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VIII ВСЕРОССИЙСКАЯ НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНЫМ УЧАСТИЕМ, ПОСВЯЩЕННАЯ 50-ЛЕТИЮ ОСНОВАНИЯ ИНСТИТУТА ХИМИИ НЕФТИ

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CONTROL OF STRUCTURE AND PROPERTIES OF DEPOSITED WEAR-RESISTANT COATINGS BY MODIFICATION OF THE MELT OF THE LOW-FREQUENCY MODULATION TAKE

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Annotation. The work investigated the influence of modes of electric arc welding of steel 09G2S electrodes T590 on the properties of the coatings.

The influence of electric arc influence on the structure, physical, mechanical and operational properties of coatings deposited by T590 electrodes was studied.

It is found that this modification allows to increase the uniformity of the structure of the deposited coatings, grind it and increase the hardness. Application of the method of pulsed arc welding saves in the coatings, deposited electrodes T590, previously formed the reinforcing phase.

Electric arc welding with electrodes is an economical and widely used in industry method of restoring machine parts and mechanisms, giving their working surface wear resistance [1, 2]. The most common wear-resistant surfacing materials include alloys with chromium, tungsten, boron, molybdenum, etc., the wear Resistance of these surfacing materials is highly dependent on the type and quantity of these phases in the alloys.

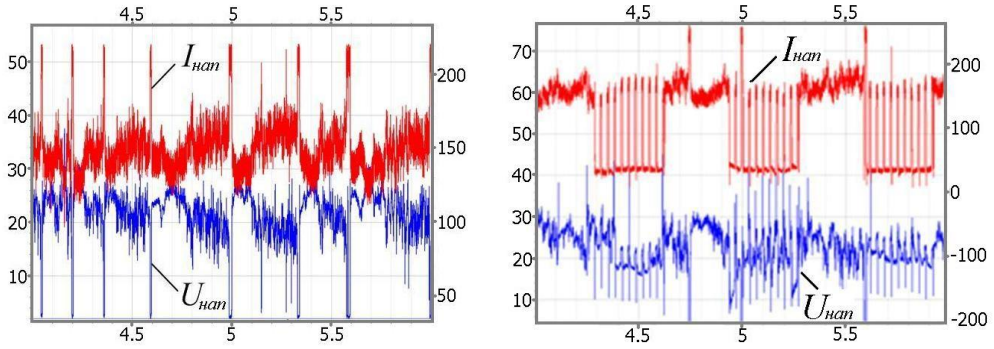
Deposition processes due to differences in heat inputs and properties of electrode materials have a specific effect on the properties of coatings. The decrease in the properties of the deposited metal occurs due to defects that may occur during the deposition [3-4]. This can lead to accelerated destruction of coatings [5-8]. Modern methods of surfacing allow to regulate the cooling rate of the coating material and control the processes of melting and crystallization, the formation of the structure and physical and mechanical properties [1-2].

An important task is to study the influence of technological modes of deposition of electrodes on the characteristics of the coatings by using pulsed processes that reduce the heat input and structural heterogeneity of the metal. Purpose: to Improve the properties of the deposited coatings using pulsed arc methods.

Materials and methods of research. The study of the deposited layers obtained by welding electrodes T 590. As a substrate on which surfacing was made, samples of steel 09G2S were used. Surfacing was carried out by the FEB-315 MAGMA power source with the Pulse console for the implementation of the pulse-arc process. For surfacing coatings used methods: a) direct current, b) pulse mode with frequency modulation current within 1 - 5 Hz. Registration of the parameters of the electrode deposition process was carried out using a digital oscilloscope AKIP 4122/1V. The microstructure was investigated by optical microscope NEOPHOT-21 in a section perpendicular to the longitudinal axis of the deposited coating. The microhardness of the deposited coatings, the heat-affected zone and the base metal was measured on the Leika microhardometer at a load of 0.5 N on the indenter.

The possibility of obtaining the necessary coating composition is determined by the initial concentration of elements and the degree of absorption of these elements by the metal during the formation of the drop and the melt bath.

Research results and discussion. Characteristic oscillograms of current and voltage on the arc when surfacing with coated electrodes are shown in figure 1.



a) b)

Figure 1. Typical oscillograms of current and voltage during surfacing coated electrodes: a) – direct current deposition mode, b) – mode of welding with modulated current; I NAP – current welding , U surfacing voltage.

Microstructure studies were carried out in the Central parts of the first and second layers of deposition by electrodes, in the transition zone from the coating to the base metal - in the areas of overheating and normalization. The microstructure of the base metal 09G2S is perlite and ferrite with a grain size of ≈ 4.7 microns. The volume fraction of perlite is ≈ 20 %. In surfacing coating electrodes T 590 is formed malagentia the structure of the metal coating (figure 2).

The microstructure of HAZ consists of several sections after surfacing: area of overheating with widmanstatten structure and area normalization is characterized by more fine-grained ferrite-perlitic structure. In the initial state, the base metal - steel 09G2S has a hardness of ~ 250 HV. The hardness of the coating material deposited by the coated electrodes is ~ 270-300 HV. ZTV hardness: 210-230 HV.

As a result of the pulse mode of surfacing grain size coatings and the width of the heat affected zone is smaller.

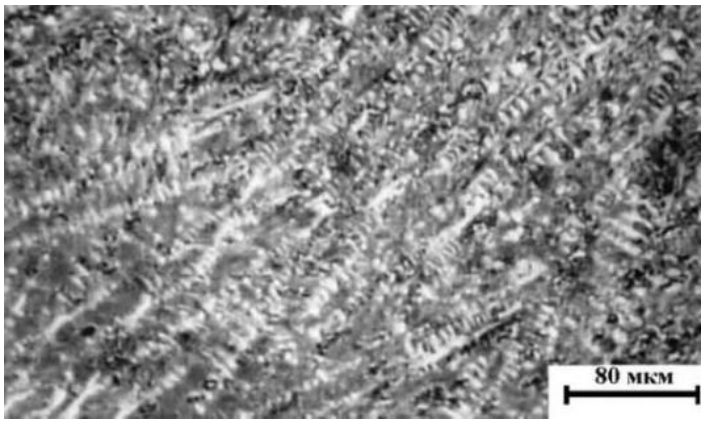
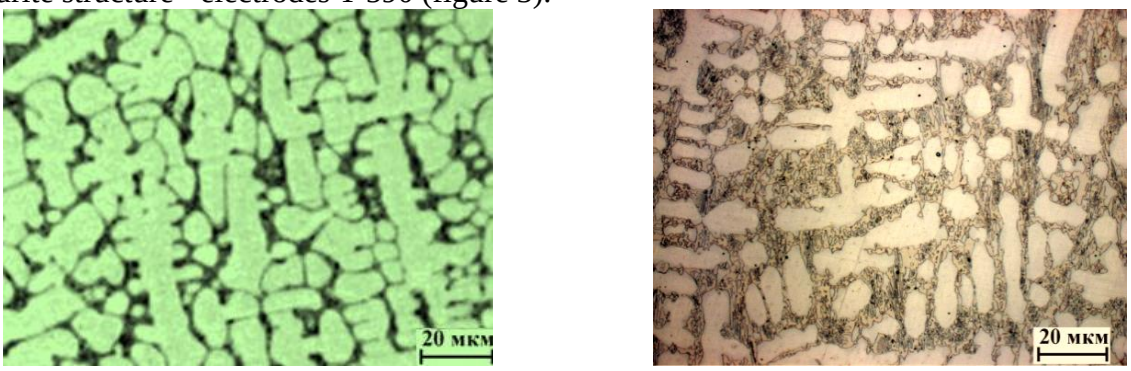


Figure 2. Dendritic structure of the coating deposited by electrodes T 590.

This indicates an increase in the quality of the deposited coating. When applying the coating on a DC mode, the heating temperature of the surfacing bath is higher, which, as a consequence, causes the growth of grain. When coating on pulse modes, by directed low-frequency high-energy action of the electric arc on the formed metal, due to the constant reciprocating motion of the melt with the frequency of current modulation, a more homogeneous structure with smaller structural components is formed. This formation of the coating metal is a consequence of the active mixing of the melt, which helps to equalize its heat content by controlling the movement of the metal in the weld pool, and also regulates the amount of molten metal under the arc to the beginning of the current pulse, thereby reducing the penetration depth. The periodic movement of the metal in the melt also contributes to a more uniform distribution of alloying elements in the volume of the molten metal.

The use of pulsed-arc deposition technology with coated electrodes allows to control the processes of crystallization of the molten metal through programmable heat input into the coating zone, and, as a result, to grind the structure of the coating metal and improve its properties. For manual arc welding not provided by management cephaperason. When surfacing carbon steels hardening occurs due to the formation of a new surface layer. The properties of the deposited surface of steels depend on the type of alloying elements that determine the phase composition, phase transition boundaries and mechanical characteristics. The structure of the deposited metal and its properties are influenced by the technological parameters of the electrode deposition process, the number and size of the alloying elements.. The properties of the coatings deposited by the electrodes are influenced by the carbon content, preservation of the reinforcing phases (carbides, borides, etc.) in the process of surfacing, their size and location in the matrix material. The coating deposited using the pulse mode have: 1) ledeburite structure - electrodes T 590 (figure 3).



a) b)

Figure 3. The structure of the deposited coating electrodes T 590 (a, b) on the modes: DC (a), pulse changes in the energy parameters of the mode (b).

In the process of the thermodeformation cycle of deposition of coatings by electrodes, as a rule, there is a formation of cracks (hot and cold), which leads to a decrease in the properties, which are lower, the higher the structural heterogeneity in the coating. By grinding the structure and reducing the structural heterogeneity, on the contrary, the properties of coatings are increased. Grinding of the coating structure obtained using a pulsed mode leads to an increase in its properties: hardness, wear resistance and other indicators [1-5].

This can be due to changes in the temperature in the area of the heat source during the deposition process, often exceeding the melting point of even refractory compounds when surfacing at a constant current. As a consequence, this leads to their dissolution in the bath melt. In the case of pulsed deposition mode can be achieved the formation of a metal, regardless of the brand of the electrode used, with a more uniform and fine-grained structure. The graph of changes in the microhardness of the electrode coatings T 590, deposited on the pulse mode, the zone of thermal influence and the base is shown in figure 4.

The average value of microhardness of coating metal is higher than 5000 MPa. The anal dependence is observed after surfacing in DC mode, only with lower values of microhardness of the coating.

Summary

1. The influence of modification by electric arc influence at pulse-arc surfacing by T 590 electrodes on the structure and properties of coatings is studied. Modification of materials of surfaced coatings on low-carbon steel 09G2S can improve the uniformity and dispersion of the structure, as well as hardness.

2. Using the method of pulse-arc surfacing of coatings deposited with electrodes T 590 allows them to retain the reinforcing phase.

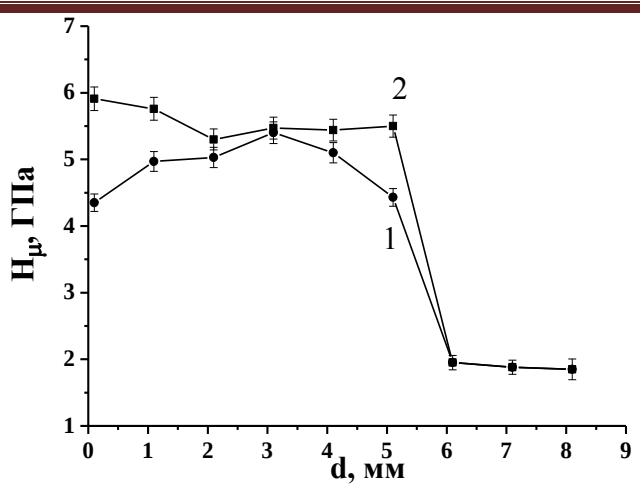


Figure 4. The change of microhardness the depth of the steel base and the deposited coatings: 1) direct current, 2) pulse mode.

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