MACHINERY AND EQUIPMENT MEKHANIZATSII

UDC 669.018.25: 631.3

COMPOSITE MATERIALS BASED POWDER KARBIDOSTALEY carbide with an admixture of chromium and titanium FOR WORKING OF AGRICULTURAL MACHINES

VA Maslyuk, PhD
RV Yakovenko, Ph.D.
Institute of Material name Frantsevich

VD Voytyuk, PhD
N. Denisenko, Ph.D.
National University of Life and Nature Ukraine

Abstract. *The article regularities obtaining wear-resistant materials such as powder karbidostaley on the basis of "chromium steel, chromium carbide" and development on the basis of their working parts of agricultural machines.*

Keywords: working bodies, abrasive wear, chromium steel, composite materials, durability, chromium carbide, hot stamping

Formulation of the problem. The vast majority of modern hardware combination is moving, which provides the ability to perform their job functions, so creating new industry and development of effective materials that can operate reliably in a variety of conditions, represent a major challenge in the field of mechanical engineering and transport. From materials requiring low values of energy losses due to friction, high wear resistance, and in some cases high corrosion resistance for use in aggressive environments. These materials include powder materials nerivnovazhenoyu structure without tungsten hard alloys and karbidostali. Carbide powders are heterogeneous composite materials, which consist of solid refractory compounds distributed in the plastic matrix of iron triad metal.

Bezvolframovi hard alloys is based alloys of titanium carbide and karbonitridu cemented nickel-molybdenum binder. They are characterized by a lower modulus of elasticity and a higher coefficient of thermal expansion that is sensitive to shock and heat stress than tungsten-cobalt hard alloys, and in some cases contain expensive and scarce

nickel and molybdenum. A distinctive feature of powder structural materials is their porosity, regulation which may operate in a wide range of physical and mechanical properties of manufactured parts. There are several methods for structural parts of high density. It repeated pressing and sintering, hydrostatic, and isostatic hot pressing, rolling metal powders, pressing beveled punch and metal membranes, porous hot stamping blanks, explosive pressing, extrusion, impregnation liquid metal sintering to form a liquid phase. Karbidostali its properties are intermediate between solid alloy and tool steel. High hardness, wear resistance and the ability to retain these properties at high temperatures determine the possibility of wide application.

Analysis of recent research. There currently are mostly rare karbidostali phase sintering. Their basis is often alloyed steels, including stainless steel, as well as a solid component are used in carbide or titanium carbonitrides. The disadvantages of the known karbidostaley owned grain carbide and increase susceptibility to oxidation during sintering, insufficient corrosion resistance. When using a number of techniques required very high pressures, and this is a big operation mold. So are most promising methods of forming metal bearing components, which enable to obtain details of complex geometry at low pressures with or without the use of special molds. Manufacturing technology gives a load-bearing parts of products or preparations of sufficient strength, ductility, hardness, low residual porosity and other specific properties.

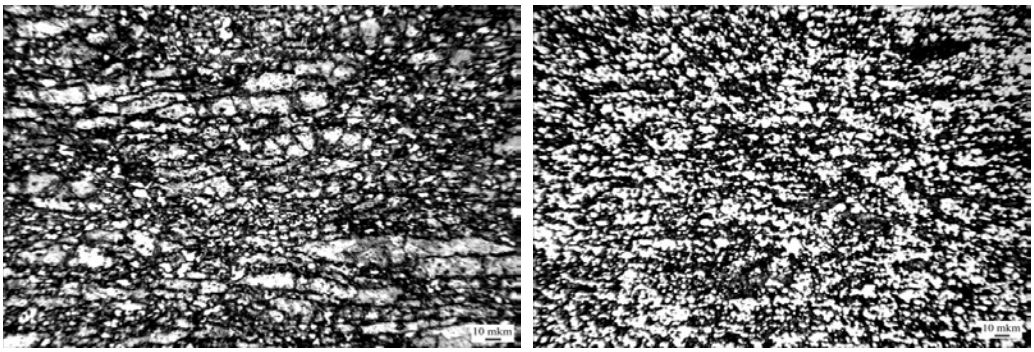
There karbidostaley work to create a system based on iron-chromium carbide. The disadvantage is the lack of resistance to corrosion. Developed earlier Composites "austenitic stainless steel grade carbide-chromium-molybdenum dysylitsyd" belong to a class of materials and have tribotechnical coarse structure (with an average size of 50-100 microns), which affects the physical and mechanical characteristics. Strength properties of metal structural materials increased by doping iron base alloy. One of the most common dopants are chrome.

Alloys based on nickel chromium carbide (KHN) and phosphoric nickel (KHNF) bonds different set of important properties that makes it possible to effectively use them for the manufacture of parts, working in conditions of friction, abrasive wear, aggressive chemical environments and high temperatures. The first attempts to create solid carbide alloys of iron with chromium carbon bonds was done in [1]. Alloys held 20% of the bonds that were the bleached pig iron from 3,8% C, of high hardness (88 HRA), but had low strength characteristics ($\sigma_{bending}$=190 МПand). The interaction of titanium with chromium carbide during sintering investigated in [2, 3], which the authors found that sintered materials there is a new phase-TiC. Dissolution of chromium carbide is in the temperature range from 950 to 1250°C. Since TiC has a different type and lattice parameters than chromium carbide, we should expect that its formation will be accompanied by a change in the size of the sample. When used in a mixture with titanium carbide particles of chromium, having a small carbon potential (particles less than 20 microns). In this temperature range is dissociation of chromium carbide and titanium carbide formation in places of concentration of carbon. Details karbidohromovyh alloys produced from a mixture of powdered chromium carbide Cr3C2 and nickel pressing and sintering in a protective environment at temperatures above 1200°C. nickel content may be 5-40%.

The purpose of research is to establish patterns of obtaining wear-resistant and corrosion-resistant materials such as powder karbidostaley on the basis of "chromium steel, chromium carbide" methods seldom phase sintering, hot stamping and hot pressing impulse and development on the basis of working parts of agricultural machines.

Results. A large number of experiments dedicated to the research the effects of production on the phase composition of powder materials such znosokoroziynostiykyh karbidostaley obtained by sintering, hot pressing impulse (IGP) and hot stamping (GSH). Established that, regardless of the method of obtaining karbidostaley carbide chromium interacts with a steel base, which is the diffusion of carbon and chromium carbide in a matrix, and iron - a matrix carbide and accompanied by the formation of complex heterophase structures and increase the total amount of carbide phase material. The increase in solid phase material leads to increased hardness and wear resistance.

An analysis of the impact of component content in baked karbidostali structure, the effect of crushing microstructure with increasing amounts of chromium carbides from 7.5 to 30% vol., Allowing control structure to achieve the required properties karbidostaley (Fig. 1). Found that haryacheshtampovana karbidostal has anisotropy base metal grains in the direction perpendicular punching effort. The feature of the structure is the lack haryacheshtampovanoyi karbidostali transition zone in contact with the metal carbide grain base. This sometimes improves strength karbidostali that in general the growth of mechanical properties of the material.



and *b*

Fig. 1. Microstructure haryacheshtampovanyh at 1200 °C karbidostaley H17N2 - 7.5% vol. Cr_3C_2 (a) - 30% vol. Cr_3C_2 (b) annealed at 1150 °C.

The regularity and processes the phase structure by X-ray microanalysis on local MS-46 microprobe company SAMESA in consolidated volume samples znosokoroziynostiykyh karbidostaley - "chrome steel - chromium carbide" in terms of their previous grinding-mixing. The analysis and the average composition of phases in karbidostali shown in Fig. 2. The dissolution mechanism of chromium carbides in the steel matrix similar to the mechanism of dissolution Sr3C2 the iron matrix and can be imagined as follows: one-way diffusion of chromium and carbon in the steel matrix and iron carbide, carbide Cr3C2 depletion in carbon and therefore recrystallization first in carbide Me2C (900°C), Then with increasing sintering temperature to 1050 ° C - a hexagonal carbide Me7C3. With further increase in temperature to 1200°C - In Me23C6. When melting the sample at 1300 °C crystallizes from a liquid carbide Me2C. A notable difference from that of Fe-Cr3C2, is that the above series of phase transformations taking place in all of chromium carbide particles simultaneously and completely, and not on the border, which caused the previous mechanical activation and increased dispersion carbide phase [4, 5].

Selective microanalysis karbidostaley H13M2 - (15, 30)% vol. Cr3C2 showed that karbidostalyah based H13M2 mechanism of interaction is like karbidostalyam based steel H17N2. To some feature microstructure karbidostali H13M2-15% vol. Cr3C2 carbide formation is Me3S after melting the sample at 1300°C. Karbidostal H13M2-30% vol. Cr3C2 after sintering at 1300°C different preservation carbide Me23S6 along with newly Me3S carbide, which can be explained by the presence of molybdenum carbide which is an active element.

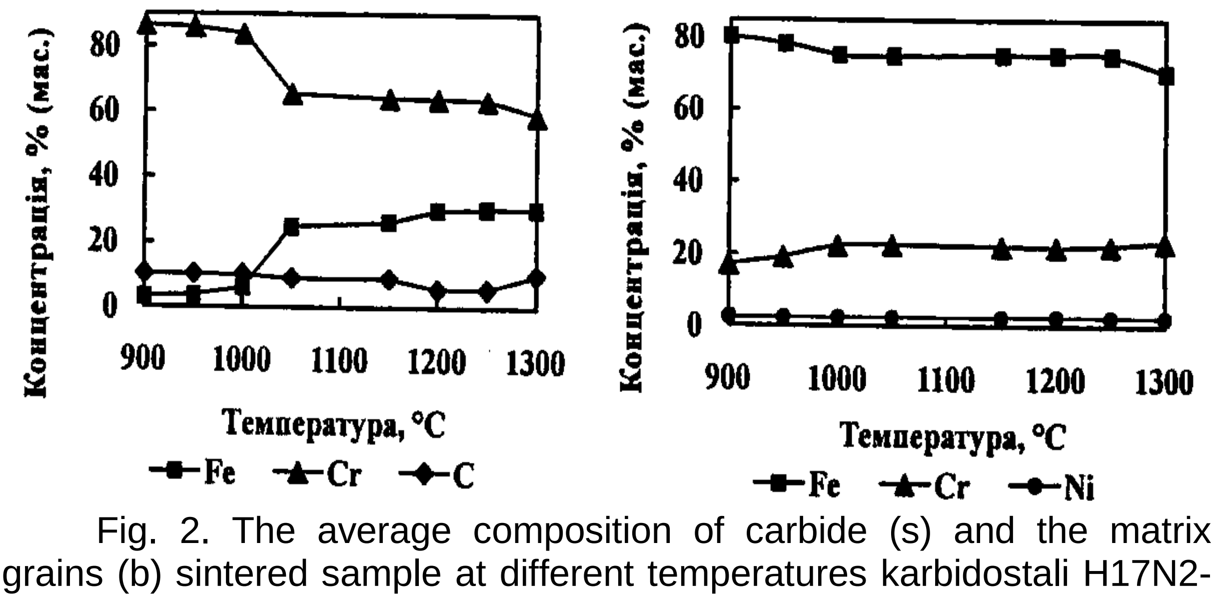
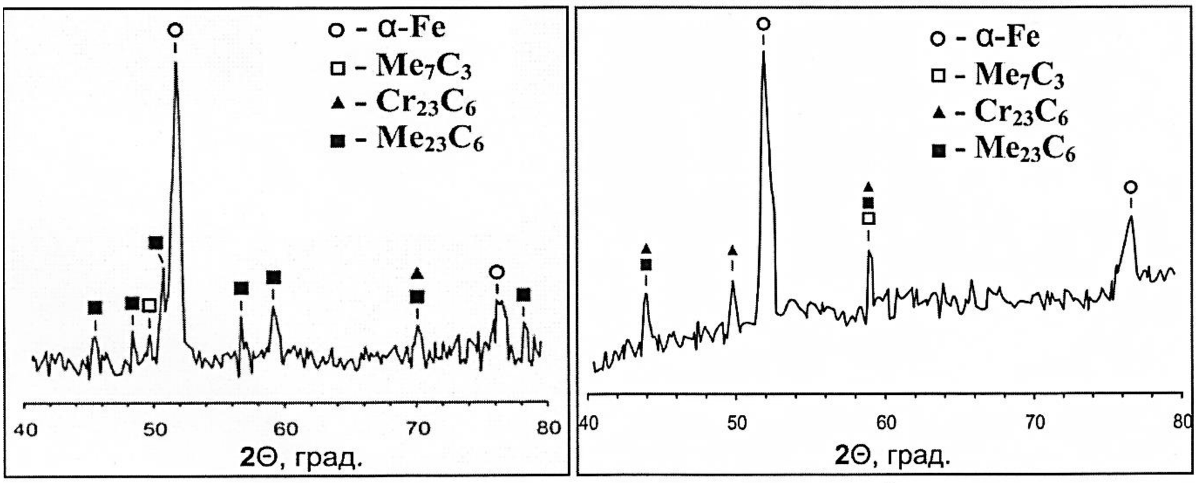


Fig. 2. The average composition of carbide (s) and the matrix grains (b) sintered sample at different temperatures karbidostali H17N2-15% vol. Sr3S2.

These X-ray diffraction studies on "Drona-3" in Co-kα-radiation showed that initial powder mixtures H17N2, H13M2 15% vol. Cr3C2 are defective crystal lattice, which further affects the structure and mechanical properties karbidostaley. The study revealed by X-ray analysis phase composition karbidostaley, sintered at temperatures of 1150, 1200, 1250, 1300°C.

At a temperature sintering 1150 °C samples are composed of carbides Cr7C3 and Me7C3, with increasing sintering temperature to 1200 ° C and 1250 ° C (Fig. 3) - the structure of existing balances and appears Me7C3 complex carbide Me23C6. At a temperature sintering 1300 °C Me2C phase formed in karbidostali H17N2-Cr3C2, and in karbidostali H13M2-Cr3C2 phase crystallizes Me3C also observed traces Me23C6. The results coincide with the results of microanalysis and evidence of active cooperation with steel chromium carbide matrix. The results of X-ray diffraction studies of samples H17N2 Sr2S3 received pulsed hot pressing indicate inherited grinding effect on the formation of the fine structure in these samples. The accumulation of stress in the samples increases the intensity of the flow of diffusion processes in the formation karbidostaley, this effect also causes the accumulation microdefects samples, which manifests itself in higher hardness (81-82 NRA).

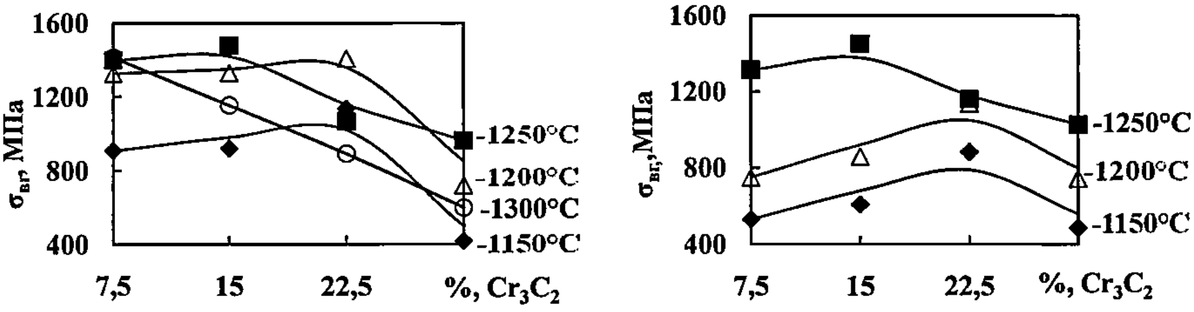


а *б*

Fig. 3. The diffraction pattern karbidostaley H17N2 about. - 15% Cr3C3, (a) and H13M2-15% vol. Cr3C2 (b) sintered at 1250 ° C.

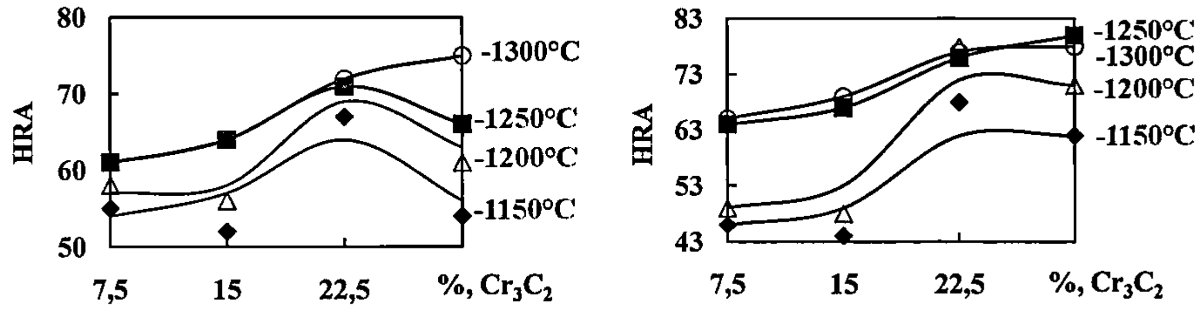
The authors conducted a study of mechanical properties and corrosion resistance znoso- karbidostaley "chrome steel Sr3S2." Investigation of bending strength sintered karbidostaley the content Sr3S2 shown that his administration increased strength compared to steel output (H17N2, H13M2) throughout the sintering temperature range, reaching their maximum values 1450-1470 MPa at a temperature sintering 1200 and 1250 ° C (Fig. 4). Hardness karbidostali based H17N2 Sh3S2 with increased content and sintering temperature increases and reaches a maximum (74 NRA) after sintering at 1300 ° C (Fig. 5). Karbidostali based H13M2 30% vol. Sr3S2 have the highest hardness (80 NRA) after sintering at 1250 ° C, due to the proximity of the region to the martensitic characterizing structural diagram Sheflera [6].

Some mechanical properties karbidostaley drop of 15% vol. chromium carbides at temperatures 1150-1200 ° C to obtain can be explained by the fact that so many solid phase at these temperatures znemitsnyuye steel frame. When the number karbidostali Sh3S2 22.5% vol. its composition is close to eutectic and who, at the given temperature, the significant amount of liquid phase, intensifying mass transfer processes, which leads to higher mechanical properties. At 30% vol. Sr3S2, due to the increasing number of carbide phase there is increasing rigidity while reducing bending strength.



а *б*

Fig. 4. Dependence bending strength karbidostali the content of chromium carbide sintering at different temperatures: a) steel H17N2; *b*) H13 steel M2.



а *б*

Fig. 5. Dependence of hardness karbidostali the content of chromium carbide sintering at different temperatures: a) steel H17N2; b) steel H13M2.

Karbidostal H17N2-44% vol. Sr3S2 obtained IGP has a hardness of 80-82 NRA but characterized by low flexural strength (400 MPa). This is due to high content Sh3S2 large and fragile material. Reducing the amount of chromium carbide in karbidostalyah obtained IGP increases bending strength up to 1350 MPa while maintaining hardness at 79-80 NRA. It is also possible due to the use of sprayed and non-calcium hydride received restoration H17N2 steel powder. The greatest impact on the strength and hardness of steel karbidostaley based H17N2 received GS, causes the following annealing at 1150 ° C (Fig. 6). This can be explained by increased adhesion between particles and metal carbide phases and relieve tension and interplay between diffusion and carbide matrix. Comparison of the results of the study of mechanical properties karbidostaley obtained by different methods leads to the conclusion that the use of GSH leads to increased hardness karbidostaley 1.2 times compared to baked karbidostalyamy based H17N2, due to intense thermomechanical action of GSH leads to the manifestation of the effect of thermomechanical processing. Bending strength karbidostaley obtained IGP is on the lower level and 400 MPa. In karbidostaley obtained by sintering and hot stamping strength of one (1410-1470 MPa), while GS karbidostali obtained at lower temperatures than sintered preheating.

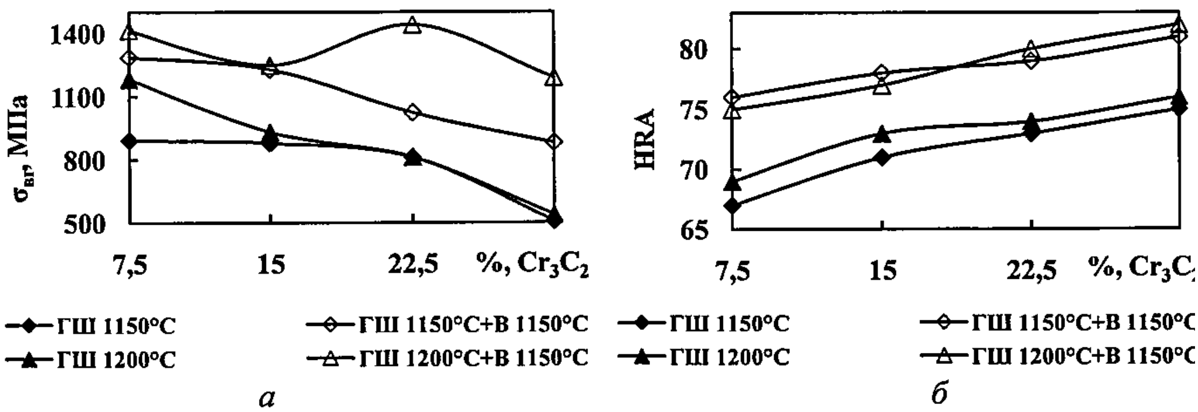


Fig. 6. The dependence of the bending strength (a) and hardness (b) karbidostali the content of chromium carbide obtained by hot stamping (GSH) and GSH followed by annealing (B).

Investigation of fracture karbidostaley obtained optimal modes of chromium carbide content showed that, as expected, increase the number of solid component, along with increasing hardness, leads to a reduction in fracture karbidostaley (Fig. 7).

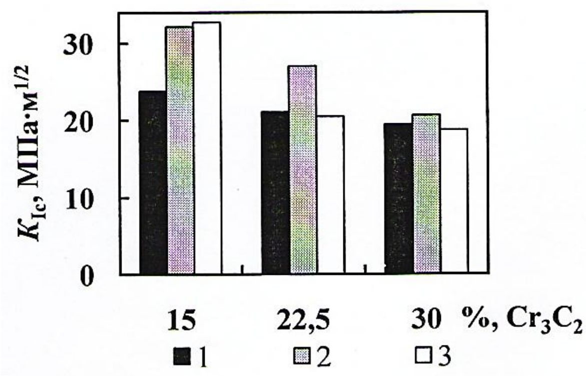


Fig. 7. crack karbidostaley with different content at optimum temperatures Sh3S2 obtain 1 - H17N2-Sr3S2 (GSH obtained at 1200 ° C); 2 - H17N2-Sr3S2 (obtained by sintering at 1250 ° C); 3 - H13M2-Sh3S2 (obtained by sintering at 1250 ° C).

Fracture toughness of sintered karbidostaley different basis is approximately the same level as some of the fall in karbidostali H13M2-22,5% vol. Sh3S2 can be explained by the increase of microhardness base to ~ 4.5 GPa, and generally makrotverdosti karbidostali to 78 HRA. This is due to the formation of a liquid phase by close to eutectic composition, which intensifies the diffusion of carbon and chromium based, and iron carbide.

Karbidostali received hot stamping, with slightly lower fracture toughness than sintered karbidostali similar composition. This pattern is observed for chromium carbide content 22.5% vol. inclusive, then crack them aligned and within 19-21 MPa m1 / 2.

Somewhat lower fracture toughness haryacheshtampovanyh karbidostaley be explained nahartovanistyu structure. Due to this, we are increasing the value of hardness 79-82 NRA, leading to a drop in the value of fracture toughness. In summary, noted that investigated karbidostaley crack is high enough, for example, crack hard alloy VK21 - 11-13 MPa · m1 / 2, steel R18 - 21 MPa · m1 / 2.

The stability karbidostaley against abrasive wear by particles fixed in a pair with a diamond wheel. Tests showed that the wear resistance of sintered samples of the powder and steel H17N2 H13M2 low and increasing pressure more than 0.6 MPa leads to a catastrophic deterioration [7].

Introduction Sh3S2 increases resistance to wear sintered materials ~ 20 times, compared with the original steel. Coefficient of friction karbidostaley based H17N2 - (7,5-30% vol.) Sr3S2 decreases with increasing load (fig. 8 a). Least endurance is karbidostal of 7.5% vol. Sr3S2, and the most resistant to wear - high in karbidostali carbide (Fig. 8 b).

Karbidostali based H13M2 with durability in 1,5-3 times higher compared to karbidostallyu H17N2-Sr3S2. This can be explained by the presence of 2% molybdenum, which increases the diffusion mobility of chromium and lead to an increase in its concentration in the surface layers and which is known to increase wear resistance (Fig. 9, a, b). The research results of abrasive wear resistance of the samples of steel H17N2 (obtained IGP) have shown that they have been catastrophic deterioration under a load of 0.6 MPa. The introduction of the charge carbide impurities significantly change the nature of durability, increasing it to ~ 50 times. Comparison of durability karbidostaley shows that the intensity of wear karbidostali Sr3S2 13.5 times less than karbidostali with

TIS. This may be due to the higher concentration of Cr in the metal component of karbidostali Sr3S2 also possibly due to low intensity Tees interaction with steel base and a weak adhesive bond between the titanium carbide particles and the matrix.

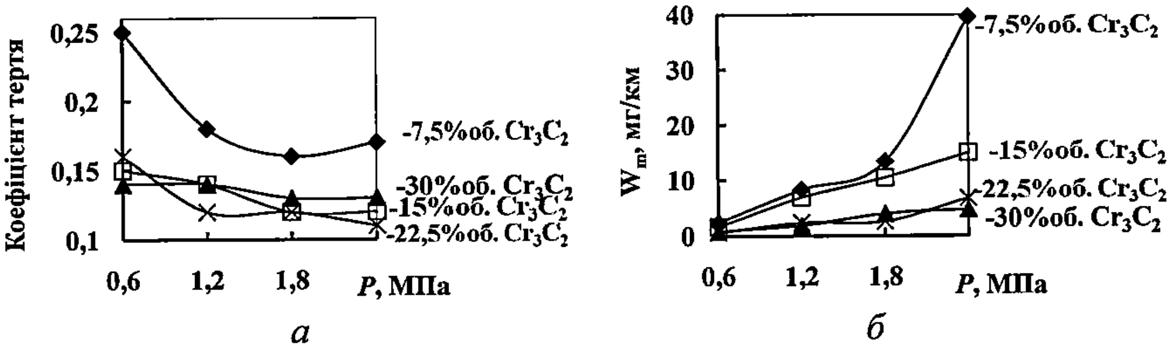


Fig. 8. Dependence of friction (a) mass and deterioration (b) to load samples karbidostaley based H17N2 with different content Sr3S2 obtained by sintering (1sp = 1250 ° C).

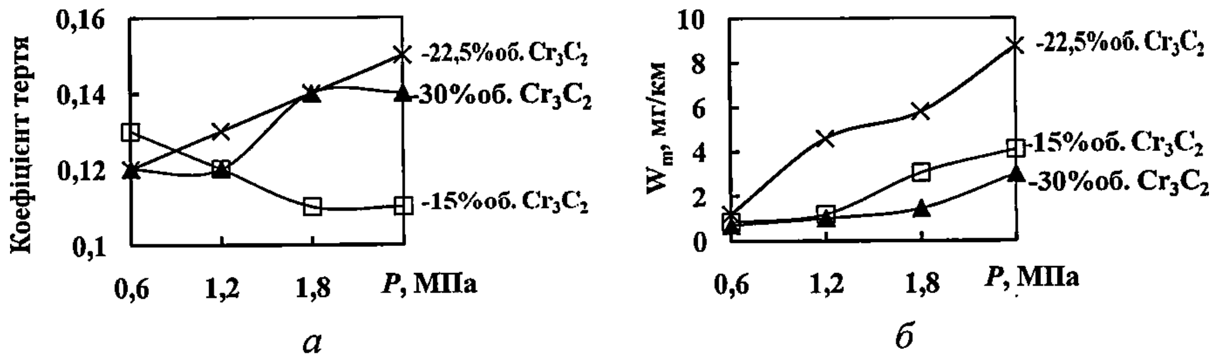


Fig. 9. Dependence of friction (a) mass and deterioration (b) to load samples karbidostaley based H13M2 with different content Sr3S2 obtained by sintering (1sp = 1250 ° C).

The study sample received durability GSH showed that administration of chromium carbide wear resistance increases 10 times compared with the original steel. With increasing content Sh3S2 karbidostali resistance against abrasive wear increases (Fig. 10 b). The coefficient of friction for steel H17N2 and karbidostaley from 7.5 and 15% vol. Sr3S2 slightly increases with the load, and for karbidostaley high in Sr3S2 it decreases (Fig. 10 a).

A comparison of the value of mass wear steel H17N2, H13M2 and karbidostaley on the basis showed that the wear resistance karbidostaley obtained by sintering, IGP and GSH ten times higher than the wear resistance of steel output, and increases with the number of carbide component. Coefficient of friction karbidostaley, unlike steels decreases with increasing load when abrasive wear. Wear on fixed abrasive particles is a very tough process, in which is the direct destruction of the surface layer in this case, wear resistance and friction coefficient is determined by the mechanical properties of the material and its resistance to direct damage.

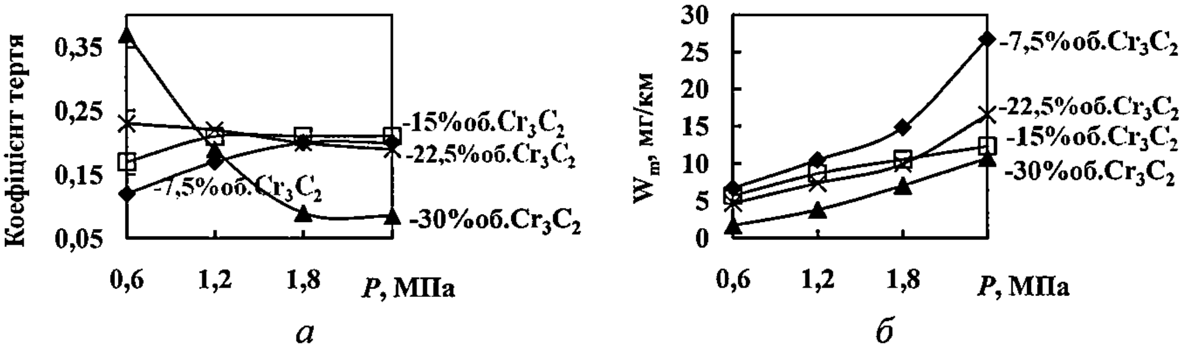


Fig. 10. Dependence of friction (a) mass and deterioration (b) to load samples karbidostaley based H17N2 with different content Sr3S2 received GS 1200 ° C + in 1150 ° C.

Karbidostali of 7.5% vol. Sr3S2 have low durability, compared to karbidostalyamy (15-30% vol. Sr3S2), regardless of method of receipt. This is probably just due to the feature of the microstructure where there are significant dimensions of the metal phase (average size of 35 microns) and the presence of porosity of 12%. Increase of carbide leads to increased wear resistance, which is caused by the increase in the fate of the solid component by heterophase interaction with the base size and milling metal phase that in terms of abrasive wear on fixed particles leads to increased wear resistance.

Studied the corrosion resistance of materials in a 3% solution of NaCl, 30% NaOH solution and 20% NNO3 solution at room temperature. Corrosive environments elected on the basis of published data on the corrosion resistance of steel output and anticipated applications. Studies have shown that corrosion resistance of sintered samples karbidostaley H17N2 H13M2 and 15% vol. Sr3S2 30% solution reaches 10 NaON ball (completely resistant). Perhaps carbide additives during sintering actively interact with a steel base, in some cases increase the corrosion resistance of materials. With increasing content Sr3S2 30% vol. is reduced to 3-4 score (lowered stable). The 3% NaCl solution karbidostali with only 22.5% vol. Sr3S2 score with 10 other stores have 2-3 score (slabostiykyy) (Table. 1).

For corrosion resistance in 20% solution NN03 karbidostali based H17N2 H13M2 and belong to the class and slightly lowered stable, this indicates that the introduction of carbides reduces the corrosion resistance of the material in this corrosive environment. Karbidostal 30% vol. Sr3S2 is unstable in this solution and has 1 point corrosion resistance, this can be explained, on the one hand, relatively high porosity (up 7%) and intensive interaction of solid component of the foundation that leads to diffusion of carbon in the steel and the formation martensytopodibnyh structures (microhardness base is 2,1-4,1 GPa), which reduces the corrosion resistance of the material as a whole [8, 9].

1. Corrosion resistance of sintered karbidostaley.

Immediately number-ka	Storage, %		Relative density p%	Corrosive properties					
				30% NaOH		3% NaSI		20% NNO3	
	steel	Sr3S2		P mm / yea	Mark*	P mm / yea	Mark	P mm / yea	Mark
1	H17N2	7.5	0.95	0.06	4	0.48	3	0.54	2
2	H17N2	15	0.96	0.00	10	0.26	3	0.09	4
3	H17N2	22.5	0.95	0.28	3	0.00	10	0.03	4
4	H17N2	30	0.93	0.49	3	0.36	3	2.53	1
5	H13M2	15	0.93	0.00	10	0.33	3	0.11	4
6	H13M2	22.5	0.95	0.41	3	0.00	10	0.06	4
7	H13M2	30	0.97	0.03	4	0.59	2	0.31	2

* On a ten point scale.

2. Corrosion resistance karbidostaley obtained by hot stamping.

Immediately number-ka	Storage, %		Relative density p%	Corrosive properties					
				30% NaOH		3% NaSI		20% NNO3	
	steel	Sr3S2		P mm / yea	Mark*	P mm / yea	Mark	P mm / yea	Mark
1	H17N2	7.5	0.99	0.00	10	0.14	3	0.81	2
2	H17N2	15	0.99	0.00	10	0.00	10	0.25	3
3	H17N2	22.5	0.99	0.09	4	0.00	10	0.16	3
4	H17N2	30	0.98	0.09	4	0.00	10	0.16	3

* On a ten point scale.

Corrosion resistance karbidostaley H17N2-44% vol. Sr3S2 obtained IGP vacuum is at third ball (slabostiykyy) in the studied solutions. This is significant nahartuvannyam structure. Corrosion resistance karbidostaley obtained GS, 30% solution reaches 10 NaON ball (completely resistant) to chromium carbide content of 15% vol. including, but further increase content Sr3S2 corrosion resistance drops to 4th ball (lowered stable). The 3% solution of NaCl observed the opposite situation, relatively low corrosion resistance on the 3rd score (weakly stable), has karbidostal of 7.5% vol. Sr3S2 (tab. 2), with karbidostali (15-30% vol.) Are Sr3S2 10th grade resistance to corrosion. In 20% solution NNO3 steel H12N2 has 1 point (unstable) and karbidostal H12N2 - 15% vol. Sr3S2 - 2 score (slabostiykyy), other stocks have karbidostaley 3 (slabostiykyy) point corrosion resistance. Thus, corrosion resistance karbidostaley largely determined by the ability of external selective action on the components of the material. At a time when the stability of the carbide phase stability than steel ties for action reagent, the overall stability of carbide alloy - steel will increase with a decrease in content of steel. Otherwise, there will be a reverse picture. We brought aspects of the practical use of research results. Fig. 11 presented the proposed technological scheme of production znosokoroziynyh inserts for hammers kormodrobarok.

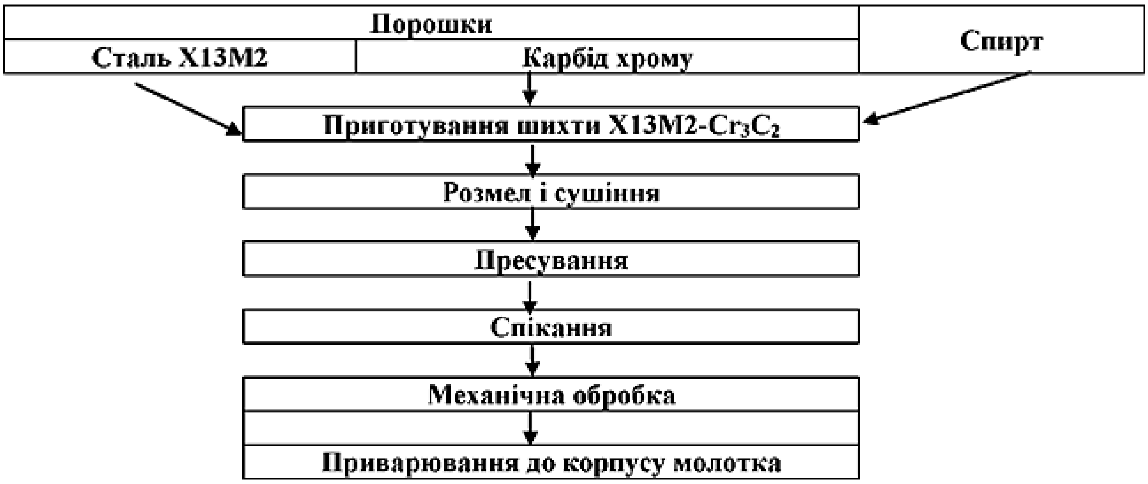


Fig. 11. Technological scheme of production "modular inserts" to kormodrobarok hammers.

Performance tests conducted on kormodrobartsi hammers BMK-1 at the milling feed grain. Along with hammers, reinforced with inserts H13M2 - 30% vol. Sr3S2 (Fig. 12), tested hammers of base material with heat treated steel 65G. Durability hammers determined by the change in their weight. Production tests have shown increasing longevity experimental hammers, reinforced with inserts karbidostali H13M2 - 30% vol. Sr3S2 in 2-2.5 times and improve the technological operation grinding feed compared with steel hammers serial 65G. [10] The results of tests are performed in teaching and research farm at the National University of Life and Environmental Sciences of Ukraine, hammers, reinforced with alloy inserts H13M2-30% vol. Sh3S2 recommended for use in feed mills BMK-1.

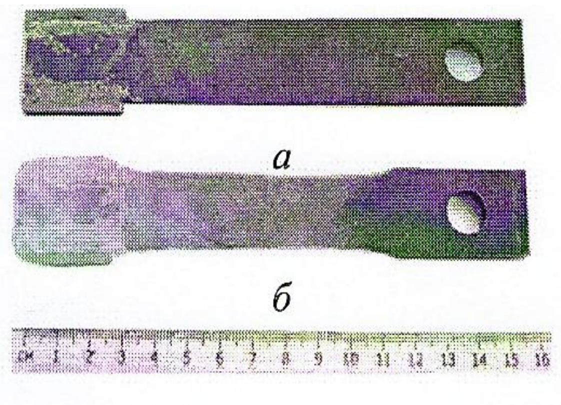


Fig. 12. Hammer crusher BMK-1 with inserts of karbidostali H13M2 - 30% vol. Sr3C2 connected ELECTRIC (a - for testing, b - after production testing).

Conclusions

1. On the basis of "chromium steel X17H2, X13M2 - Cr3C2, and data diagrams Cr-Fe-C, microstructure results, microrengenospectral and phase analyzes and studies the physical and mechanical properties, durability and corrosion characteristics developed znosokoroziynostiyki powder materials: X13M2 - (15-30% vol.) Cr3C2 and X17H2 - (7,5-30% against.) Cr3C2 structural purposes.

2. A production test hammers kormopodribnyuvachiv reinforced with inserts designed karbidostaley X13M2 - 30% vol. VP NUBiP Cr3C2 in Ukraine "Agronomic Research Station." Tests showed increasing longevity experimental hammers 2-2.5 times and improve the technological operation grinding feed compared with steel hammers serial 65G.

List of references

1. Petrov AM Strukturoobrazovanye compositions at a joke T-Cr'3C2 / A. Smith, D. J. Radomыselskyy, S. Titarenko // Poroshkovaya Metallurgy. - 1974. - №1. - C. 85-89.

2. Radomыselskyy I. Tverdыe IZ powder alloys and cast iron chromium karbyda / *I. Radomыselskyy, V. Klimenko* // Clearing leaf. - 1961. - №12. - C. 34-39.

3. VN Klimenko Spekanye, strukturoobrazovanye and properties of materials poroshkovыh system karbyd chromium-iron / VN Klimenko, VA Maslyuk, Yu Sambros // Poroshkovaya Metallurgy. - 1986. - №8. - C. 39-43.

4. Uprochnenye bыstoryznashyvayuschyhsya surfaces bezvolframovыmy tverdыmy alloys and karbydo-containing steel / VA Maslyuk, *SG-Napara Volhyna, RV Yakovenko* // The International Scientific and Technical seminar "Modern Problems of the preparation, production, zahotovytelnoho production, processing and assembly in mashinostroeniya and pryborostroenyy" (21-23 February 2006). - Svaliava, Ukraine. - S. 103-105.

5. Uprochnenye bыstoryznashyvayuschyhsya surfaces bezvolframovыmy tverdыmy alloys and karbydo-containing steel / VA Maslyuk, *GA Bahlyuk, SG-Napara Volhyna, RV Yakovenko* // Uprochnyayuschye and coating technology. - 2007. - №1. - P. 42-48.

6. Yznoso-korrozyonnostoykye kompozytsyonныe materials based on stainless steel nodes for machines and mechanisms trenyya / VA Maslyuk, SG-Napara Volhyna, LN Orlov VK Kud, RV Yakovenko / / Metallurgy Poroshkovaya mashinostroeniya a tractor. The quarrel and cutting materials. Materials, technology and equipment for nanesenyya funktsyonalnыh protective coatings "(26-30 March 2007). - Minsk, Belarus. - P. 85-86.
7. Yakovenko RV and Mehanycheskye trybolohycheskye properties yznosokorozyonnostoykyh system karbidostalej steel - Cr3C2 / *RV Yakovenko VA Maslyuk, GA Bahlyuk, VT Varchenko, DN Brodnykovskyy* // Abstracts report and II-mezhdunarodnoy samsonovskoy conference "Materyalovedenye refractory compounds" (18-20 May 2010). - Kiev, Ukraine. - P. 91.
8. Yakovenko RV Trybolohycheskye and physicochemical properties mehanycheskye yznosostoykyh kompozytov based korozyonnostoykyh steel / *RV Yakovenko VA Maslyuk, GA Bahlyuk, VT Varchenko, DN Brodnykovskyy* // International specialized scientific-technical seminar "Kompozytsyonnыe frictional materials: Properties, Production, Application (25-26 May 2010). - Minsk, Belarus. - S. 122-130.
9. Yakovenko R. Effect of method of obtaining the structure and properties karbidostalej karbyda with the addition of chromium / RV Yakovenko VA Maslyuk, *GA Bahlyuk, AE Kuschevskyy* // Journal of East Ukrainian National University. Dal. - 2010. - №10 (152). - Part 1. - P. 281-284.
10. Patent №45567 Ukraine, IPC (2009) V22 / F 7/02. Hammer for kormodrobarok / VD Voytyuk, MI Denisenko, AA Kotrechko, VA Maslyuk, RV Yakovenko T. Oliynyk; 17.07.2009 stated; opubl.25.12.2009. Bull. №24.

Abstract. *In this article set zakonomernosty obtaining yznosostoykyh poroshkovыh materials such karbidostalej based systems "hromystaya karbyd chromium steel" and development workers organs detail agricultural machines.*

Keywords: Rabochie orhanы, abrazyvnoe yznashyvanye, hromystaya steel kompozytsyonnыe materials, Durability, karbyd chromium, pressing horyachaya

Annotation. *In paper conformities to law of receipt of wearproof powder-like materials are set to the type of steel-carbide on the basis of the systems «chromic steel-carbide of chrome» and development of details of workings parts of agricultural machines.*

Key words: workings parts, abrasive wear, chromic steel, composition materials, longevity, carbide of chrome, thermoforming

632,952 UDC: 66.02

CONCEPTUAL FOUNDATIONS OF BIOTECHNOLOGY MIKOBIOPREPARATIV FRUITING BODIES OF FUNGI

Teslyuk VV, Doctor of Agricultural Sciences
National University of Life and
Nature Ukraine