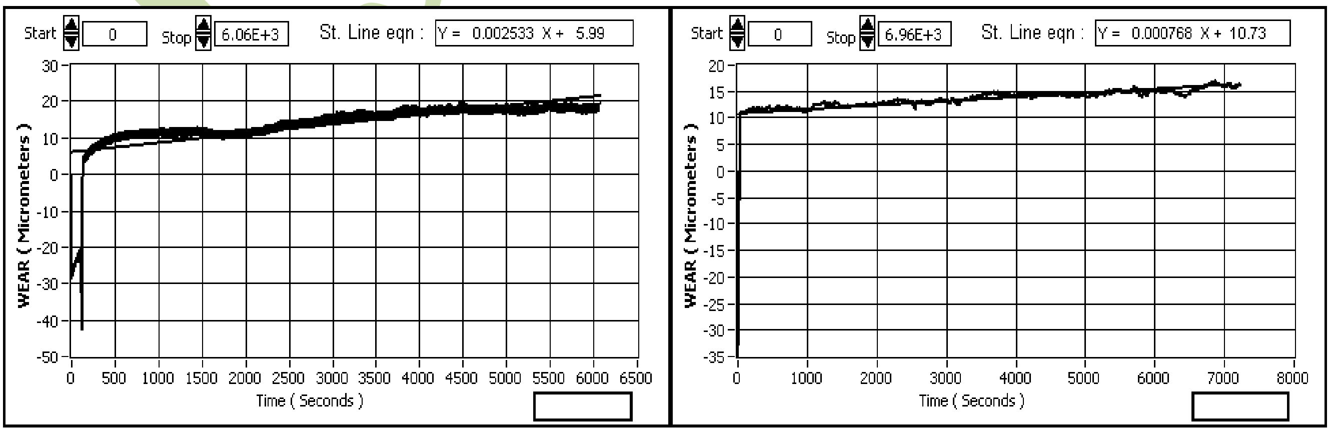
**Table 3. Testing Parameters for Wear and Friction Monitoring**

| Testing Parameters | | | |
|---|---|---|---|
| **Sr. No.** | **Sliding Velocity (mm/Sec)** | **Disk Diameter** | **Disk RPM** |
| 1 | 1381.6 | 20 | 1320 |
| 2 | | 40 | 660 |
| 3 | | 60 | 440 |
| 4 | | 80 | 330 |
| 5 | | 100 | 264 |
| 6 | | 120 | 220 |

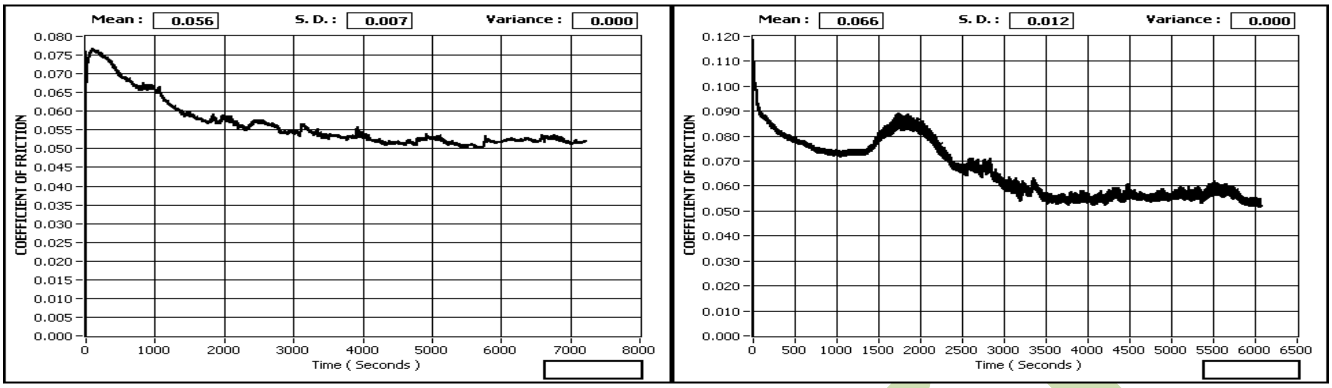
## GRAPHICAL RESULTS

Using Friction and Wear monitor, we get the graphical results in terms of time Vs. wear/coefficient of friction/frictional force for both materials as follows.

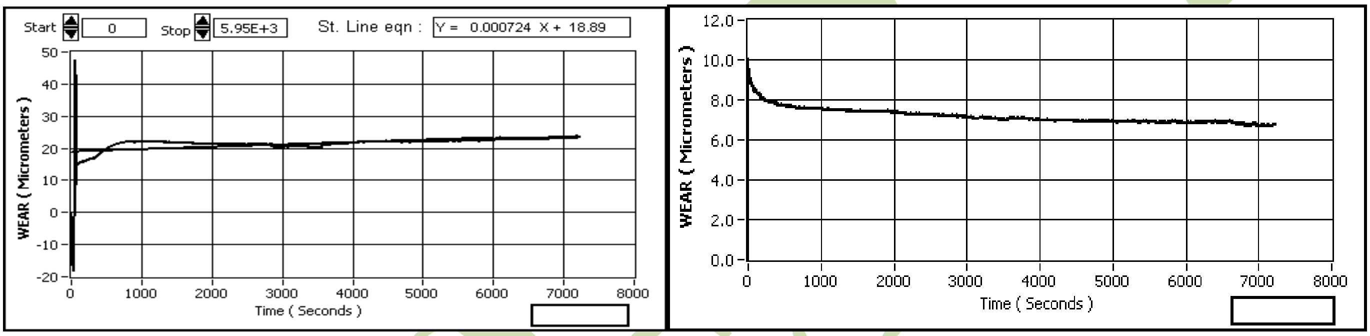
### Wear Rate of Material 1



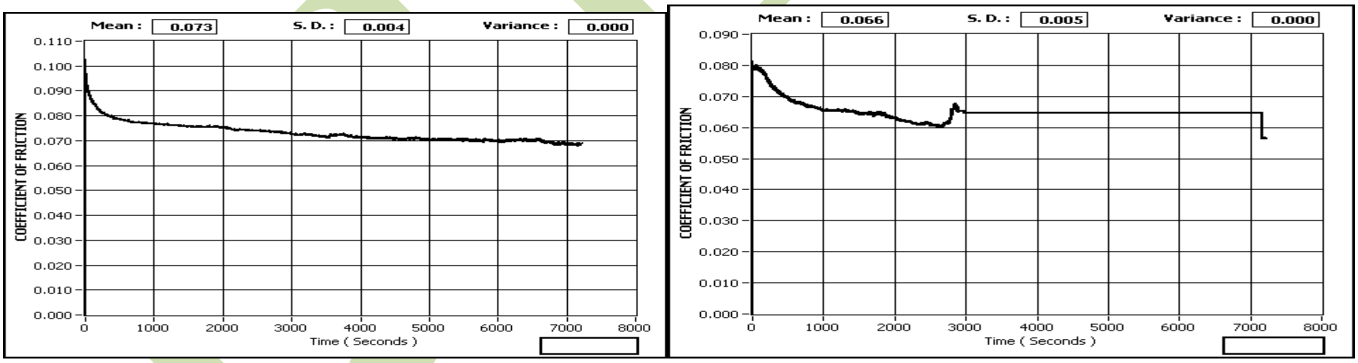
## Coefficient of friction of Material 1




## Wear Rate of Material 2




## Coefficient of Friction of Material 2



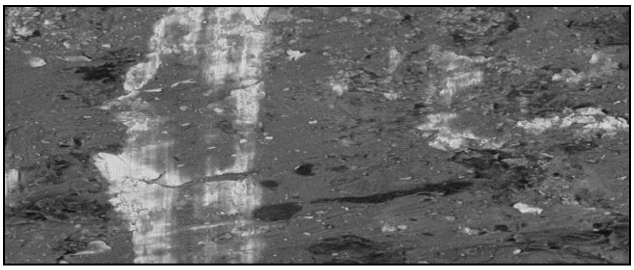



**Figure 5 : Microstructure after Friction and Wear Trials**

## CONCLUSIONS

The experiments were successfully conducted on the wear and friction monitor of DUCOM Industries Bangalore. The regular material with 90 % Fe, 10 % Cu used and testing pins made at the 1100° C and 150 mm/min belt speed. The improved material made with the same procedure and added 0.5 graphite , 0.6 zinc sterate. It was observed that the material with graphite and zinc sterate improves the wear resistance after stability. Also improved material gives better coefficient of friction than earlier material. A specimen pin model was developed to predict the wear phenomenon.

**Table 4 : Comparison of parameter for AP001 and AP002**

| Testing Conditions | | Constant Load | |
|---|---|---|---|
| Sr. No. | Parameter | AP001 | AP002 |
| 1 | Coefficient of Friction | 50 | 15 |
| 2 | Frictional Force (N) | 4 | 3 |
| 3 | Temperature (° C) | 9 | 3 |
| 4 | Wear (µ) | 20 | 5 |

The model developed predicted the wear so well. It was observed that the material improved as the percentage wear resistance increased. It was also observed that the temperature stability of the specimen pin of an improved material developed agreed with the experimental results.

## REFERENCES AND CITATIONS

1) D.P. Kulkarni, R.S. Vajjha, D.K. Das, D. Oliva, *Application of aluminum oxide nanofluids in diesel electric generator as jacket water coolant, Applied Thermal Engineering 28 (14-15) (2008) 1774-1781*.

2) Bhushan, *principles and applications of Tribology*

3) Paulo D *2000 J. Mater. Porc. Technol. 100273 (2000)*

4) Prasad B.K. *1997 Metal Trans 28 809 ( 1997)*

5) Backensto A B 1990 *Effect of lubricants on the properties of copper-tin powder and compacts, Advances in P/M conf. N. Jersey, pp 303-314 (1990)*

6) Upadhyaya A N, Mishra S and ojha *S N 1997 J. Mater. Science 323227 (1997)*

7) Prasad B K. *Dry Sliding wear response of some bearing alloys as influenced by the nature of micro constituents and sliding conditions*