CONSIDERATIONS ON THE STRUCTURE OF SINTERIZED MATERIALS FOR AUTOLUBRIFICANT HYDRODYMNIC WASTE

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Abstract: *Self-lubricating hydrodynamic bearings can be successfully achieved by powder metallurgy, with the great advantage that porosity can be a proper lubricant tank. By self-lubricating material or sintered anti-friction material is meant a material that has to meet complex requirements of mechanical, thermal, chemical and economic nature. Then one can study this phenomenon, Reynolds found that due to the viscosity and the movement of one of the surfaces (inclined in the form of a) a positive pressure p developed in the part.Convergence of the lubricating film.*

Key words: powder metallurgy, hydraulic system, Reynolds, sintering.

1. INTRODUCTION

Good mechanical properties and high economic efficiency allow the replacement of parts obtained through conventional technologies with powder metallurgy parts.

The anti-friction character of a material is the cause of the many physico-chemical processes in the marginal area, moving from the surface material in motion relative to the lubricant. The structure of the surface and its properties depend on how it was made.

In recent years, interest in iron-based sintered bearings has grown over the bronze, both economically and technically.

Generally, iron-bearing porous bearings are used at speeds of: 1.5 m / s, for which moderate loads and 4 m / s for loads of 5 x 105 Pa. The maximum bearing load can be 60 x 105 Pa at a speed of 0.5 m / s.

This type of camp, quite widespread in the hydraulic systems, because during the movement, pressure is created in the lubricant film. Then one can study this phenomenon, Reynolds found that due to the viscosity and the movement of one of the surfaces (inclined in the form of a) a positive pressure p developed in the part. The equation of determination is the equation of Reynolds is called the pressure equation.

2. EXPERIMENTAL

In the case of bronze bearings, the maximum speed is 3 m / s at a load of 1.5 x 105 Pa, and the maximum load can reach 30 x 105 Pa for a speed of 0.15 m / s. For higher speeds, the bearings are provided with additional lubrication, and where thermal stresses occur, a graphite or other adhesion (MoS2). Bearings are considered to be thin-walled parts and tear-free

Visible plastic, the resistance to radial crushing can be determined by testing the specimen at compression. The durability of the bearings is controlled by 2 parameters: the pressure (specific load) and the speed. By sintering, more homogeneous structures can be obtained and the properties of the materials can be improved by thermal and thermochemical treatments. Self-lubricating materials are manufactured from powders of the chemical elements that form the chemical composition of the bearing.

The chemical compositions used for forming the iron matrix antifriction parts are in Table 1

Table 1 Composition of powder mixture

Composition of powder mixture						
Materials	Iron[%]	Copper[%]	Tin[%]	Lead[%]	Molibdenum[%]	Brass[%]
Fe7Cu8	Rest	7	8	1	1	-
Fe6Cu 5	Rest	6	5	2,5	1	-
Fe5Cu5	Rest	5	5	1	1	-
Fe2Cu5	Rest	2	5	1	1	2,5

Brass - is obtained from iron powder, mixed with zinc and other elements below 1%. To 70 Zn 30, powder from IMNR Bucharest.

For material response to mechanical stress, the porosity of specimens obtained from powder mixtures is very important, depending on the sintering temperature and the holding time of the sintering process.

We find an increase of the porosity of the samples with the increase of the sintering temperature, the maximum values being obtained at a temperature of 900 ^oC, while maintaining 50 minutes for the first 3 materials. For mixed blended brass, the porosity is maximal at 800 ^oC and 50 min hold time due to the formation of the Cu-Sn phase and its diffusion into the metal matrix, preventing the diffusion of Pb in place of the Sn, low melting granules , forming pores.

3.RESULTS AND DISCUSSION

On the properties of sintered materials of metallic powders a great influence o also represents the technological parameters of sintering: compaction pressure, temperature and duration of sintering, cooling rate.

For the Fe7Cu8PbSn material sintered at 900 ^oC we have the structure in Figure 2.

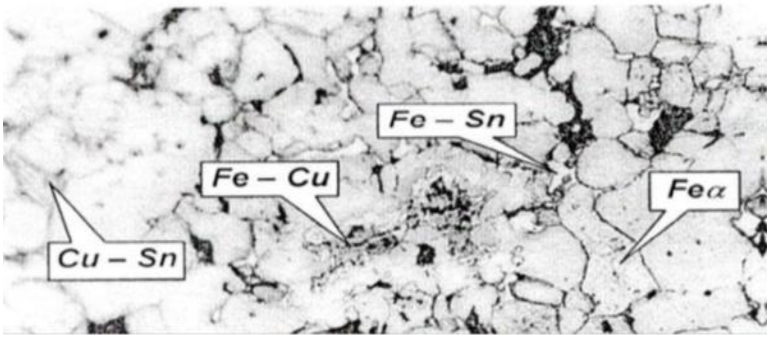

Fig. 2. *Microstructure of the Fe7Cu8PbSn sample*

The microstructure of specimens of sintered materials highlights the uniformity of the structure, the porosity, the boundaries between the particles. We present structures after sintering at 900 ^{o}C.

The microstructure of the sample reveals a uniform structure and a homogeneous distribution of the phases, the basic matrix being ferrite with well-shaped grains, well-defined limits of the particles, considerable pores. Dark grains contain lead grains, which are found to be unalloyed because of solid phase insolubility. There are also small amounts of tin, iron, copper or combinations there of.

For the Fe6Cu5PbSn material sintered at 900 ^{o}C we have the structures of Figure 3.

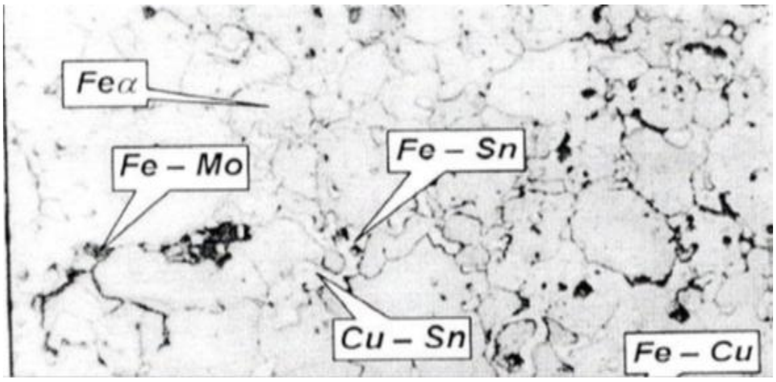

Fig.3. *Microstructure of the Fe6Cu5Pb5Sn sample*

Microstructures 3 highlight a structure with well-shaped grains, well-defined boundaries between particles, pores of considerable size. Dark grains contain lead grains, which are found to be unalloyed because of solid phase insolubility. The pores are generally small and rounded, but irregular pores also appear. In the structure are found the Fe-Sn, Sn-Cu and Fe-Cu phases.

For the Fe5Cu2,5Pb5Sn material sintered at 900 ^{o}C we have the structure of Figure 4.

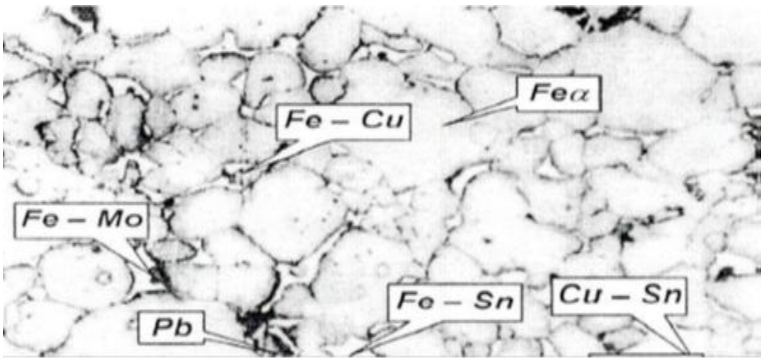

Fig.4. *Microstructure of the Fe5Cu5 sample*

The microstructure reveals a homogeneous structure and uniform distribution of the liquid phase in the well matrix base matrix. Several grains of lead, Fe-Sn, Sn-Cu and even Sn-Pb-S and Cu-Fe-S are evenly distributed in the ferrite.

For Fe 2 sintered silver 5Pb material at 900 ^{o}C we have the structure in Figure 5.

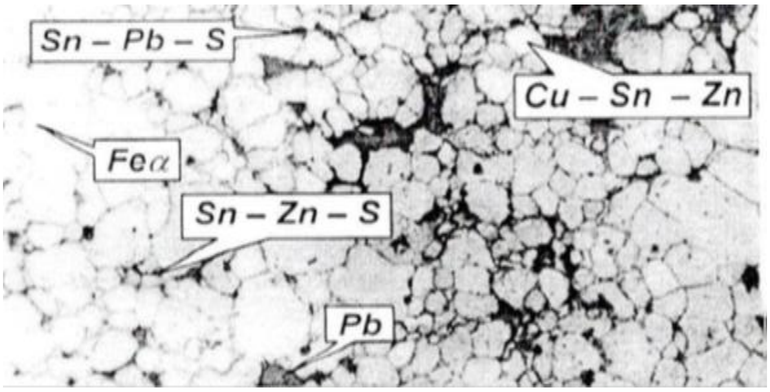

Fig.5. *Material with brass in microstructures*

Microstructure 5 hig hlights a finer structure and a finer porosity. Homogeneous structure with well-shaped grains. The lead being insoluble is found as a separate phase. Grains of intermetallic compounds of the Fe-Sn, Sn-Cu, Sn-Pb-S and Cu-Fe-S and even of the Sn-Pb-S, Fe-Zn-S or Cu-Sn-S phase .

4. CONCLUSIONS

It is found that:

1. For brass materials we have the highest porosity.
2. Cu-added alloys have maximum porosity values at different sintering temperatures.
3. As the sintering temperature increases, the porosity also increases and it varies inversely with the compaction pressure.
4. Samples with large porosities are subjected to tests for self-lubricating parts.

The study and analysis of the materials determined the following:

- generally with the increase of the sintering temperature the porosity values increase, and with the increase of compaction pressure they are inversely proportional, therefore at low pressures we have large porosities and at high pressures we have small porosities.
- the brass materials in the composition have larger porosities than the other materials.
- structural analysis of materials shows a homogeneous structure of both constituents and porosity, the metal matrix being ferrite. The pores and pores are well-formed, the boundaries between them are well-highlighted. The most intense phases are Ferrite and Pb. Former compounds such as Cu-Sn, Fe-S, Sn-Pb-S and Cu-Fe-S, but also Sn-Pb-S, Fe-Zn-S or Cu-Sn-S are formed.

This type of camp, quite widespread in the hydraulic systems, because during the movement, pressure is created in the lubricant film.

REFERENCES

[1**] K.D. Christian**, PhD – *Thesis* ,Troy (1990) .
[2] **T.M. Cadle –C.J. Landgraf**, *PM`90Wembley*, Vol.2 ,124 (1990).
[3] **D. Dobrota**, Research on the Influence of Manganese Content of Physical and Chemical Characteristics Iron-Based Sintered Products, Science of Sintering, Vol.45, No.1, I pp. 21-29, (2013).
[4] **Fa. Schenck** : Information leaflet , *Rotating beam machine "Rapid Pum"*
[5] **D. Spoljaric**- H. Danninger –B. Weiss- R. Stickler : Proc . *PM Auto `96* , Isfahan-Iran , (1996).