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METAL SPRAYING – A METHOD FOR IMPROVE SLIDING BEARING PROPERTIES

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ABSTRACT
Sliding bearings, important machinery elements, sustained other members (spindles or cranked shafts) to send motions. By sliding surfaces, the bearings are taking over radial, axial and combined forces and in the same time, they allow the spindle to have rotary motions or oscillations. The relative motion between bearing and spindle is faced with a resistance due to friction, which the overcome necessitate energy input. Accordingly sliding bearings frictions, thermal effects is very important for practical applications. In the paper we are presented, some technological aspect about metal spraying, usual materials couple and metallizing installation schema.
Keywords: sliding bearing, metal spraying, metallizing installation

1. INTRODUCTION
Sliding bearings are machinery elements which sustained other members, like spindles or cranked shafts, to send motions. By sliding surfaces, the bearings are taking over radial, axial and combined forces and in the same time, they allow the spindle to have rotary motions or oscillations. The relative motion between bearing and spindle is faced with a resistance due to friction, which the overcome necessitate energy input. Accordingly sliding bearings frictions, thermal effects is very important for practical applications. Special emphasis is also laid on bearing dynamics, stability and operation under variable loads and speeds.
We have distinguished two kinds of friction: *sliding friction*, and *rolling friction*. Due to these friction, in the couple bearing - spindle develop heat and wear, dignified by substance loss. When the thermal effect and the wear, exceed the calculate values, the sliding bearing is take out of service. The knowledge of friction processes, the couple materials selection, the contact surfaces qualities and form design, correct lubrication with appropriate lubricant, are the main and efficient solutions to disprove and diminish the friction and his destroyer results.
In the paper we are presented, some technological aspect about metal spraying, usual materials couple and metallizing installation.
The elaboration of a new technology for sliding bearings, with superior performances, suppose to know theirs roles, materials, types of existing sliding bearings and working conditions. One of the promising ways to come down the costs and improve the dynamic characteristics is protection coating.
The efficiency of protection coatings is conditioned by [1]:
- Good compatibility between physical-chemical characteristics of layer and substratum;
- Layer chemical and mechanical stability;
- Good layer adherence;
- Exploitation medium.

2. INTERFACES PHENOMENA FOR ANTIFRICTION ALLOYS

After the coating processing, the connection to the interface of basis material and layer can be: mechanical adherence and metallurgical adherence [2], [6].

2.1 Mechanical adherence interfaces

Metal spraying technology, with powder or wire, using chemical, electrical or plasma energy, bring about mechanical adherence between basis material and coating layer (Fig.1). The melted particles are transported with high speed to the support surface and adhere to this as a result of impact. A common thermal spraying coating characteristic is the lenticular or lamellar aspect.

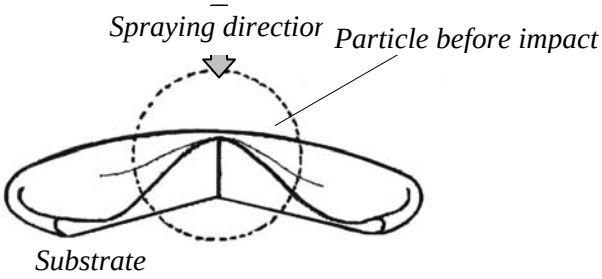

Figure 1. Metal spraying – particle before and after impact with basis material (substrate)

Layer adherence is defined by American Society for Testing and Materials (ASTM): the state in which between two surfaces can exist valence forces, interlock forces or both [2].
The basic joint mechanism with metallic substrate can be group:

- Mechanic interlock or staying;
- Metal-metal or ceramics-metal joint;
- Chemical linkage (intermetallic compound with substrate).

2.2 Metallurgical adherence interfaces

Alloyed transition layer - In metal spraying coating by melting support, the connection coating layer-support is realized by an intermediary alloyed layer, formed by melting and blending the addition material with superficial support layer.
Diffusion interfaces - A coating technology with diffusion interfaces is pack-cementation. The support material is covered (with addition material), heat up and maintain at a temperature and sufficient atmosphere for diffusion. The most usual aluminium coatings are based on intermetallic compound β-NiAl. In Figure 2 is presented an aluminium coating type structure.

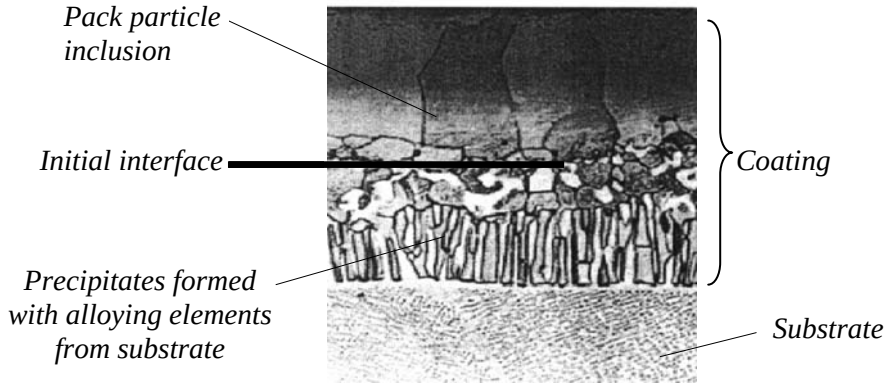

Figure 2. Aluminium coatings by support diffusion

The properties and durability of coating layer are influenced by interfaces sistem phenomenas. Depending coating technology, the interfaces can be by different nature and resistance.

3. METAL SPRAYING DEVICE

The basic principle of metal spraying is: a metallic material is melted by energy and atomized and directed on a technical surface. Metal spraying procedures could be classified:

- Powder metal spraying;
- Wire metal spraying.

Powder metal spraying are using for loading powder metal materials with special granulation for faster melting. This procedure is more expensive because the powder technology is complicated and deposition equipment is costly.

The wires metal spraying procedures are using the addition material like wires (d < 3,5mm). For melting wires, we can use:

- Chemical energy ⇒ *oxyacetylene flame metal wires spraying*;
- Electrical energy ⇒ *electric arc metal wires spraying* (Fig. 3);
- Plasma energy ⇒ *plasma-jet wires metal spraying*.

The principle of electric arc metal wires spraying is: two wires between exist an electric potential, progress uniform until they make electric arc and melt. The melted metal bath is air-stream atomized and directed to support material.

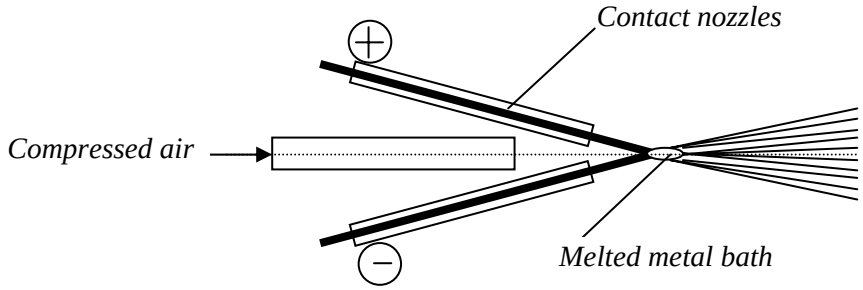

Figure 3. Working principle for an electric arc wire metal spraying

Electric arc metal wires spraying have some main advantages:

- High temperature of electric arc is enabling to melt every metallic material;
- Melted metal bath is hot and fluid and could be air-stream atomized in smallest particles;
- The spraying layers have a good adherence by infinity of micro-welding points realized;
- This procedure avoids the work fragmentation with gases bottles changes and the gases stock and load;
- The metal spraying device is simple and easy to provide.

4. SOME TECHNOLOGICAL ASPECTS ABOUT METAL SPRAYING

A complete technology process includes the following steps:

1. Cleaning and degreased surfaces (for easier the control);
2. Control (visual, with magnifying glass, pervasive liquids, X-Rays);
3. Surfaces preparing for metal spraying (mechanic magnifying roughness);
4. Metal spraying;
5. Mechanic processing (by turning, rectification);
6. Final control.

The single casting sliding bearing could be metallizing only for proportion length/diameter less than 0.75. The metal spraying is effectuate in the first half of sliding bearing, then it is reverse end for end and finish the last half part (Fig. 4).

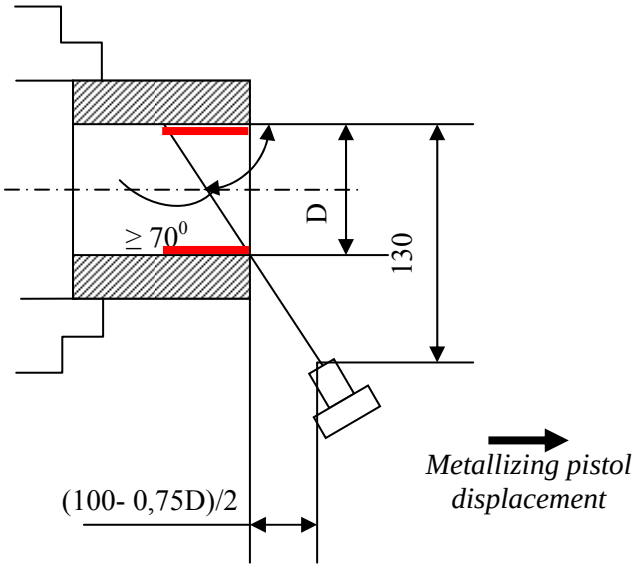

Figure 4. Metal spraying of single casting sliding bearing

The metal spraying of two parts sliding bearings suppose that they are metallizing together but is very possible to cannot separate them after the layer loading. For avoid this phenomena, we are introduced "spy plates" (Fig.5).

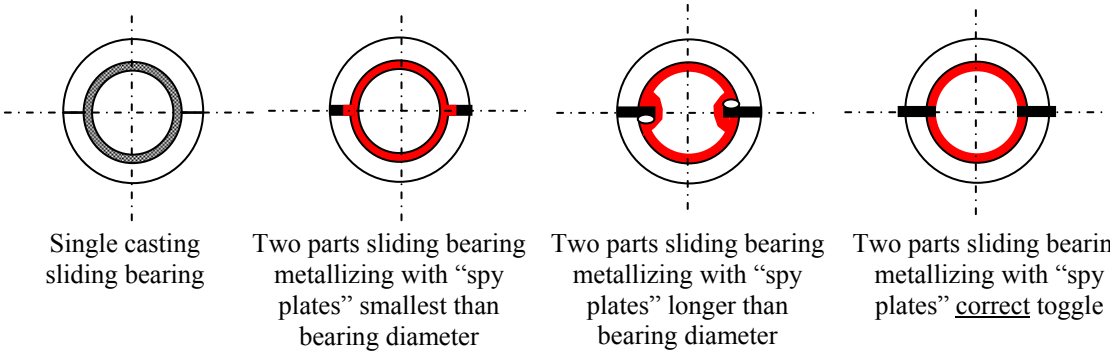

Figure 5. Metal spraying with "spy plates"

5. CONCLUSIONS

The technology of metal spraying has some important advantages: the possibility to lay down every metallic material which could be wiredrawing, the possibility to effectuate the layers without destroy or make any damage (include introducing the stress) to basis material and obtaining a very good adherence. There are also advantages: air-stream atomized in smallest particles, no explosion danger, no gases stock problems, we can realize or recondition sliding bearings from different materials, the work parameters being easy to settle.

6. REFERENCES

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