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REASEARCHS OF MICROALLOYING INFLUENCE ON TRIBOTECHNICAL CHARACTERISTICS OF BABBIT ВК-2

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The estimation of influence of alloying elements on a wear, durability and shock viscidity of babbit ВК-2 is carried out. The spline-approxinated model of quantitative estimation of influence of content of every alloying element is built on the basis of experimental data.

Keywords: babbit, alloying elements, tribotechnical characteristics, estimation of influence *of* alloying additions, spline-approxinated model

Entry. The root and piston-rod bearing of combustion engines in the moment of start work on conditions of insufficient quantity of lubrication. At this case there is an intensive wear on the mode of half-dry friction. The process of wear at the indicated conditions is characterized by fatique destruction of superficial layers, and also layers near a surface [1,2].

Raising of task. In this connection it is more expedient to execute the estimation of fatique durability of materials from data of tests on tension in combination with the traditional measuring of wear and shock viscidity.

Basic part of researches. Tests on a wear carried out on samples sizes 11x16x10 mm with the use of friction machine 2070 СМТ-1 on a chart «stock-disk». Samples of subjected preliminary bedding with help a rider as a disk by a diameter a 50 mm, executed from grey cast-iron.

Tests on a shock bend carried out in accordance with ГОСТ 9454-78 on samples without an incision on a pendulum rig. This characteristic is structurally sensible for babbits and in a great deal depends from chemical composition. Its size can be subdivided into two constituents: work on formation of crack and work on its development Therefore, than anymore size of shock viscidity, the, other things being equal, must be higher and fatique durability. Tests on tension executed for ГОСТ 1497-73 on the machine of «*Amsler*» type.

The basic way of increase of durability of babbit is its alloying. In most leaden alloys basic rain-forcer is antimony which forms plenty of crystallization focis, being the modifier of the first kind. Taking into account that antimony possesses large affinity to the calcium, than lead, and able to form fine-dispersed excretions of the second phase with calcium, the yet greater growing of structure was expected shallow.

For checking of influence of antimony on properties of babbit ВК-2 there are five alloys poured off. Burdening of alloys conducted from a calculation the made of

optimal composition of babbit BK-2, alloyed by an antimony within the limits of 0.1-0.5 %.

Introduction of antimony to the alloy was accompanied by negative results: wear of alloys at the level of 0.027-0.031 g/(mm^2·kilometre). It is related to co-operating of antimony with alkaline metals with formation of particles of the second phases which due to a wide difference in relative density between these phases and lead emerged in a slag and impoverished a matrix alloying elements.

It is known that a nickel better than other elements hinders to the liquation of alloying elements in leaden slag. The series of alloys on the basis of babbit BK-2 with addition 0.2 % antimonies and 0.01-0.20 % nickel are poured off.

The analysis of the got results shows that in an interval 0,05-0,18 % a nickel does not have influence on the liquation of alloying elements. At the same time it is sight the decline of fluidity of alloy at the increase of nickel content is marked.

It is known that a nickel causes most tensions of compression in the crystalline grate of lead, which more consolidate a solid solution, than tensions of tension. On this basis, it is necessary to check influence of nickel on properties of babbit BK-2 in the conditions of absence of antimony.

Additions of nickel within the limits of 0.01-0.21 % do not render any noticeable influence on properties of babbit BK-2. A copper in leaden alloys is a modifier, both first and second kind. In addition, it causes tensions of compression in the crystalline grate of lead. Necessity of estimation of influence of copper related to possibility of its hit in an alloy at the industrial melting of babbit with the use of shaving remelt which contains the copper of bronze corps bearing. The conducted experiments showed that most additions of copper caused the increase of durability of babbit, but the further increase of content of copper is already reduced durability and especially shock viscidity.

Most influence on strength properties of babbit BK-2 is rendered by magnesium which is the negative modifier of the second kind. But alloying of alloy by magnesium does not provide minimum strength properties of babbit, because the increase of magnesium content results in the decline of quality of products on the criterion of buckle of babbit layer. Most near properties to magnesium on influence on leaden alloys has zinc which does not cause buckle.

On results complex research of influence of chemical elements on mechanical characteristics of babbit BK-2 approximation by square splines on every alloying element as [3] was conducted:

$$\theta = \sum_{i=1}^{N} \left[a_i + b_i \cdot x_i + c_i \cdot x_i^2 \right] , \qquad (1)$$

where N - a quantity of chemical elements, alloying the babbit BK-2; x_i - content of alloying element with the number i; a_i. b_i, c_i - coefficients of splines for an alloying element with the number i; θ - characteristic of babbit BK-2 (tensile strength, hardness, specific viscidity).

In dependence (1) the coefficients of splines (a_i. b_i, c_i) are certain for the next components of alloying elements in the babbit BK-2:

$[Ca]$ = {0-0.14 %}; $[Na]$ = {0.11-0.29 %};
$[Cu]$ = {0.002-0.39 %}; $[Sn]$ = {1.70-2.00 %};

$$[Zn] = \{0.003\text{-}0.47\ \%\};\quad [Ni] = \{0.01\text{-}0.21\ \%\},$$
$$[Sb] = \{0.10\text{-}0.50\ \%\}.$$

Conclusion. Comparison of properties of different alloys for the concentrations of alloying elements (x_i, i = 1..7) is given by possibility to draw conclusion, that the basic work-hardening can be got due to alloying by zinc. Maximal durability of alloy, containing 0.19-0.20 % zinc, depends neither on the presence of copper nor from the presence of magnesium. However it right for alloys, containing a no more than 0,05 % copper, because at greater content of copper and durability and shock viscidity begin sharply to go down from pasteurization effect of dendritic structure and plenty of pores, and if coppers in an alloy more than 0.15, then strong buckle of babbit layer is marked. It is therefore expedient to reduce possible content of copper from 0.20 to 0.05 %.

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