To study the Tribological Effects on Bearing Material (Brass) of Connecting Rod

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Abstract - *The tribological quantities of bearing material were evaluated for automobile industries, machinery parts and for other industrial applications. It is well known fact that in combustion engines connecting rod connects the piston to the crankshaft. The connecting rod bearing is used for the purpose to form a low friction, well lubricated surface between connecting rod and crankshaft. The bearings of connecting rod are manufactured by using non-ferrous metals like brass, gunmetal, bronze etc. This study describes the effect of different working load and speed on the tribological properties of brass. The tribological quantities (coefficient of friction and wear rate) of brass were measured on "Pin-On-Disk" tribotester.*

The main objective of this paper is to study the influence of wear parameters like rotating speed, load and wear track on the wear rate and coefficient of friction of brass. The tribological properties of brass were measured and best parameters is obtained which gives us minimum wear.

Key Words: **Friction, Wear rate, Lubrication, Bearing, Pin-On-Disc.**

1. INTRODUCTION

Tribology is defined as the science and technology of interacting surfaces in relative motion, related topics and practices. It deals with the technology of lubrication, power of friction and avoidance of wear of surfaces having relative motion under load. It includes the study and application of the principles of friction, wear and lubrication. Friction is the resistance to relative motion of two adjacent bodies, whether they are solids, liquids, or gas molecules. Wear is the removal of material from one or both of two solid surfaces in relative motion. Friction and wear occur at moving machinery components. The friction and wear rate has adverse effect in the performance and life of machinery parts. Friction and wear also affect the materials used in various industrial applications such as cutting operation, machining, gears manufacturing, bearings manufacturing, metal forming etc. Existing materials are improved to extend the lifetime of devices and its components. Lubrication also play an important role to reduce friction and wear rate. Lubrication is the process to reduce wear of one or both surfaces in close proximity and moving relative to each another, by interposing a substance called lubricant between the surfaces to carry or to help carry the load between the opposing surfaces. The purpose of research in tribology is to minimize and eliminate losses resulting from friction and wear at all levels of technology where the rubbing of surfaces is involved. Research in tribology leads to greater plant efficiency, better performance, fewer breakdowns and significant savings.

In the present study brass material is tested under different operating condition and same lubricating condition to find out the best suitable working parameter which gives less wear rate and coefficient of friction.

2. MATERIAL SELECTION

After the literature review brass material is selected because of its increasing use in industries. Brass has good mechanical properties, good corrosion resistance and good heat transfer ability, good appearance ductility, excellent machinability. Physical properties of brass are shown in the given table below:

Table -1: Physical properties of brass

Density	8450 kg/m^3
Melting point	950$^\circ c$
Thermal conductivity	130W/m$^\circ c$
Poisson's ratio	0.33µ

3. EXPERIMENTATION

In this study, the bearing material BRASS which is widely used in industry was investigated in order to see the possible effects of wear and friction. The setup of the method comprises of a pin with square surface as the tip and a circular rotating disk which is placed at a perpendicular with respect to the square pin surface. The disk is made of hardened steel on which the pin is held with a jaw in the apparatus and rotation is provided to disk which causes wear of the pin on a fixed path on disk. The pin is pressed against the surface of the disk with load being applied with the arm attachment provided to the apparatus. Machine is attached with a data acquisition system and software which gives result values.

Table -2: Specification of pin-on Disc friction and Wear Monitor

Test Parameters	**Values**
Specimen	Rectangular pin, size (5× 5 × 50)mm
Normal load	5N-200N
Disc rotation speed	200rpm- 2000rpm
Wear track dia.	50mm-100mm
Sample disc size	165mm-8mm
Material of disc	EN-31
Hardness of disc material	60HRC
Sliding speed range	(5-10) m/sec.

3.1 Friction and wear monitor machine

The pin-on-disc test apparatus was applied to the wear and friction monitor machine. It was shown in Fig. 1 which was used to investigate the dry sliding wear characteristics of the brass.
The setup consists of a stationary pin, which was direct contact on a rotating disc. Here pin was stationary and disk was rotating at varying speed and varying load. Now controller shows the speed, load and contact time. A constant 100mm track diameter was used throughout the experimental work. Various parameters like load and sliding distance were studied. The wear loss was measured in microns.

Fig -1: Pin-On-Disc Machine setup

Controller of wear and friction monitor machine shown in Fig. 2. This controller control speed of rotating disk. Controller of machine give information about speed, contact time, temperature, wear and friction force. Whole set up of wear and friction monitor machine shown in Fig.2.

Fig -2: Controller of Pin-On-Disc machine

4. RESULTS

In this study, friction coefficient, temperature values and wear losses of bearing samples are determined. All the test pins were tested at lubricating condition, for which SAE40 oil was utilized.

Table -2: Working parameters

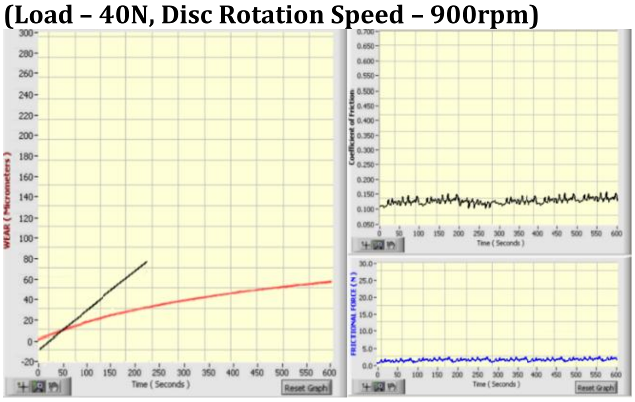
Load applied	4kg , 3kg
Wear track dia	100mm , 100mm
Duration of testing	600sec. , 600sec.
Rotation of disc	900rpm , 700rpm
Test pin size	(05×05×50)mm

With increase in load area of contact also increased which results into high friction and high wear rate. It was possible to record reading at different time interval. Readings were recorded for the Wear rate, frictional force and Coefficient of friction. The wear loss was measured in microns.

With the help of software and arrangement made in the wear equipment results were obtained on WINDUCOM software through graphs. Results of wear test are as below:

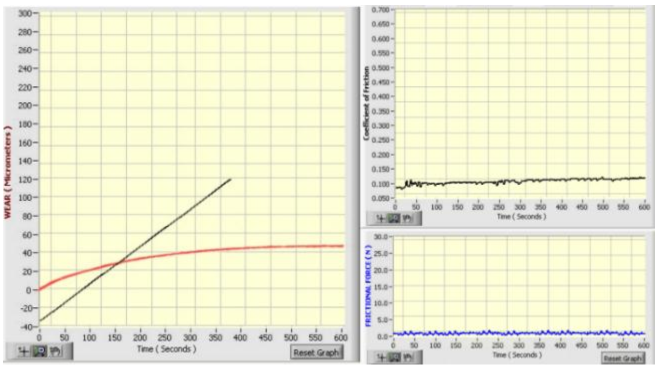
4.1 Graphical Representation:

(Load – 40N, Disc Rotation Speed – 900rpm)



Graph 1. Wear, coefficient of friction, frictional force

(Load – 30N, Disc Rotation Speed – 700rpm)



Graph 1. Wear, coefficient of friction, frictional force

5. CONCLUSIONS

After performing the wear test brass at varying rotation speeds and load it can be said that minimum wear is obtained when disc rotation speed is 700 rpm for 30 N load and maximum wear is obtained when disc rotation speed is 900 rpm for 40N loads. By changing the load and keeping the sliding distance constant the variation in wear rate is observed so it can be said that load has significant effect on wear rate. Graph of brass for wear rate is smooth curve in nature. Presently brass is used for manufacturing bush bearing. So from the experimentation it is concluded that brass is best suited for medium speed applications.

5. FUTURE SCOPE

By considering the aspects of present study more work can also be done by changing some parameters and working conditions. Different lubricant can also be used at different load and speed. In place of brass different bearing material can also be used. Friction and wear test results can also be evaluated by using different tribotester.

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