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A REVIEW ON WEAR THEORY

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Abstract: Tribology is the study of friction, wear and the lubrication of interacting surfaces. Wear is a progressive loss of material from the mating surfaces of a pair of bodies in relative motion. It is one of the critical tribological domains and a persistent phenomenon regarding the deformation, damage and removal of material at contact surfaces, wear greatly affects the lifetime of mechanical components. Wear is very important as it causes damage to working parts and loss of mechanical efficiency.

Keywords: Tribology, Friction and Wear.

1. INTRODUCTION

Tribology is the study of friction, wear, lubrication and design of bearings. Tribology may have its origin in Greek word Tribo meaning rubbing processes. It is the science and technology of interactive surfaces in relative motion and the practices related. The prime cause of wear is friction. When sliding occurs, touching asperities in relative motion finally give rise to wear particles out of the dislodged lips of the members. The process is slow, but continuous. Abrasive action may be operative between two bodies where the asperities of the harder abrade the softer. When hard particles, which may be the wear particles themselves, are present between two rubbing surfaces, a case of three-body abrasion occurs. The mechanism of two-body abrasion is akin to ploughing.

2. FRICTION

Friction is defined as the resistance to motion experienced, when the solid body slides over the other. When two bodies are in contact and one tries to slide over the other, the frictional force results at the interface.

2.1 TYPES OF FRICTION

Two rubbing surfaces are separated by a film of shear stress of the substrate material. By the **sliding friction**, we mean the friction between two surfaces when one undergoes sliding or displacement along the surface of the other, while by **rolling friction**, we mean the friction of a moment vector which lies on the plane of rolling.

Clean friction between the two sliding surfaces depends on the absorbed layer and chemical composition. It is resulted under the considerable plastic deformation of parts. Clean friction is accompanied by the molecular adhesion between the particles of grains of the sliding surfaces.

Dry friction is resulted from the sliding of the two rubbing surfaces without any film of lubricant in between.

Boundary friction is resulted when two sliding surfaces are separated by a thin film of lubricant oil. The character of boundary lubrication changes with volumetric characteristic of the oil and depends on the nature and conditions of the working surfaces. The film of oil in boundary lubrication is characterized by the presence of absorbed layer with oriented molecular structure.

Semi-dry friction is a transitional friction that is a combination of dry and boundary friction.
In **Semi-liquid friction** the major portion of the load is taken up by the layer completely separated by oil film. Clean friction can be met only when the sliding surfaces are working in vacuum or in inert gas.

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3. PHENOMENON OF WEAR

Wear occurs, when two surfaces interact with each other under relative motion. The wear processes are not always harmful, since they can also be responsible for unconventional processes of processes by abrasives. Wear cannot be eliminated, but it may be reduced to a minimum by judicious application of certain distinct methods.
Wear is the destruction of material produced as a result repeated disturbance of the frictional bond. As per DIN Wear standard, wear can be defined as the progressive loss of substance from the surface of the body, caused by mechanical action, and relative motion of a solid liquid or gaseous counter body. This mechanical action is termed as tribological action.

Wear results in small loose particles called **wear debris** or wear particles.

3.1 TYPES OF WEAR

The types of wear are:

- Abrasive Wear
- Adhesive Wear
- Corrosive Wear
- Cavitation and impact chipping
- Erosive Wear
- Minor Wear
- Surface fatigue

3.2 LAWS OF WEAR

The laws are based on relative velocity, proportionality, properties of softer material. These can be stated as under:

a) Volume of wear is proportional to the distance travel
b) Volume of worn out material is proportional to load
c) Volume of worn out material is inversely proportional to the yield stress or hardness of the softer material

3.3 ABRASIVE WEAR

Abrasive wear is usually caused by ploughing out or digging of the softer material by the harder material.

4. TRIBO MONITORING FOR FRICTION AND WEAR

The experiment can be carried out by the following methods namely:

a) Contact Geometry
1. Pin-on-disc
2. Ball-on-disc
3. Flat-on-disc
b) Measurement
1. Wear
2. Temperature Control
3. Friction
c) Controlled Condition
1. Different environments
2. Vacuum
3. Lubrication
4. Pin heating
d) Disc Holding and customized specification

5. WEAR PARTICLE ANALYSIS FERROGRAPHY

Ferrography detects troubles affecting normal operation of machine tools and wear of machine components. Machine lubricating oil contains various metallic wear particles produced by moving contact machine components.

5.1 FERROGRAPHY

Ferrography technique is based on enabling magnetic separation of wear debris from a lubricant sample flowing down a specially prepared microscopic slide.

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5.2 WEAR DEBRIS

Wear debris is defined as the progressive loss of a substance from the surface of a body by mechanical action that is contact or relative motion of a solid, liquid or gaseous counter body. This mechanical action is called tribological action and the wear results in occurrence of small loose particles called wear debris.

6. CONCLUSION

From the above points we can conclude that to limit wear, one has to reduce the contact load and increase the surface roughness. The various types of wear and friction have been studied. It can be seen that in addition of certain metals to the parent material by the method of spraying or coating it can alter the wear rate and tensile strength. It can also have impact on surface hardness. Thus the study of wear theory is very important to understand the design of bearings and working of the interconnecting materials.

REFERENCES

1. LONG Yan, LI Yuan-yuan, ZHANG Da-tong, QIU Cheng, CHEN Wei-ping “Sliding wear and friction behavior” Trans. Nonferrous Met. Soc.China. Vol. 12, No.4, Aug 2002.
2. Deriaguin, B.V., What is Friction? Academy of Sciences, USSR (1952).
3. Bowden, F.P., Recent Studies of Metallic Friction, The Charted Mechanical Engineer (May 1958).
4. Kragelsky I.V. and A.U. Ishlinsky, Increasing Wear Resistance and Durability of Machine, Mashgiz (1953).
5. Rowe Geoffrey, W., Friction and Lubrication, Review of Progress, Chartered Mechanical Engineer, I. Mech. Engg., London (Sep. 1961).
6. Bowden F.P., and D. Tabor, Friction and Lubrication, Methuen (1956).
7. Tabor D, Mechanical Friction, Prof. Roy. Soc., Serial A251 (1959).