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INFLUENCE OF THE STRUCTURE OF BABBITT ON THE STRESS–STRAIN STATE IN THE ZONE OF FRICTION CONTACT

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The methods of mathematical simulation are used to study the process of contact friction interaction for homogeneous lead and heterogeneous intact or run-in B16 babbitt. It is shown that the hard and soft structural components of the run-in babbitt strongly decrease the size of the zones of plastic deformation in the material, improve its wear resistance, and promote the increase in the operating reliability and service life of plain bearings.

Babbitts consist of a relatively plastic and ductile matrix with inclusions of hard supporting particles. In the process of friction, the plastic base of the material of a bearing suffers wear, whereas the shaft operates in contact with hard supporting inclusions. The existing methods used for the numerical analysis of the optimal content of solid phase in the alloys are based on the analysis of the dependence of the friction force on the sizes of structural elements. By using this dependence, one can estimate the influence of structural components on the friction coefficients and establish the rational sizes of these components [1].

Since the processes running in the contact zone are quite complicated, the traditional methods of tribomechanics are inapplicable to the analysis of the influence of the structure of heterogeneous materials on their stress-strain state. At the same time, the development of computers and numerical methods rapidly increases the possibilities of the numerical analysis of the influence of structural inhomogeneities of metal systems on their stress-strain state.

To determine the structural units responsible for fracture in the process of friction, we use a generalized model of contact of solid bodies (Fig. 1).

Up to a certain pressure, the bodies are in contact only in relatively small regions (contact spots). The total area of these regions is an actual contact area equal, in fact, to a small fraction of the nominal area and depending on the surface roughness and loading conditions:

$$\sum_i \iint_{A_{ri}} p_i(\omega)\, d\omega = F_N, \tag{1}$$

where p_i is the pressure distributed over a contact spot A_{ri}.

In turn, the actual contact spots are concentrated in the contour regions whose sizes are determined by the microgeometry of contact, waviness of the surfaces, and their deviations from the basic geometric shape. In the process of friction, contact spots continuously vary and their contour contact regions move. It is worth noting that, in the process of contact interaction, the surfaces of contacting bodies acquire certain equilibrium roughness that differs from the initial roughness. This is explained by two processes simultaneously running at the contact points.

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