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EXPERIMENTAL RESEARCH REGARDING THE FRICTION COEFFICIENT WITHIN SLIDE BEARINGS

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Abstract: Knowing the friction coefficients has a very significant importance, especially when talking about friction couplings that have frequent starting and stopping points. Because of the multitude of factors that appear in the friction process, the calculating relations for the determination of the friction coefficients are very complex and also difficult to solve. This is why it is very important to have the possibility to determine the friction coefficient through an experimental path, but taking in consideration a great precision. The present paper presents the results of the experimental research regarding the friction coefficient within slide bearings.

1. INTRODUCTION

The fast and remarkable progresses of the global industry rise some very important problems concerning the superior capitalization of certain categories of cheap and widely spread raw materials, as well as the continuous improvement within accumulations, of the making out of technological processes at the level of the future international technique. The experimental researches based on the structural transformations and of what resistor appear in metallic material, material used-up antifriction in the building of machines hi-tech manufacture of the bearings with slide, because these have direct consequences about the efficiency and reliableness of the bearing.

The grilish work put the accent and about propriety tribologycal of metallic materials used-up antifriction to the manufacture of the bearings with slide.

2. EXPERIMENTAL DETAILS

In order to establish the static friction coefficients for all the coatings, a typical method such as the inclined plane slope was used [2, 3].

This method may estimate the friction coefficient value based on some typical linear size measurements. Thus, it will exist a correlation between the friction angle "α" and the friction coefficient "μ" as follows:

$$tg\alpha = \mu \tag{1}$$

In the same time, by the help of a plane, it inclines the friction couple that is in a rest state, with variable dropping, until the sliding phenomenon appearance in the couple. The angular value $\alpha_{lim} = \alpha_l$ when the sliding appears, is in direct correlation with the static friction coefficient μ_s according with:

$$\mu_s = tg\alpha_l \tag{2}$$

The dropping of tribosystem driving plate is achieved with a motion screw that is seated up in a nut having the fillet axis inclined under 60° given the horizontal.

The establishing of the driving plate slope is given by a constructive "L_s" size measurement, according with a non-linear function $\alpha_1 = \alpha(L_s)$. For the practical application, the non-linear function values are tabled by help of computer, for different values of "L_s".

So, it is possible to read directly the static friction coefficient, in concordance with the measured length. The measurement regarding "L_s" sizes have been made using a digital micrometer.

3. RESULTS

Because when talking about the coupling made out of the same material, with the same rugosity, different values of the static friction coefficients have been registered, another aspect has been taken into consideration, the one when during the relative movement, the direction between the couplings switches.

The determinations have been made on the high precision tribometer with prisms [2] (fig. 1)

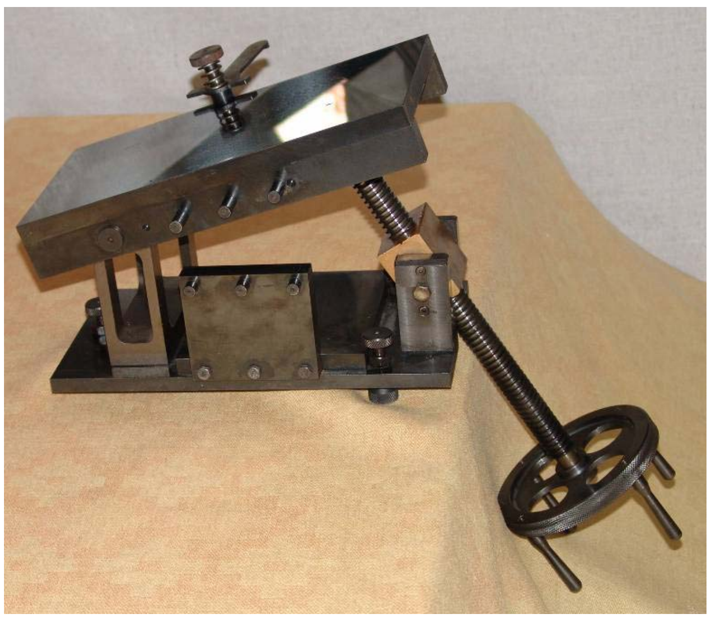

Fig. 1. Tribometer with prisms

When talking about a couple with an antifriction material based on Al-Sn (AS20) + steel OLC 45, ten determinations have been made for different rugosities of the mobile semicoupling, for the case in which the direction of the making of the semicoupling is parallel and ten determinations for the different rugosities of the mobile semicoupling, when the direction of the making is perpendicular.

And also when the coupling has an antifriction material based on Cu-Pb (CP10S10) + steel OLC 45, there have been made ten determinations for the different types of rugosity of the mobile semicouplings in order to establish the static medium friction coefficient.

Table 1 presents the medium values of the static friction coefficient experimentally determined for the coupling made out of the antifriction material based on Al-Sn and steel OLC 45, depending upon the rugosities of the mobile semicoupling having, in the meaning, a parallel or perpendicular direction with the sliding direction [1].

Table 1. The value of the static friction coefficient from Al-Sn and OLC 45

No.	Sample no.	Semicoupling		Rugosity	Friction coefficient values	
					Direction of the making	
		Fix	Mobile		Parallel	Perpendicular
1	1	AS 20	OLC 45	0,4	0,3610	0,3513
2				0,8	0,4060	0,4097
3				1,6	0,3180	0,3201
4				3,2	0,3157	0,3241
5	2	AS 20	OLC 45	0,4	0,3364	0,3738
6				0,8	0,4105	0,3768
7				1,6	0,3354	0,3688
8				3,2	0,3617	0,3389
9	3	AS 20	OLC 45	0,4	0,2481	0,3038
10				0,8	0,2707	0,2756
11				1,6	0,2418	0,2582
12				3,2	0,2839	0,2548
13	4	AS 20	OLC 45	0,4	0,2804	0,2607
14				0,8	0,2583	0,2757
15				1,6	0,2942	0,3130
16				3,2	0,2677	0,2714

Table 2 presents the medium values of the static friction coefficient values obtained after the determination for the coupling made out of the antifriction material based on Cu-Pb (CP10S10) and steel OLC 45, for different rugosities of the mobile coupling [1].

Table 2 The valuesof the static friction coefficient from CP10S10 and OLC 45

No.	Sample no.	Semicoupling		Rugosity	Friction coefficient values
		Fix	Mobile		
1	1	CP10S10	OLC 45	0,4	0,2451
2				0,8	0,2286
3				1,6	0,2057
4				3,2	0,2451
5	2	CP10S10	OLC 45	0,4	0,2256
6				0,8	0,2342
7				1,6	0,2103
8				3,2	0,2055
9	3	CP10S10	OLC 45	0,4	0,2552
10				0,8	0,2190
11				1,6	0,2212
12				3,2	0,2040
13	4	CP10S10	OLC 45	0,4	0,1982
14				0,8	0,1996
15				1,6	0,1817
16				3,2	0,2028

For sample 1 and 2 the determinations have been executed under temperature T = 12ºC and humidity u = 70,5%, again for sample 3 and 4 the determinations have been executed under temperature T = 20ºC and humidity u = 83%.

4. CONCLUSIONS

Knowing the friction coefficient represents a very important issue, especially for the friction couplings where the starting and the stops are quite frequent, because the static friction coefficients appear at the border between motion and rest, meaning at the starting point.

From the experimental research already made we find out the variations met in the case of the friction coefficient of the antifriction materials, used in the process of the making of the bushings.

After the experimental measurements we can draw the following conclusions:

- the variations of the static friction coefficient are quite high even if the velocity in sliding was kept relatively constant, for the same material, situation that can be explained through the fact that on the surface of the antifriction materials there can be some faults as well as through the fact that the determinations have been executed under different temperature and humidity conditions;
- the differences in temperature are noticeable at the level of the sliding surfaces of the bushings, due to the friction between the axes and the bushing;
- the static friction coefficient is influenced by the temperature, the working conditions, as well as by the relative sliding velocity;
- in appreciatively the same conditions of trying out the antifriction material based on Cu-Pb (CP10S10) we obtain a lower static friction coefficient than the one of the antifriction material based on Al-Sn (AS20). So the conclusion is that we can get a better friction behavior of the antifriction material based on the synthesized powder Cu-Pb (CP10S10) than the one of the antifriction material based on Al-Sn (AS20);
- the friction coefficient is influenced by the interaction of the microrugosities of the mobile semicoupling with the tiny soft layer of antifriction material put on the steel structure, because the resistance during the shearing is determined by it.

In the case of the couplings made out of the same antifriction material based on Al-Sn (AS20) with the same rugosity, there have been registered different values of the static friction coefficients in the moment when the relative movement between them changes its processing direction.

The value of the coefficient is greater when the processing directions of the elements of the coupling are parallel. This can be explained by the fact that the contact surface of this particular case is bigger than in the case when the direction of the processing in perpendicular.

The friction coefficient is also influenced by the micro geometry of the surfaces that get in contact during the friction.

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