ANALYSIS OF FRETTING CORROSION IN MACHINE ELEMENTS

A. KOWAL
Mining Mechanization Institute, Akademicka Str. 2, 44-101 Gliwice, POLAND; e-mail: kowalal@polsl.gliwice.pl

S. STRZELECKI
Institute of Machine Design, Stefanowskiego 1/15, 90-924 Łódz, POLAND; e-mail: strzelec@pkml.p.lodz.pl

Keywords: fretting corrosion, machine elements

ABSTRACT
Fretting-corrosion occurs on the contact surfaces of meshing elements loaded by pressure at relative and small oscillation movements and it is a special art of machine element destruction. The condition for occurring the fretting is the relative slip, e.g. with the amplitude varying from a few to tens of micrometers, some number of slip cycles and normal load. The wear of fretting type can initialise the cracks of one of machine elements contacting the other one.

The paper introduces the mechanism of occurring the fretting corrosion, gives some examples of surfaces destruction’s, dependence for amplitude oscillation movements as well as the results of fretting experimental investigations.

RELATIVE AXIAL MOTION OF PIN JOINT
In operational pin joints and in the sliding connections of shaft and hub the clearance fits are used. The backlashes can be the reason of occurring such useless phenomena as the slips between loaded and mating elements of the joint. An example of the pin joint with the places where the fretting corrosion occurs between flat planes, is introduced in Fig.1.

Fig. 1 The zones of bolted joint where the fretting wear occurs [1]

For the clearance fit, e.g. the mean standard fit H8/e8 and nominal diameter 50 up to 80 mm, the tolerances of dimensions are 0 to +46 μm for the standard bores and for the shafts -60 and -106 μm. Hence the radial clearances at this fit can be in the range from \( l_p = 60 \) up to \( l_p = 152 \) μm. After the loading of joint in the radial direction it occurs the deflection causing the total clearance being the sum of clearance of tolerances and clearance caused as result of deflection. Nonuniform load in the form of bending moment and forces in the radial direction on the length of pin joint causes that the main geometric axis of clevis pin and the bore cross each other what results in edge effect on the bore edges.

PIN JOINT RESISTANCE AGAINST THE FRETTING CORROSION
The investigations carried-out on some samples [3] have shown, that at the fretting fatigue it occurs the dependence between cycles number of load and coefficient of friction. The increase of cycles number causes an increase of friction coefficient value and at \( N = 10^4 \) the friction coefficient reaches the value \( \mu \approx 0.6 \).

Own investigation of cylindrical samples [4] has showed the wear on their surfaces after \( n = 40000 \) cycles of load variation. For the detachable (operational) pin joints applied as the knuckle joints in the suspension of shaft hoists, the shallow corrosion surface changes can be even dangerous.

FINAL REMARKS
The problem of fretting corrosion of machine elements is very important in the coalmining industry particularly for the operational pin joints used in one point suspensions of multirope hoists. It causes the changes of friction coefficient what results in the loss of ability of relative rotational movement of the joint and additionally causes the lack of uniform load distribution of hoisting ropes.

REFERENCES