6th INTERNATIONAL MULTIDISCIPLINARY CONFERENCE

THE INFLUENCE OF THE SURFACE FINISHED STATE ON THE POLIAMIDIC ROLLING FRICTION COUPLES

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ABSTRACT

The friction destructive processes generate on the friction couples have been developed the preoccupation of a great number of scientists which studies the important effects in technical, technological, economic and social level. A friction couple which was correct lubricate may have a long life of functioning. So, for this reason, the present paper presents some researches about surface finished state on the friction couples.

KEY WORDS: *friction, friction surfaces, rolling friction coefficient*

1. INTRODUCTION

All over the world, the preoccupation of replacing metallic materials with other types of materials has widely spread. Within the Machine Manufacturing Department, this fact has determined preoccupation oriented towards the replacing and observing in operation metallic components of technological equipment with components of non-metallic materials. Out of the trends adopted, the present paper shows research carried out, having as objective the study of variation of friction coefficient values at the steel-polyamidic material rolling couple in relation to the surface finished state, under different lubrication conditions. The rolling couple under experiment is represented by the following elements: bearing races made of different polyamidic materials, on which bearing metallic balls roll. Non-metallic materials used are ERTALON 66 SA-C and ERTALON 66-GF polyamides, provided by ERTA-Plastic Engineering. The shape of the bearing race profile is rectilinear. Rolling is done without lubrication, with lubrication with T90 EP2 STAS 8960-85 oil type and lubrication with glycerin. The diameter of bearing balls, made of bearing steel RUL3 STAS 1456-80, with diameters of 7,13 mm. The condition imposed to the balls is that the set under test be in the same dimensional group, with the objective to undertake the load equally by all balls in contact.

2. CONDITIONS AND EXPERIMENT MANNER

For each constructive variant the following operations have been carried out:

- Measurement of test piece roughness under experiment;
- Grading a control of dynamometers;
- Placement of test piece fixing device on a horizontal support;
- Checking the fixing of test pieces in the device;
- Positioning dynamometers in guide;
- Lubrication of bearing races (if the test is done on lubricated surfaces);
- Application of load progressively to values established on the plate and the reading of friction force at the driving into motion of the system.

3. EXPERIMENTAL RESULTS AND INTERPRETATION

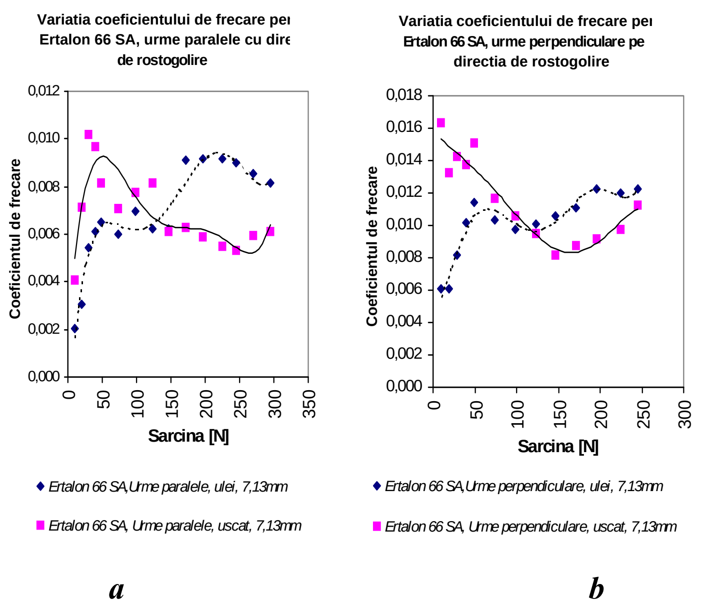
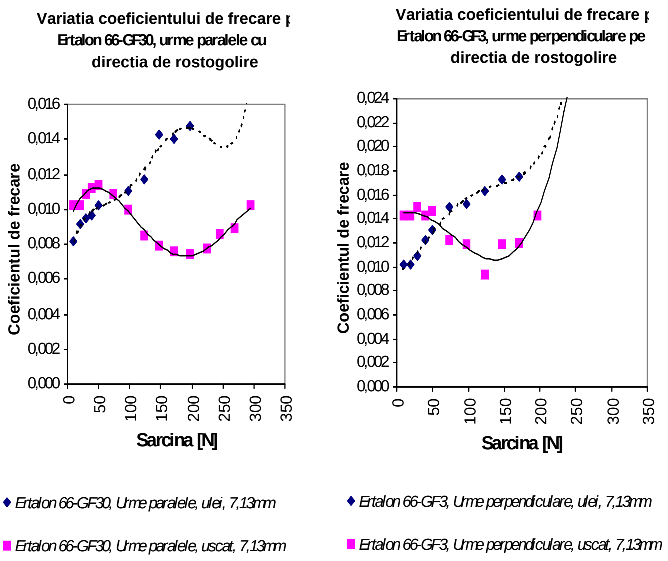


Fig.1
Variation of friction coefficient Ertalon 66 SA
a) parallel traces on the rolling/bearing direction, dried and lubricated contact;
b) perpendicular traces on the rolling/bearing direction, dried c and lubricated contact

The study of friction coefficients for the three materials under testing was done taking into account load variation, lubrication status of surfaces. For all test pieces used, roughness was determined and the profile graph on the direction of rolling was plotted. We have observed deviations from rectilinearly at the test pieces, fact that can lead to local variation of pressure on contact due to loading differences of rolling bodies.

The geometrical deviations of the rolling surface can determine the occurrence of situations in which in



a ***b***

Fig. 2

Variation of friction coefficient Ertalon 66 GF 30

a) parallel traces on the rolling/bearing direction, dried and lubricated contact;

b) perpendicular traces on the rolling/bearing direction, dried and lubricated contact

the identified area being mostly with rolling motion, on portions there might be mostly sliding motions. The values of the Rz roughness of bearing races are:

a) For ERTALON 66 SA-C: working traces parallel with the Rz 1,6 μm rolling direction; traces perpendicular on the Rz 6,3 μm rolling direction.

b) For ERTALON 66-GF 30: working traces parallel with the Rz 0,8 μm rolling direction; traces perpendicular on the Rz 6,3 μm rolling direction..

Roughness value determination was done at the beginning of measurements. On rolling under load, roughness values underwent changes due to plastic deformations of roughness edges up to the creation of the balance state between the force applied on the contact area and the flow characteristic of the material. The applied load varied between 9,81N and 350 N. The diameter of balls used: 7.13 mm. The number of balls that undertook load: 20. Surface lubrication status: dry, lubricated with mineral oil.

Bearing on races made of polyamidic materials has led to the decrease of friction coefficient value for the load domain in which the experiment took place. The minimum values of the friction coefficient were obtained for bearing races of Ertalon 66 SA, with processing traces parallel with the rolling direction.

The variation of the friction coefficient in which bearing races are made of polyamidic materials meets the general tendency above mentioned for dry rolling/bearing. In the situation of rolling on lubricated races, the evolution is continuously increasing for the case of Ertalon 66-GF30 (fig. 2a and b).

4. CONCLUSIONS

Analyzing experimental results, the following can be concluded:

1. On dry surfaces, at heavy loads, the friction coefficient decreases for a certain loading domain. This fact is explained by the gradual replacement of the predominantly sliding motion with a predominantly rolling motion, as well as through roughness changes through plastic deformations that take place at the level of the contact area, to establish the balance between load the flow characteristics of the friction couple materials.

2. In the evolution of the friction coefficient curve in relation to load there is an optimum (a minimum value) after which its value tends to increase slightly. This increase is explained by the phenomena of elastic deformations of the materials and the losses through hysteresis and the adhesion phenomena.

3. The general behavior presented at points 1 and 2 is of all the studied materials, some having the coefficient value decrease lower than zero, the area being marked by a flat portion in the evolution of the variation curve. As a general statement for dry friction of rolling is the decreasing evolution of the friction coefficient, the maximum values being measured in the inferior part of the loading domain.

The minimum values of the friction coefficients were obtained for the bearing races of Ertalon 66 SA, with processing traces parallel with the rolling/bearing direction.

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