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Manufacturing technology ELEMENTIVIZ wear-resistant powder composite MATERIALIVDLYA working body shredder

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In the article the results of laboratory and production testing durability kormodrobarok hammers made of powder composites.

Technology, manufacturing, wear, composite material shredder.

Formulation of the problem. During the operation kormopodribnyuvachiv a change quantitative and quality of their work, which is associated with heavy wear their major working bodies (hammers). Background and claimed that in Ukraine annually grinding to be hundreds of thousands of tons of ore, cement, grain, sugar, salt, bones, etc.). Vibration pendulum oscillation of workers do strike impact on hardpoints and support units.

The problem of improving the life of hammers kormopodribnyuvachiv remains relevant their durability is limited and the cost of maintenance and spare parts is very high.

Analysis of recent research. According to the local scientists [1] hammers kormopodribnyuvachiv prone to fatigue. On the surface friction parts witnessing fatigue ulcers that occur as a result of cyclic loads (Fig. 1).

The purpose of research. The purpose of this work is to improve the durability of hammers and ensuring a longer service life by making them out of composite powder materials.

Results. Hammers kormopodribnyuvachiv in the air flow around them - grain flow is the most loaded parts, they are bending and torsion forces.

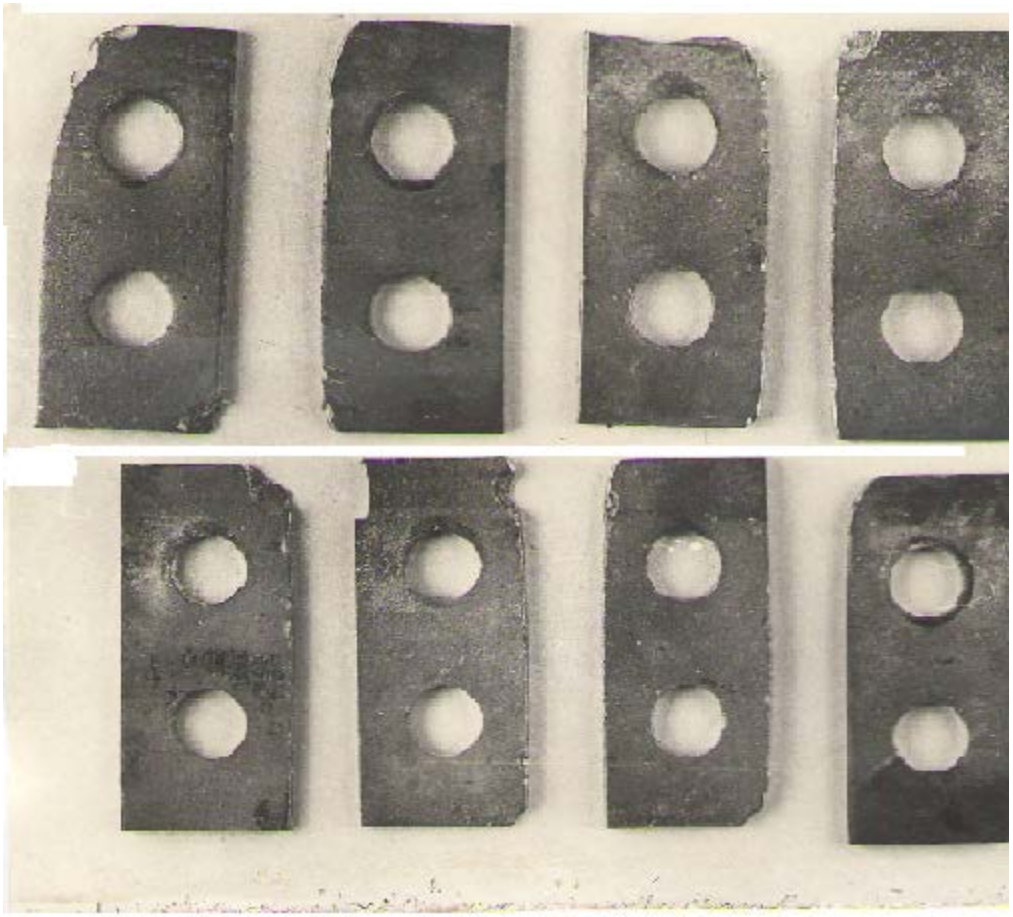


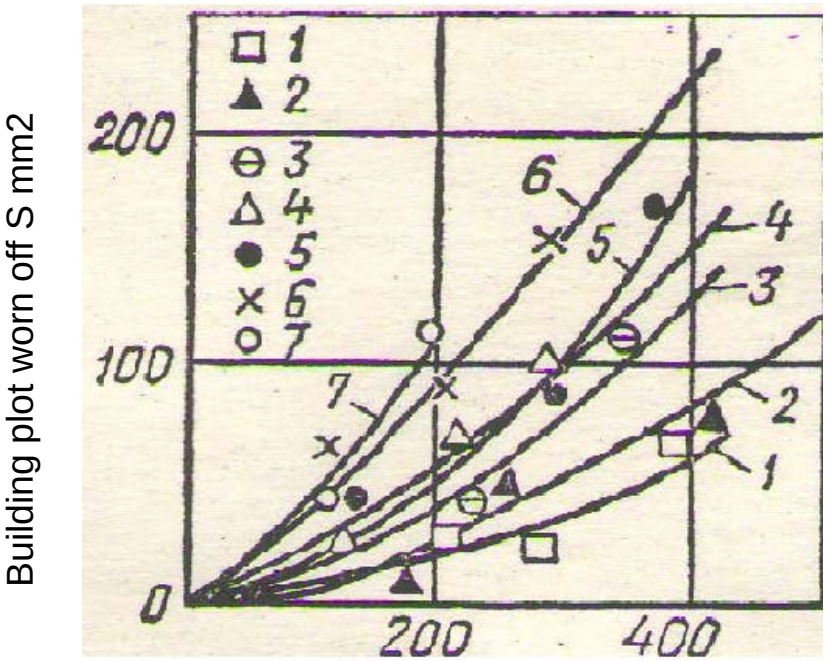
Fig. 1. Typical types of operational damage to the hammer mill DB-5 after crushing 50-60 tons of grain (hammer material - steel 65G).

To do this, we used the following materials and methods of strengthening: strengthening point cored wire PP-AN 170, micro plasma processing cored wire PP-AN 148, laser machining, induction welding alloy C PG-27 using eutectic coatings №1, hot stamping porous workpieces, as well as research and development of powder composites KHZH-70 KHNF-15 KHTNF-25. Research conducted strengthened hammers in industrial environments, in grinding zernosumishey farms in Kyiv, Zhytomyr regions and in Belarus.

The structure and chemical composition of the friction surfaces examined with a scanning electron microscope-microanalyzer «Cam Scan - 4DV», with the system of dispersed energy analysis «Link-860."

In the study of the elemental composition of the surface layers to a depth of surface friction was used Auger scanning electron microscope Gamp - 10 S ».

As a result of production testing operation hammers constructed curves depending on their operating time (Fig. 2).



Operating hours crushers Q, t

Fig. 2. Dependence demolition hammers consolidated operating time of machines: 1 - Steel 65 (PP-microplasma strengthening Antonov An-148);
2 - Steel ST3 (modular plate KHZH-70); 3 - Steel 65G (point strengthening PP-AN170); 4 - Steel 65G (eutectic coating №1); 5 - Stal65H (laser strengthening); 6 - Steel ST3 (point strengthening); 7 - Steel 65G (serial).

So accordingly, the obtained data, the highest durability with hammers steel 45, strengthening micro plasma processing cored wire PP-Antonov An-148 (Fig. 2, curve 1) and hammers, reinforced modular plates of composite powder materials KHNF-15 and KHZH-70 (Figure . 2, curve 2).

Production tests have shown that durability hammer crushers KDU-2.0 DCM-5.0, DB-5, compared with serial 65G steel up to 1.96 times at a point strengthening cored wire PP-AN170, while strengthening eutectic coverings number 1 to 2.5 times, and the use of composite materials such KZHH-70 KHNF-15 KZHH-65 at 3-5.

As a result of comprehensive research designed scientific basis for the creation of percussion working with composite materials. The authors substantiate the first time in Ukraine and create new materials for the agricultural machinery by hot stamping porous workpieces. This method can increase the utilization of materials from 55 to 50 ... 95 ... 98%. 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.

Temperature range of hot stamping pieces of iron from 900 ... 1300 ° C. main technological equipment for hot stamping - it dies. Hammers manufactured in the form of a plate bearing the basis of which a material based on iron containing chromium carbide, graphite and glass. Reinforcement layers are made of without tungsten carbide based on carbide chromium containing graphite and phosphorus ligature copper or nickel phosphorous alloy eutectic composition.

Alloys based on nickel chromium carbide (KHN) and phosphoric nickel (KHNF-15) connections different set of important properties.

X-ray analysis shows that the original powder prevailing higher chromium carbide (Cr3S2) [2]. As the raw materials used iron powder (0.8% C) and chromium carbide Cr3S2 (Cr - 86,9 cer - 0.08 Szv'yaz. - 13%) [2].

The structure of the alloy containing 70% iron, two-phase (Fig. 3, Fig. 4). It consists of a complex of iron chrome carbide particles and metallic phases. According to the quantitative analysis phase is a metal-carbon ferrochrome and has the following atomic composition,% 77.9 Fe, 10,9 Cr, 11,2 C. carbide phase contains 36.5 Cr, Fe and 25.5 t38,3 % C, which roughly corresponds to the formula (CrFe) 3C2 with some excess metal atoms [3].

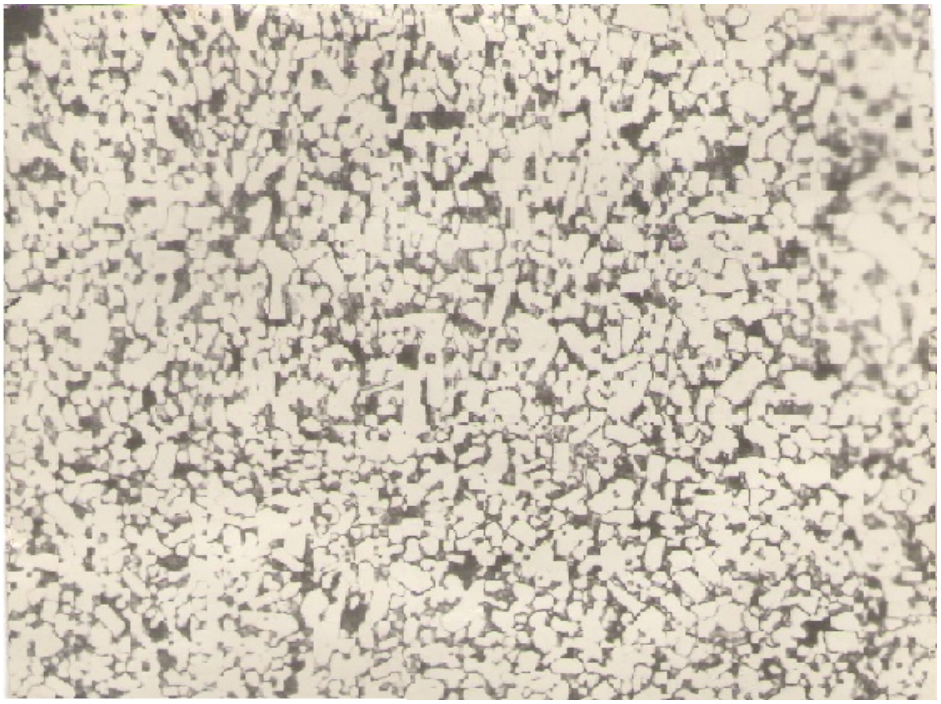


Fig. 3. The microstructure of the alloy KHNF-15 h400.

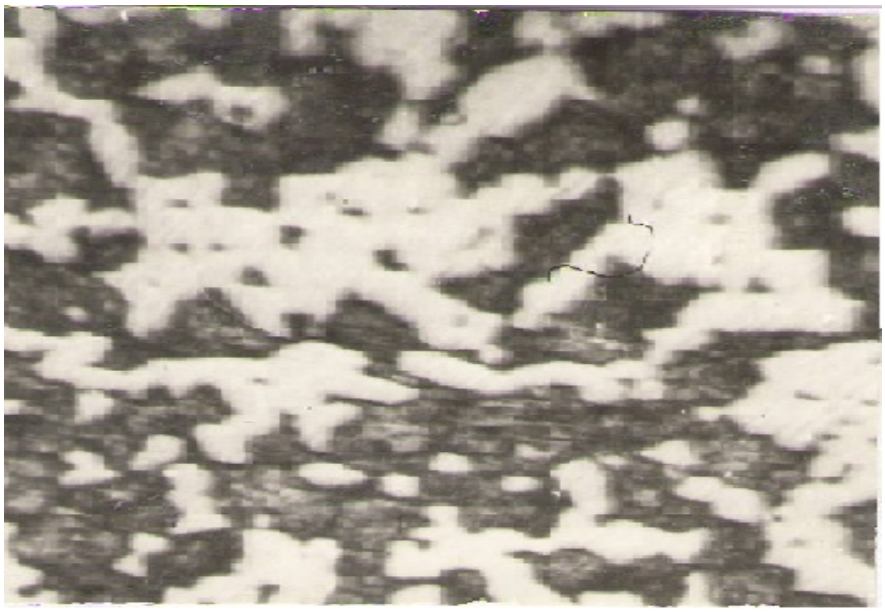


Fig. 4. Microstructure alloy KHZH-70 h400.

The test results of mechanical properties of alloys KHNF KHZH-15 and-70 are shown in Table. 1.

1. Basic physical and mechanical properties of alloys KHNF KHZH-15 and-70.

Properties	KHNF 15	KHZH-70
Density, kg / m3	6950	7580
Hardness, NRA	84.5	80
Impact strength, 10-5 J / m2	0.12	0.27
Tensile strength in bending, MPa	1200	1270

From Table. 1 we can see that the alloy KHZH-70 yields 15 KHNF alloy hardness, due to fewer carbides in the source material, but is predominant in strength and particularly impact strength (more than twice).

To ensure compatible stamping bearing base and reinforcing layers in the composition of the initial mixture reinforcing layer is added in the form of ligature one of eutectic alloy of copper and phosphorus, or nickel or phosphorus, having a melting point respectively 715 and 875 ° C, and playing function liquid oil, and The composition of the carrier base - glass, which has a melting point of 650-750 ° C.

Introduction to the composition of the initial mixture ligatures and especially glass allows a dense product reinforcement layers which are connected with the foundation bearing hammer bilateral diffuse zone, which promotes relaxation percussion hammer impact on the volume of plates (Fig. 5). The process of manufacturing the hammer includes preparation of initial powder mixture for the carrier base and reinforcing

layers, backfilling layers forming a plane matrix is performed in a sequence: reinforcing layer bearing base forming and hot stamping.

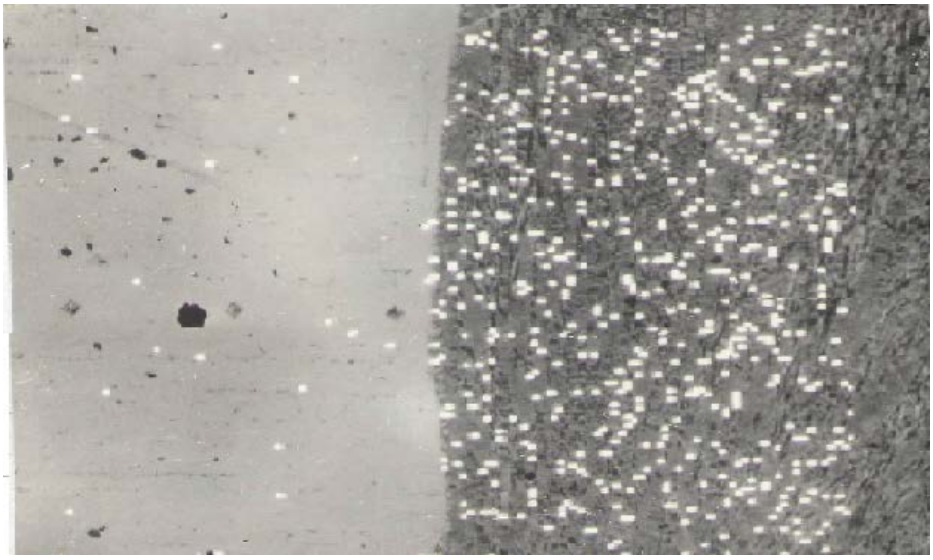


Fig. 5. The depth of penetration of chromium (diffusion zone) on the hammer h1000.

Also experimental hammers are reinforced with wear-resistant powder elements of composite material based on titanium carbide and chromium nickel alloy with a bunch KHTN-25, a new mikrokompozytsiyni materials with great resistance and regulated physical and mechanical properties. Since (TIS) is a different type than the lattice parameters and chromium carbide, we should expect that its formation is accompanied by a change in the size of the sample. When used in mixtures 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 areas of concentration of carbon [4]. Investigated as a method of manufacturing modular elements made of composite materials. Modular plates with hard metal mounted on a steel base (steel St3) hammer several ways: soldering, mechanical fastening with screws, sealing, rivets and welding. Coefficient of thermal (thermal expansion) carbide KHNF-15 KHZH-70 KHZH-30 is almost equal to the coefficient of thermal expansion of carbon steels, hard alloys is well welded carbon steel. Also used for mounting of modular electric plates on the basis of a steel hammer (knife) possible in the field.

Conducted testing animal feed installations CMD-F-2, equipped with hammers carbide hammers have received increasing wear resistance compared with serial 20-fold (by encapsulation of DNU "UkrNDIPVT them. L. burned") and 100 times for laboratory results. Preliminary tests showed that manufacturing hammers with working part

layer provides the effect samozatochuvannya regulated by the difference in wear resistance of faces and core.

Experimental Station for the manufacture of crushers hammers composite materials Novograd Volyn agricultural plant, and the plant Brovary Powder Metallurgy [5].

Conclusions

The technology of production of wear-resistant elements of powder composite materials for the job of shredders. Without material obtained from tungsten carbide for use in conditions of impact-abrasive wear. Proved high efficiency production technology workers of powder metallurgy based on the use of powders derived from domestic raw materials and does not contain such expensive and scarce components such as tungsten, cobalt, nickel.

The results form the methodological basis for solving issues grinding feed by working with composite materials.

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In Article rassmotrenы results laboratornыh and proyzvodstvennыh trials yznosostoykosty Molotkov kormodrobylok, yzhotovlennыh IZ poroshkovыh kompozytsyonnыh materials.

Technology, Production, yznos, kompozytsyonnыy Material, Flowing.

The paper discusses the results of laboratory and production tests of wear resistance of corn crusher hammers manufacture of powder composite materials.

Technology, manufacture, wear, composite material, fodder shredder.