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FEATURES GAS-PLASMA SPRAYING TO CONTACT RESTORATION UNITS ELECTRIC VEHICLES

I. Radko, Ph.D.
e-mail:nni.elektrik@gmail.com

Increasing the technological level and quality of machinery and equipment - an important reserve increase productivity, saving all kinds of resources and the basis of scientific and technological development of the economy of Ukraine.

Interest in technical capacity gas-thermal coating especially growing now. This is due, above all, the benefits that give plasma coating technology in some areas. Plasma spraying techniques have allowed to develop technology to disperse metals (powder) and the production of refractory metals of the machine complex shapes and surfaces. Plasma technology has opened up new ways of getting high-modulus and high strength composite materials reinforced with fibers (matrix) and used for protection against heat, corrosion, erosion impact of high gas flows, increased wear and heat resistance and so on.

The use of gas-plasma spraying in electrical related, on the one hand, with the improvement of performance of electric vehicles through the use of special coatings contacts eroziyestiykymy characteristics, and with increased reliability inshoho- all electrical equipment. The full operation of electrified technological equipment is impossible without reliable switching devices.

The purpose of research- development of scientific principles restoration of the working surface contact by using gas-plasma spraying of composite contact materials.

Materials and Methods doslidzhen.Dlya restore contact details Electric is a cost effective method - gas-plasma spraying. It lets you cover a variety of the types of materials that are characterized by high strength and electrical resistance. This may be used not very difficult to use and expensive technological equipment.

Coating by spraying progra - one of the methods to increase the reliability and service life of contacts and details of electrical equipment and the most simple, cost-effective and advanced recovery process dimensions of worn surfaces Electrical contacts switching devices.

Results. Gas-plasma spraying is the most promising methods of hot-gas coating. This method consists in melting a material which is applied with a high temperature jet that forms plasma arc spraying and subsequent melt stream of ionized gas. Electric arc in plasma Vodka is excited between the cathode and the anode-cooled nozzle. Through the blown arc plasma gas chamber, which is partially ionized and high temperature coming out of the nozzle at high speed. The jet plasma obtained thus characterized by temperatures up to 500-1500 ° C and a rate

that is several times the speed of sound. By high temperature gas stream is introduced in the form of powder or wire material for spraying. The rate of spraying particles is within 100 - 400 m / s.

As materials have proliferated plasma water and gases: argon, pure nitrogen, hydrogen, helium, and mixtures thereof. Productivity plants gas-plasma spraying ranges from 0.5 to 10 kg / h, adhesion sprayed coating is 60 MPa [1,2].

Gas-plasma spraying process has the following advantages: versatility plasma method, which enables coating of various materials; features the ability to save the structure and properties of materials base (kontaktotrymachiv electric apparatus) the possibility of coating on contacts complex surfaces and forms.

In further provides for a capacity of 160-300 kW plasma torches, increasing the speed of sprayed particles to 1000 m / s, achieving productivity of 15-20 kg / h. This will provide coverage strength of 150 MPa and a density of 96%.

Coverage -This layered material consisting of a deformable particles, which are interconnected by contact surfaces and welded dilyankamydiametrom Dh area (Figure 1). Welded areas not fill the entire plane of contact between the particles and therefore strength and density below sprayed coatings strength and density of the coating in a compact state. The strength of welded areas most dependent on the number of seizure foci, which are formed in the area during the FX impact, deformation and hardening particles and determined by the development of chemical interaction ukontakti materials [2].

In the coating can identify structural elements that reflect the process of its formation and separated outside the section defined properties. The boundary interface between the coating and the basis of 1 (see. Figure 1) determine the adhesion or bond strength between them. The properties of the coating adhesion strength stipulated particles in it [3]. Clutch cover the basics and called adhesion and adhesion of particles upokrytti -koheziyeyu. The boundary interface between the layers (layer border), obtained in a single pass spray 2, resulting from unequal exposure duration between causing particles in layer and between the layers. Over the period of exposure of layer deposition surface covered previously applied layer pollution, oxidizing processes and contact between her and sprayed particles hampered, which is the cause of the limit.

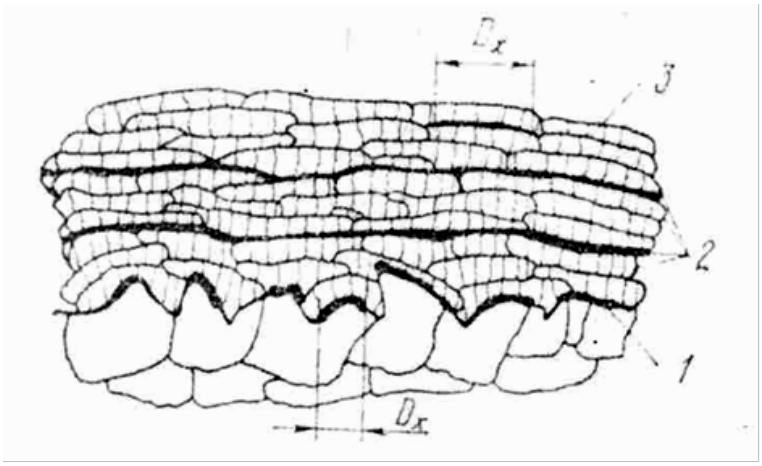

Fig. 1. Scheme of the structure of the plasma coating:

1 - the boundary between the surface and the base; 2 - the boundary between the layers; 3 - limit (contact area) between the particles in a layer

It is quite clearly seen in microsections plasma coating (Fig. 2).

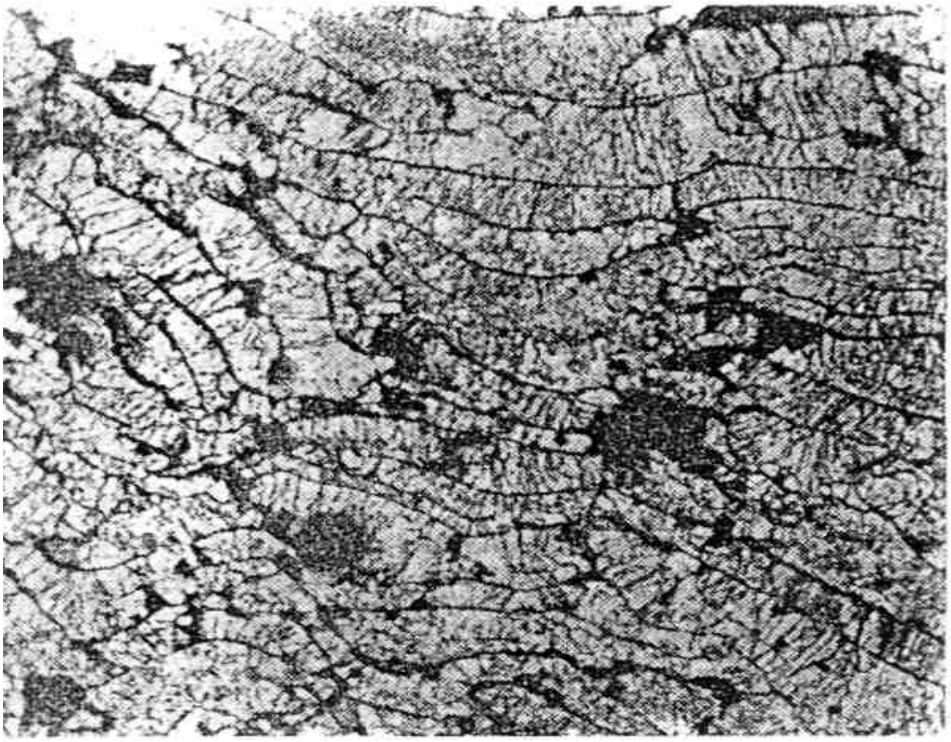

Fig. 2. microsections gas-plasma coating.
(increase h1000. Material 85% Cu + Mo + 10% 2% 1% MoO3 + C + 2% Ni)

Layer structure which is formed in a single pass - uniform and defined different size and speed particles that are in the peripheral and central zones of the two-phase flow (consisting of particles and gas). In addition, there is a screening effect of peripheral particles relative shares of the central zone as peripheral particles in motion napylyuvacha first lie on the surface of the base. Uneven energy state particles and their size can be reduced by various technological measures [3].

Terms formation of boundaries between layers and between the particles is determined by length of stay in the atmosphere. Depending on the size and configuration of sprayed contact details. spray trajectory moving 'Pause' moments between layer blending can reach several seconds. And this time is several orders longer pause interaction between particles in a layer that is applied in one pass. Between the coating layers on the surface of the coating is absorption of gases, oxidation and delaying dust fractions sprayed material and its oxides.

Formation coverage consistent conclusion many deformed particles leads to the pores, especially in areas touching particles. Coatings formed in the atmosphere, so mikroporozhnynyzapovnyuyutsya gas, which affects the properties of limits, especially in layers that have the greatest saturation adsorbed gases. Because of the large coating roughness and extremely rapid spreading and crystallization of particles in the contact area with the surface of previously deposited particles remain defects and cavities which are formed as a result of evolution of gases that were dissolved in the molten shares. The interaction with the atmosphere, the adsorption of gases and dust settling factions worsens properties of layered borders [4].

Structure and properties of coatings depend on the size distribution of sprayed powder. With decreasing particle size of the powder coating improves filling - its density increases, the amount mikroporozhnynzmenshuyetsya, the structure becomes more uniform coating. But too fine powders are not suitable for plasma spraying. The minimum particle size can be set with rational considerations. Great difficulties arise when trying to transport and the introduction of the spray particles measuring 10 microns or less. Such powders can not be pre-prepared and aligned particle size powders conventional methods of training because they do not prosiyuyutsya on sieves. Fine powders komkuyutsya result of humidity and molecular forces of cohesion and a conglomerate of several particles at serving their carrying gas flow. In plasma, they can completely evaporate or lose speed, deviate from the trajectory and not reach sprayed surface contact details. Certainly recommended spraying powders with a particle size of 40-70 microns.

Coupling between the particles in the coating, and the adhesion between the base and the surface (under cohesion and adhesion) arising as a result of such forces, the forces of mechanical grip; nevalentnyh weak interaction forces (such forces Van der Waals forces); chemical power connection. Force the first two types are characterized by instability, generally have a low level and therefore they should not be taken into account when creating coatings. However, when spraying the material with a highly developed surface (porous ceramics, etc.) the strength of the mechanical coupling with the substrate coating can reach 10-15 MPa [1-2].

Chemical interaction leads to welding of the particles, which occurs through the formation of cells in contact with delight. The more cells capture, the better the adhesion of the particles. Welding particles is just warming up at the base to a certain temperature, called temperature chemical interaction. This temperature corresponds to the filling of the contact surface during particle capture cells by 50-70%. With this filling chemical interaction of particles with the base is deep enough for their removal is necessary to put considerable effort. At

temperatures lower substrate temperature chemical interaction particles are easily separated from the base as chemical interaction does not develop.

The temperature chemical interaction in which there is a strong coupling exists for almost all combinations of particles and materials basis: elements, alloys, simple and complex substances. So sputtering coating can be applied for many inorganic materials that can be melted. Depending on the particular material pairs "covering - the basis of" heating temperature may be in a negative temperature (100 degree scale) and reach 1000 ° C or more [3.4].

Conclutions

The received local coverage of various contact materials, which are characterized by high strength and electrical resistance by gas-plasma spraying. For this applied enough simple to operate electrical equipment.