УДК
620.22:669.017

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CHARACTERISTICS OF THE DIFFUSION SATURATION OF THE THERMITE STEEL SURFACE WITH POLYMERS

Purpose of the study. *The research is aimed at finding new active saturating media and methods for intensifying the processes of thermo-chemical treatment of termite alloys.*

Key words*: polymers, thermite steel, structure, technology, composition, properties.*

Introduction. The development of modern technology requires the creation of new materials to ensure reliable operation of machine parts and tools in various conditions. In solving this problem, considerable attention should be paid to the introduction of effective methods of chemical-thermal treatment into production. The synthesis of termite materials, given the advantages of the technology, is booming. At the same time, the use of diffusion coatings in various industries solves a number of important national economic problems, the relevance of which is confirmed by the increasing attention both in Ukraine and abroad. The solution of these tasks is carried out as a result of the development of fundamentally new highly efficient diffusion saturation technologies. The wide possibilities for this are revealed by the use of diffusion coatings of termite alloys with a complex of elements. Complex diffusion coatings have high strength, viscosity, heat resistance, corrosion resistance, wear resistance, that is, they provide high operational properties of the machined parts.

Therefore, the creation of new highly efficient saturating media for complex saturation, which allows obtaining coatings with special properties and contributing to the intensification of the diffusion processing process, is an urgent task [1]. Analysis of patent and literature data has shown the promise of using compounds of organic nature, in particular polymers, to intensify the processes of carburizing termite alloys [1-4]. In addition, such coatings can be used in the manufacture of tools for processing leather, wood, plastic, etc.

Materials and methods of experimental research. The studies were carried out on samples of "Ст 4" carbon termite steels and on "P18" alloyed termite high-speed steel. Diffusion saturation of the samples was carried out by heating with industrial high frequency currents and electrical resistance at a speed of 230-650 K/s. The structure and phase composition of the diffusion

layers were studied using metallographic, x-ray phase, and X-ray microanalysis. Metallographic studies were performed using an "MIM-7" optical microscope, X-ray diffraction analysis and X-ray microanalysis was performed using a scanning electron microscope.

Experimental studies began with the selection of the optimal components for the carburizing process of termite steels.

The selection of effective organic media was carried out on the basis of a comparison of the thermodynamic factors of the decay of molecules. Carbone organic compounds were analyzed by the temperature and energy of breaking the chemical bonds of the different functional groups fnd used components of media for carburizing.

The analysis showed that organic compounds with low bond breaking energies up to 300 kJ/mol compounds during heating to saturation temperatures of 670-1410 K (optimal temperature for nitrogen diffusion in α, γ-phases of iron) decompose with the formation of a weakly active molecular nitrogen, which has not been used as an effective medium for saturation, due to the high dissociation energy of its molecules.

The high saturating ability of polymers is explained by the peculiarities of their decomposition under the influence of a number of factors: high temperatures, high-speed heating, and the electromagnetic field as a result of thermal and electrochemical reduction degradation, which proceed with the formation of low molecular weight volatile products on the surface of thermite steel that can actively adsorb and diffuse deep into the alloy.

The results of the study of the temperature-time parameters of the saturation process showed that, depending on the temperature and processing time, the structure and properties of the carbonized layer vary over a wide range. At low temperatures 755-930 K is mainly the saturation of steel with nitrogen, when 1100-1150 K – nitrogen and carbon and 1150-1350 K – carbon. For example, the phase composition of samples of steel "P18" treated at 1250 K, regardless of the time of saturation, consists mainly of solid solution of nitrogen and carbon in γ-iron solid solution on the basis of nitride Fe_3N.

Carburizing in the composition based on urea-formaldehyde resin can significantly increase the hardness of steel, for example, for low-carbon "Ст 4" – 4,6 GPa, for alloyed "P18" – 13,5 GPa.

Tests of steel samples "P18" after carburizing in urea-formaldehyde resin (1250 K for 3-3,5 minutes) under sliding friction conditions showed an increase in wear resistance by 3,5 times compared to untreated samples. The values of impact strength, strength indicators of samples "Ст 4" after processing differs little from those for samples after carburizing, which

allows us to recommend the developed compositions for industrial use. The technological scheme of industrial use of the developed compounds is proposed.

Thus, the results of the studies showed the feasibility and prospects of the implementation of processes of diffusion saturation of the thermite steel in polymer-containing media, making it possible to develop technological compositions and technology of steel carburizing processes.

Conclusions. Resin-based polymer-containing compositions have been developed that provide high rates of diffusion saturation processes for termite alloys. These compositions can increase the rate of carburization up to 15-20 times in comparison with commonly used industrial environments. At the same time, high-quality diffusion layers with a high hardness of 6000-13500 MPa are formed, allowing a 2-3 times increase in the wear resistance of the machined parts.

The activating effect of polymers in the processes of diffusion saturation of steels is caused by the formation in the treatment zone of a high concentration of active low molecular weight products, various radicals of the pyro-polymer residue capable of interacting with the metal surface and diffusing deep into the alloy. These compositions are highly adaptable, which is explained by good adhesion to a metal surface, and the absence of corrosive effects on the materials of workpieces and equipment.

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