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RESEARCH WORKING SURFACE STRUCTURE SERIAL CONTACTS

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The object of research - contact switching devices operated in electrical systems and livestock farms.

The goal - to develop scientific principles study of the working surface contacts by metallographic and X-ray structure analysis of composite work surfaces contact materials.

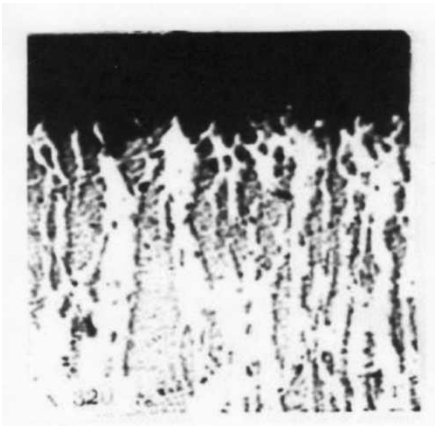
Methods of study - conducted metallographic and X-ray analysis work surfaces serial contact after testing them in electrical resistance.

SPUTTERING, PLASMA TORCHES, ELECTRIC DEVICES, ACTUATORS, SWITCHES, CONTACTORS, CONTACT DETAILS.

Materials and methods of research. In-depth study of physical processes that occur on the working surface contact during operation, a prerequisite for further combat electrical erosion, which is a major cause of the destruction of electrical contacts. The microstructure is one of the major factors that affect the electrical contact properties.

The microstructure depends on the production technology, the properties of raw materials, design features of the device, power electric arc composition of the atmosphere. (1,4,5)

Fig. 1 shows the microstructure initial contact materials CpH-type electromagnetic actuator 10 PML-1h105 1100 after switching.



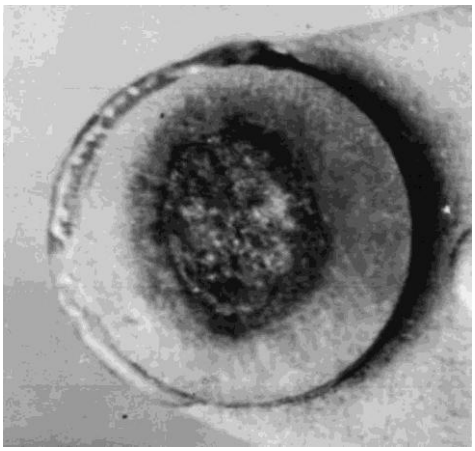
x 320

Fig. 1 Microstructure rolling contact with the material CpH-IO electromagnetic starter PML-1100 after switching 1h105.

As approximation to the work surface grain size of silver and nickel phase increased as a result of thermal action of the arc. Worktop depleted silver component which evaporated as the temperature evaporation of silver (2210 °) is much lower temperature evaporation of nickel (2730 °). (Fig. 1)

The working surface appear shallow pores and sinks, which were clusters of silver grains and refractory component nickel.

The depth of the layer in which there microstructural changes is 0,05-0,08 mm. Nickel directly on the contact surface and a depth of 0,05mm oxidized.



x 1 3

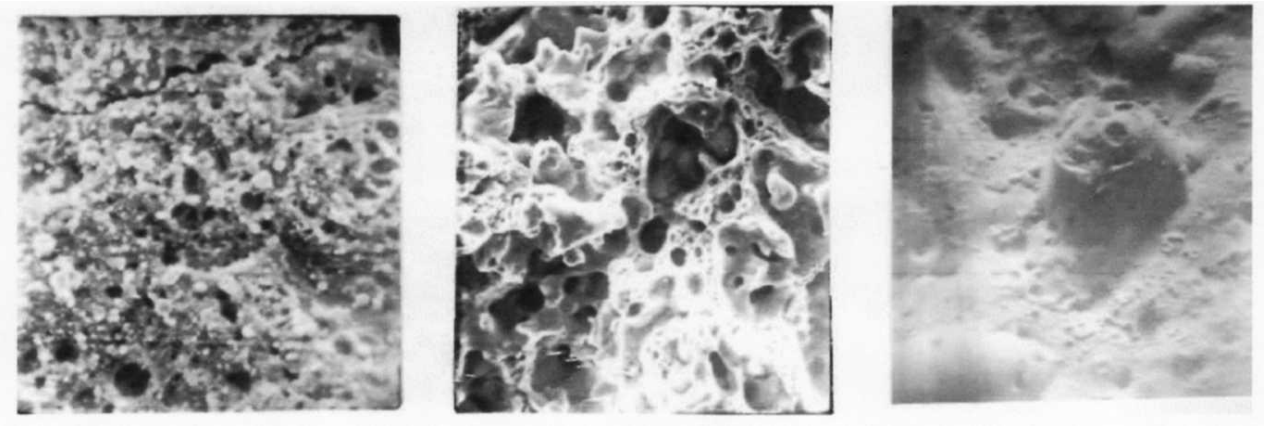
Fig. 2 Exterior rolling contact with the material CpH-electromagnetic actuator 10 PML-1100 after switching 1h105.

During the electrical contact is melting and evaporation intensive fusible component - silver from the working surface of the cathode, thus forming discrete,

bumpy surface (Fig. 2) the degree of roughness depends on the current strength and the number of switching. On the surface erosion were big performances in the pits light patterns are included, which in this X-ray analysis are pure silver (3). Chemical analysis of the surface layer showed that the amount of nickel on the working surface is significantly increased (from 10 to 20-25%), indicating the priority of silver fumes from the surface contact during switching of electric current.

A detailed study of the working surface contacts revealed that as a result of the arc melts not only fusible composition - silver, but also grain nickel (Fig. 3a), as evidenced by the presence of typical stages hardening the edges of nickel grains (rys.3b). Thickened nickel grains have a conical shape, which is typical bridged transfer (Fig. 3c).

On the tops of some nickel grains formed viscous job sites, indicating that the destruction of the material after adhesion contacts.



a) x85 b) x300 c) x400

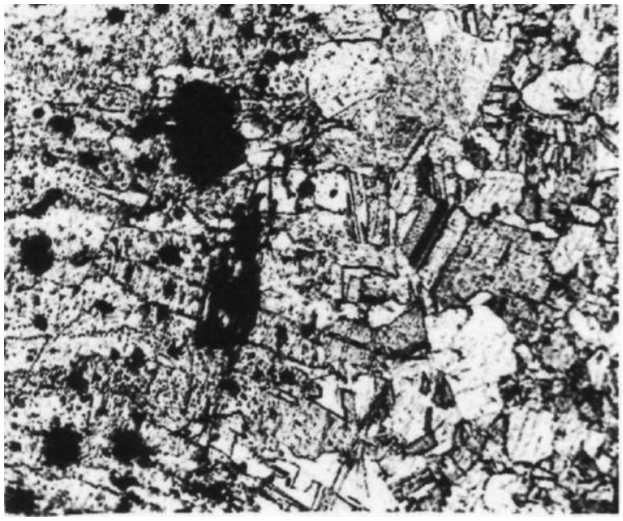
Fig. 3 Electron microscopic images CpH-surface contact 10 after switching 1h105.

The results obtained suggests that contact is made at the time the points refractory component, which determines the slope and material for welding.

The lowest electrical resistance have contact with the material CPM-0.2 [1], which corresponds to the chemical composition: Cu - 0,1-0,5%; Ni -0,005-0,2%, Ag - rest. (2)

When switching current 4; 6.3; 10 contacts of this material obhoryannya observed melting and working surfaces contacts.

Metallographic analysis showed that in the microstructure of the surface layers varies significantly.



x200

Fig. 4 Microstructure contact with the material CPM-0.2 1h105 after switching.

From Fig. 4 shows that the switching current material that is transferred to the stationary, heated to a boil, partially transferred to the surface of colder fixed contact, and the rest is deposited over the surface rolling, forming a cavity (Fig. 4 black craters) and columnar grains perpendicular to the work surface contact.

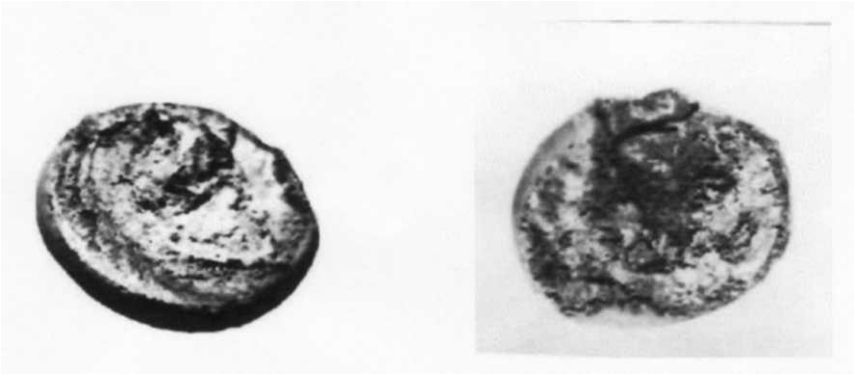
Microstructure real and movable contact is different in structure. Fig. 5 anode surface covered with small grains cathode metal vapor, which crystallized when extinguishing electric discharge. (5)

Also, on the surface, which settled a pair of metals, you can see the increase of silver grains, formed as a result of recrystallization temperature under the influence of metal vapor.

When switching DC is directed transfer of material from a fixed movable contact. Consequently, the crater formed at the cathode and the anode performance..

x200

Fig. 5 Microstructure anode contact material CPM-0.2 1h105 after switching.



a) x7 b) x7

Fig. 6 Appearance contact with the material CPM-0,2 electromagnetic starter PML-1100V after switching 1h105 (I = 6,3A and-anode, b-cathode)

Conclusions

Theoretical and experimental studies of restoration of contact nodes can make the following conclusions:

1. Structural diagram control the kinetics of physical and mechanical properties, restoration of worn surfaces of the contact details of electrical apparatus. The particles of material distributed by the diameter of the circle, and the coating thickness is determined by Gaussian distribution.

2. The functional dependence of the impact strength of the current, the nature of the load, environmental parameters, physical and mechanical properties of the material (melting point, hardness and background.) On the process of destruction of the working surfaces of contacts and contact reliability.

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