TRIBOLOGY PROPERTIES OF HIGH STRENGTH ZINC ALLOY ZA12

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Bedding, wear resistance, friction coefficient and seizing resistance of surface friction of steel 45 shaft - ZA12 bearing bush have been measured in laboratory conditions. The critical value of the friction power has been determined at a 1.57 m/s peripheral velocity. The relation between the structure and bearing bush behaviour has been established in laboratory and working conditions.

INTRODUCTION

High strength zinc alloys ZA12 (ZnAl11Cu1) and ZA27 (ZnAl27Cu2) developed in the last years have excellent technological and mechanical properties. It is known that they have excellent tribology properties too, but there are no available data for a real estimation of a possible practical application [1-3].

The aim of this work is to investigate the tribology properties of ZA12 samples cast under different conditions in comparison with the properties of the ZnAl10Cu5 and CuAl9Fe4 bearing alloys.

RESULTS AND DISCUSSION

The results obtained for the alloy ZA12 bedding behaviour(Fig.1), for the

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wear resistance (Fig.2), the friction coefficient, the friction materials compatibility and the seizing resistance (Fig.3) are fully comparable to the corresponding properties of the ZnAl10Cu5 and CuAl9Fe4 alloys.

Critical situations and seizing do not occur during the bedding and in the operation process. Local destructions as a result of the materials fatigue are not observed on the working surfaces after the full number of cycles. Only scratches, characteristic of the friction surfaces and local plastic deformations of the largest microunevenesses are observed. The small friction coefficient values (from 0.0021 up to 0.009) and the low lubrication oil temperature (55°C) are evidences for the normal operation of the pairs.

The critical loading after which a sharp friction coefficient increasing is taking place, is alterating for the different samples from 20 to 23.6 MPa at a peripheral shaft velocity of 1.57 m/s. Thus, the maximal permissible value of the friction power which guarantees the normal work of the bearing is 31.4 MPa.m/s (Fig.4).

The tribological properties of the ZA12 alloys are dependent upon the samples cast structure. Considerable differences are observed in the investigated specimen structures which are determined by different cooling rates during the crystallization process: 18°C/s (samples 1, 5 and 6), 12°C/s (sample 2), 5.5°C/s (sample 4) and 2°C/s (sample 3). It is established that the crystal sizes are decreasing with the higher cooling rate and the eutectic modifying degree is altering with a maximum. The structures of the specimens 1 and 3 are almost identical with the typical eutectic structures and they have the best wear resistance.

Bushes from the ZA12 alloy and from the normally used CuSn10P1 alloys cast in sand moulds are working 20 months in the road wheels bearings of a rotor excavator in an open mine.

CONCLUSIONS

The investigations show that the ZA12 bushes wear is fully comparable with that of the CuSn10P1 bushes. The advantage of the ZA12 bushes is in the fact that the sand particles occasionally falling in the bearing are cutting deeply into the zinc alloy without influencing the normal work of the bearing and without scratching the shaft.

EXPLANATION OF THE FIGURES

Samples: 1-ZA12 cast in a steel mould, 2-ZA12 cast in a graphite mould, 3-ZA12 semibush cast in a sand mould, 4-ZA12 bush cast in a sand mould, 5-ZnAl10Cu5 cast in a steel mould, 6-CuAl9Fe4 cast in a sand mould

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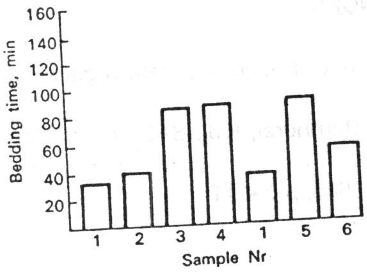

Fig.1. Bedding time of the friction pairs

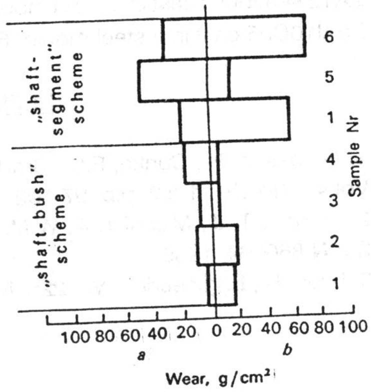

Fig.2. Wear of the bush (a) and of the shaft (b) after 2x10^6 cycles

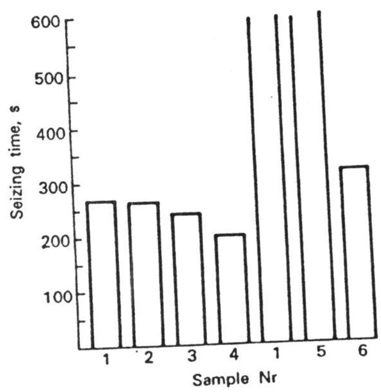

Fig.3.Seizing time of the friction pairs after the lubrication stoppage

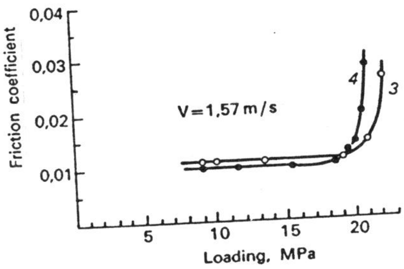

Fig.4. Friction coefficient alteration depending on the loading increasing