URL: http://www.uabio.org/img/files/docs/140526-wba-gbs-2014.pdf
3. Uminskyi S. M., Chuchui V. P., Inyutin S. V. (2014). Alternative fuels from biomass "TES" Publishing House and Typography, 2014. 375 p.

UDC 622.75:629.7

INCREASE OF WEAR RESISTANCE USING THE TECHNOLOGY OF FELTING OF METALLIC COATINGS

Sergey UMYNSKY, Ph.D., Associate Professor, *ymoshi@ukr.net*
Ihor DUDAREV, Ph.D., Associate Professor, *247531@ukr. net*
Odesa State Agrarian University
Odesa, Ukraine

Maria KOROLKOVA, Ph.D., Associate Professor, *prohojiygoogl@gmail.com*
Military Academy
Odesa, Ukraine

In modern conditions of the market economy, the requirements for the accuracy and reliability of machines and equipment in the agro-industrial complex are increasing. Significant material and labor resources are required to carry out repair and restoration work of units and aggregates that have failed, which is especially relevant when using imported production equipment. Cold methods of electrochemical restoration, as practice shows, are able to ensure the necessary surface accuracy during the manufacture and repair of parts. To determine the influence of the characteristics of plasma reflow on the properties of the sprayed coating after reflow, it is convenient to use a tool such as mathematical modeling, which allows you to determine the temperature distribution of the composition, the thermal processing cycle and the rate of heating and cooling of the material [1].

The nature of the thermal cycle determines the features of the structures and properties of the material formed as a result of surface treatment. Information about the temperature fields formed in the material under the influence of the heating source allows to predict the geometric parameters of the processing zone, the nature and degree of completion of phase transformations, as well as the structure and properties of the strengthened layer. Thus, in order to select rational modes of plasma treatment of a gas-thermal coating, it is necessary to know the temperature distribution in the coating and substrate during the heating and cooling process. Experimental determination of temperatures in the process of high-speed heating is associated with great difficulties (inertia of the equipment, small coating thickness, high temperatures, etc.). Therefore, the calculated determination of temperatures in a composite material under the influence of a plasma heating source is of great practical and theoretical importance [1, 2].

To select the parameters of the processing regime and predict the abrasive wear resistance, due to the change in the structure of the coating, a mathematical model of plasma melting of a two-layer material was built by solving the boundary value problem of thermal conductivity by the Green's function method. The stages of building the model include: analytical solution of the heat conduction equation through the Green's function, analysis of the influence of the parameters of the plasma treatment mode on the geometry of the reflow zone, and assessment of the structural state of the coating to determine the material with greater resistance to abrasive wear. To determine the influence of the parameters of the plasma melting mode on the temperature distribution in the "coating - base" composition, a number of calculations were carried out with a change in one processing parameter and the constancy of others. Since the voltage in plasma processes is a function of the parameters of the processing mode, and this influence is not taken into account in the developed model, we will take it as the average in the range of values of the used currents of 150-180 A, according to experimental data [2]. To prevent peeling of the coating and increase its adhesion, it is necessary to ensure the melting temperature on the surface of the substrate [2], while in order to reduce the influence on the properties of the fused coating, the share of the metal of the substrate should be minimal. Strengthening of the surface during melting of the coating is carried out by sequential formation of local melting zones with overlapping layers. To ensure the penetration of the base over the entire surface of the product, in order to prevent peeling, and to create a monolithic coating over the entire surface, the step between adjacent passes should be 3-4 mm. However, due to preheating from previous passes, this distance may vary. The dependence of the structure, physico-mechanical and service properties of metallization coatings before and after plasma reflow was investigated on the modes selected as a result of mathematical modeling of thermal processes in the "coating - base" composition, and indicators of the service properties of coatings and deposited layers were compared. To compare the properties of the coatings after plasma reflow with the deposited metal, argon arc surfacing of the investigated PP was performed. Surfacing was performed in two versions: 1 layer and, to reduce the effect of mixing with the base metal, 3 layers. Deposition modes - current 170 A, voltage 34 V. Measurement of the microhardness of three-layer deposition, with different loads on the indenter, in both cases shows an uneven distribution of hardness over the thickness of the coating, which is due to a change in the microstructure during multiple heating during the deposition process. The wear of the sprayed coating followed by plasma reflow, and the metal deposited in 1 layer, occurs by the mechanism of microcutting, which is realized in the process of one-act separation of the volume of the microvolume of the metal from the surface of the coating under the influence of the abrasive grain. This is indicated by the presence on the wear surfaces of both coatings of characteristic traces of microcutting in the form of grooves and sharp-edged dumps oriented in the direction of movement of the abrasive grains. The development of the microcutting mechanism indicates that the hardness of the used abrasive is more than 1.3 times higher than the hardness of the structural components of the fused coating and the deposited layer. The analysis of figure 3.23 g shows that when the metal deposited in 3 layers is destroyed under the influence of an abrasive, a mixed wear mechanism is also observed, since there are both characteristic signs of microcutting and smoothed areas with fatigue microcracks on the friction surfaces. However, in contrast to the mixed wear mechanism of the sprayed coating, the predominance of the microcutting mechanism is characteristic. The parameters determining the current state of the working body were the linear wear of the toe and the blade part, as well as the loss of mass. These parameters were monitored at the end of each shift, while the working bodies were removed from the machine and cleaned of soil residues using a metal brush. Weighing was carried out on scales with a mass measurement error of 0.5 g. The intensity of linear wear of the serial ploughshare across the width of the blade part was 0.65 mm/ha, and the one strengthened according to the developed technology was 0.32 mm/ha. The maximum linear wear of the working organs is observed along the length of the toe and blade part, therefore, during operation, it is the toe of the ploughshare that is subjected to the maximum load. It can be noted that when plowshares were rejected due to reaching the limit of mass wear, none of them reached the limit of linear wear. On the one hand, the obtained data correlate with the amount of mass wear of the plowshares, and on the other hand, they indicate that to increase their wear resistance there is no need to strengthen the blade part, it is enough to strengthen the nose part. Due to intensive wear of the cutting edge of the blade of the serial plow when the plow is working on medium loamy soil, its toe becomes blunt and takes on a rounded shape. This, in turn, leads to an increase in the traction force of the plow, a violation of the technological process of plowing and, accordingly, an increase in the specific fuel consumption with a decrease in the productivity of the plow [2, 3].

Conclusions. It is advisable to select the necessary parameters of the plasma melting mode of iron-based coatings applied by the arc metallization method on the basis of modeling the heat distribution in the composite bimetallic material. The effect of porosity, composition, and thickness of the coating on their thermophysical characteristics, as well as the parameters of plasma remelting on the coefficient of shape of the composition's penetration, was evaluated. On the basis of the obtained data, the main indicators of remelting were determined, which ensure fusion with the base at the maximum coefficient of the shape of the penetration of the substrate.

References

1. Leshchynskyi L. K. (2010).*Plasma surface hardening* K.: Technika, 2010. 109 p.
2. Yelagina O. Yu. Technological methods of increasing wear resistance of machine parts. *Study guide.* Logos, 2009. 488 p.
3. Vasylenko N. A. (2008).Prospects for the use of local strengthening in the manufacture and restoration of working bodies. *Tekhnika APC.* 2008. Issue 1, P. 29-31.

UDC 622.75:629.7

INCREASING THE WEAR RESISTANCE OF CUTTING SURFACES OF SOIL PROCESSING MACHINES BY CARBIDE ARC STRENGTHENING

Sergey UMYNSKY, Ph.D., Associate Professor, ymoshi@ukr.net

Odesa State Agrarian University
Odesa, Ukraine

Maria KOROLKOVA, Ph.D., Associate Professor, prohojiygoogl@gmail.com
Svitlana DMITRIEVA, Ph.D., Associate Professor, dsvetlanayur@gmail.com

Military Academy
Odesa, Ukraine

Currently, in order to increase the wear resistance of the working bodies of tillage machines, ceramic and metal-ceramic materials are the most promising. Ceramic materials have significantly greater wear resistance than hard alloys. However, their main drawback is increased fragility. This, in turn, significantly limits the use of ceramic materials for strengthening the arrow paws of tillage tools operated under conditions of significant impact loads. Metal-ceramic materials are a composite material consisting of a metal steel base (matrix) and ceramic components included in its composition (oxides, carbides, nitrides, etc.). The matrix provides these materials with the necessary impact strength, and the ceramic components provide high hardness and wear resistance. When strengthening working organs, metal-ceramic materials are most often applied from their cutting surface as coatings.

The analysis of modern scientific publications in this direction showed that currently there are a limited number of methods of obtaining metal-ceramic coatings on the cutting surfaces of arrow paws of tillage tools. Moreover, most of the known methods differ in the complexity and high cost of the equipment and materials used, and also do not provide the possibility of strengthening a wide range of arrow legs of different weights and configurations. Therefore, research aimed at creating metal-ceramic coatings on the cutting surfaces of arrow paws is currently relevant and in demand and contributes to the solution of the current national economic problem of increasing the wear resistance of the working bodies of domestic and foreign tillage tools. Currently, a promising method is carbon-vibro-arc strengthening (KVDZ) using metal-ceramic pastes. With KVDZ, a paste containing a metal matrix, ceramic components, and cryolite is applied to the surface being strengthened. After drying, the paste is melted using a vibrating carbon electrode of a KVDZ installation. During the burning of an electric arc on the cutting surface, which is strengthened, a metal-ceramic coating is formed from the components of the paste. At the same time, the metal of the arrowhead is saturated with carbon due to diffusion during sublimation of the electrode [1, 2].

Soil cultivation plays an important role in the production of agricultural crops. Therefore, the quality of soil cultivation significantly affects the yield and efficiency of agricultural production [3]. Currently, a large number of methods of strengthening the working surfaces of various parts are known. However, not all of them are suitable for increasing wear resistance, which work in conditions of intensive abrasive wear under significant loads. To strengthen arrow paws, heat treatment (hardening) is widely used, which can be carried out to the entire depth of the paw, and with the use of high-frequency currents to a hardness of at least 40 HRC for a hardening depth of 1...2 mm [3].