Parametric Study And Analysis Of Tribological Properties Of Clutch Materials

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Abstract— *This paper is focused on the analysis of tribological properties of clutch material. Clutch is very important machine element to transmit the power from one Mechanism to other Mechanism. The working principle of clutch (friction) is that no powers get transmitted until both the friction plates touch each other. Due to this friction force, there is a generation of heat occurs which reduce the life of material. Therefore the tribological properties of various engineering materials are investigated. Tribology is the science of interacting surface in relative motions.*

Keywords—tribological properties, clutch materials, generation of heat

1. INTRODUCTION

A clutch is very considerable part of machine member used to connect one shaft to the other shaft for transmitting the power. The main application of the clutch is in the automobile vehicle where it is use to engage and disengage the engine to the load.

The overall purpose of the paper is to study the wearing affect on some common type of material, which is use for clutch material. By this we find out the wearing effect with respect to time, speed and load. And from different data we find out most suitable material along the materials that we are using in the experiments.

2. METHODOLOGY

In our analysis we are going to use pin-on-disc machine, pin on disk tribometer consists of a stationary "pin" beneath associate applied load in to bear with a rotating disk. The pin will have any form to simulate a specific contact; however spherical tips usually accustomed change the contact by pure mathematics. Coefficient of friction is determined by the ratio of the frictional force to the loading force on the pin. The pin on disk check has proved helpful in providing an easy wear and friction check for low friction coatings.

This machine facilitates analysis of friction and wear characteristics in sliding contacts under desired condition. Sliding occur between the stationary pin on a rotating disk. Normal load and wear track diameter can be varied to suit the test conditions. Tangential friction force and wear are monitored with electrical sensors and displayed on the front panel.

These machines use the following principle and technique:-

1. Archard's equation: The Archard's wear equation used a model to describe the sliding wear and works on the theory of asperity contact. It concludes that the volume of the removed debris due to wear is proportional to the work done by friction forces.

Where:
Q is the total volume of wear debris produced
K is a dimensionless constant
W is the total normal load
L is the sliding distance
H is the hardness of the softest contacting surfaces
WL is proportional to the work done by the friction forces as described by Reye's hypothesis.

2. Amontons' First Law: The force of friction is directly proportional to the applied load.

$$F=\mu N$$

Where
μ is coefficet of friction
F is frition force
N is normal Load

3. Amontons' Second Law: The force of friction is independent of the apparent area of contact.

4. Coulomb's Law of Friction: Kinetic friction is free from the sliding velocity.
Euler's law: the buckling of pin is said to what proportion axial load is applied:
Axial force on pin causing the pin to buckle = (Pin material modulus of elasticity * Pin Dia.4) / Pin Length 2

3. TEST PROCEDURE AND CONDITIONS

` With the help of Pin-on-disk machine the experiment is performed. This machine is used for measurement of friction and wear of various specimens. In

this machine with the help of wear and friction monitor the value are checked. The experiment is divided in two phase,in the first phase the accuracy of the machine is checked and while in the next phase the specimen were chosen to find the friction and wear characteristics. The test parameters are load, duration of test, rotational rate, radius of track.

4. APPLICATION

Fundamental wear studies, Wear map ping and PV diagrams, Friction and wear testing of EN-8, EN-21, EN24, BB (Bright Bar) and MS (Mild Steel)and heat processed samples.

5. RESULT

It has been seen that when we increase the load friction was also found to be increase. The friction increase in small amount in the case of aluminium at starting after that the rate was increased. The maximum friction shows in EN-24. And after heat treatment friction reduce in the specimen.

Load(Kg)	**EN-24**				
	Before Heat Treatment	After Heat Treatment			
		Normalizing	Quenching(oil)	Quenching (water)	Annealing
0	1.2	1.2	0.5	0.1	0.1
0.5	1.9	1.7	1.6	1.9	1
1	4.3	3.9	3.5	3.2	2.6
1.5	6.6	4.4	4	4.2	7.6
2	15	4.9	4.2	6.2	7.9
2.5	20	5.2	5.9	10	8

It has been seen that when we increase the load wear was also found to be increase. In the analysis the mild steel shows that mild steel has more resistance to deformations than the aluminium and brass. In mild Steel wear was increasing at beginning of test and then remains constant.

Load (Kg)	**Wear (µm) for Mild steel**	**Wear (µm) for Aluminum**	**Wear (µm) for Brass**
0	1	1.0	26
0.5	4	8	50
1	4	7.5	50
1.5	6	8.0	62
2	6	8.5	69
2.5	6	8.0	90

6. CONCLUSION

The materials like EN-8, EN-21, EN-24, Mild Steel and Bright bar have been widely used in industries for various applications so therefore it important to look their charaterstics property which include friction and wear. There fore on the basics of load test vartions and heat treatment some assumptions are made.

1. In this brass shows a higher wear rate as compare to alumimnium and mild steel.
2. The maximum friction shows in EN-24 and steel shows minimum frition.
3. After heat treatment there is reduction in friction as well as wear also in some amount.
4. The variton of rotational speed is also a factor to studies the wear rate and friction rate.

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