Impact Factor: 9.9 ISSN-L: 2544-980X

SELECTION OF RAW MATERIALS OF SOLID ALLOYS USED IN DRILLING AND RESEARCH OF THEIR PROPERTIES

Parmonov S.T , Jadilova D.A[1]

Annotation: This article presents the scientific and practical results of the research of raw materials and their properties of hard alloys used in mineral drilling. Scientific and practical works in the field of powder metallurgy and the theory of raw materials of solid alloys carried out by our country and foreign scientists are the theoretical and methodological basis of this article. A systematic complex approach was used to solve the identified research tasks: theoretical, experimental, experimental laboratory research, which includes testing in the conditions of drilling fields.

Key words: single-cone chisel, double-cone chisel, three-cone chisel, drilling machine, modified steel, hard alloy, tungsten carbide, cobalt, ultradispersed titanium carbide, chemical composition, granulometric composition.

Introduction. According to international standards, conical drills are produced in 3 types: single-cone; two-cone and three-cone dolots (Fig. 1).

abc

a) single cone; b) double cone; c) three-cone.

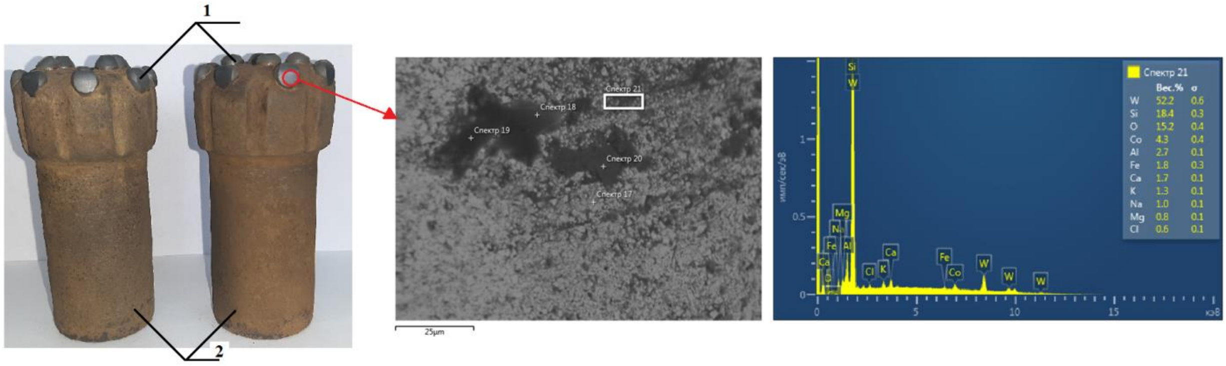
Figure 1. Types of conical awls

According to international standards, the length of the three-cone chisel is from 100 mm to 650 mm, and the diameter is from 46 mm to 508 mm. One- and two-cone dowels can be up to 20% longer than three-cone dowels. In the upper part of the dolota, there is a fastening part and it is fixed to the drilling station. The main part of these bits is made of steel modified with metals such as chromium, nickel, molybdenum, while the part of the bit that comes into contact with the ore during drilling, i.e. the base of the drill, is made of special hard alloys such as VK-6, VK-8. it is produced by powder metallurgy method and serves for long-term operation in conditions of abrasive particles.

Choosing a research object. The working part of the auger, which is the main element of the drilling rig widely used in the mining industry, was chosen as the research object. The main task of the

[1] Tashkent State Technical University Almalyk branch

dolot is to grind minerals, its general appearance, the abrasive worn surface of the working part and the chemical composition of the surface are presented in Fig. 1.



abc

1- working part; 2- fastening part

Figure 2. General view of the drill bit (a), abrasive worn surface (b) and chemical composition of the surface (c)

Based on the analysis of abrasive corrosion patterns of hard alloys in the drilling process, it should be noted that tungsten carbide-based and cobalt-bonded hard alloys in the drilling base do not completely solve the problems of abrasive wear resistance of the working surface, and the industry feels the need for new composition hard alloys.

Raw materials and their properties for the preparation of hard alloy tools. Tungsten carbide, cobalt and ultradispersed titanium carbide powders were selected as raw materials for the preparation of the working part of the tools. Tungsten carbide powder produced at the "IIChB for the production of rare metals and hard alloys" under "Almaliq KMK" JSC was selected as the material forming the basis of the hard alloy (it is produced according to the requirements of GOST 3882 and TU-48-19-60-78). Tables 1 and 2 show the chemical and granulometric composition of tungsten carbide powder produced at the "IIChB for the production of rare metals and hard alloys" under "Almalik KMK" JSC.

Table 1

Chemical composition of WC powder

W, %	$S_{universal}$, %	Amount of additives in the composition, % max.	
		$S_{is\ free}$	S
93,871	6.006	0.1	0.023

Table 2

Granulometric composition of WC powder

Size, µm	≤8	8-10	10-12	12-20	20≤
Amount of interest	1.6	4.9	13.1	80.04	0.36

Cobalt powder of PK-1u brand was selected as a binding component in hard alloy (manufactured according to the requirements of GOST 9721). Chemical and granulometric compositions of cobalt powder are presented in tables 3 and 4.

Table 3

Chemical composition of PK-1u brand cobalt powder

Co, at least, %	Amount of additives in the composition, % max.					
	Fe	Si	Ni	C	Cu	Loss of H_2 during prokalvania
99.25	0.2	0.025	0.4	0.02	0.04	0.1

Table 4

Granulometric composition of PK-1u cobalt powder

Size, µm	+71	+71...-41	-41
Amount of interest	4	66	30
Moisture	Not more than 0.15%		

Ultradisperse TiC powder (meeting the requirements of TU 6-09-492-75) was chosen to strengthen the binding component. The chemical composition and granulometric composition of ultradispersed TiC powder are presented in Tables 5 and 6.

Table 5

Chemical composition of ultradisperse TiC powder

TiC, min., %	The amount of additives in the composition, at most, %				
	$C_{general}$,	$S_{is\ free}$,	O_2	N_2	Al, Ca, Fe, K, Na, Mo, Si,
99.5	19.31	0.32	0.067	0.005	0.115

Table 6

Granulometric composition of ultradispersed TiC powder

Size, µm	-10	+10...+80	+80
Amount of interest	6	90	4

89%WC+6%Co+5%TiC (ultradisperse particle) brand dolomite samples were taken from the powders with chemical and granulometric composition in the above tables at different temperatures, and the degree of densification of the samples at the sintering temperature (th) and the amount of residual porosity (dependence on z) was studied (Table 7).

Table 7.

Dependence of the temperature of sintering of dolota samples on the degree of compaction and the amount of residual porosity

Sample number	Temperature, ^{O}S	th, %	z, %	Oven environment
101	1330	99.00	1.00	vacuum, 13.3 10^{-6} Pa
102	1340	99.60	0.40	
103	1350	99.88	0.12	
104	1360	99.98	0.02	
105	1370	99.98	0.02	
10 6	1380	99.98	0.02	

The temperature of the final annealing process had a variable effect on the degree of densification and the amount of residual porosity of dolota samples, that is, the increase in temperature from 1330 ^{O}C to 1380 ^{O}C led to an increase in the degree of densification and a decrease in the amount of ^{residual} porosity

· came But the presence of ultradispersed particles in the solid alloy ensured that their final hardening rate was at temperatures lower than 30-35 ^{O}C.

Conclusion. The selection of raw materials of solid alloys used in mining drilling and the study of their properties allows to interpret all the properties of alloys in advance. The inclusion of ultradispersed particles in tungsten carbide-cobalt-based hard alloys not only increased their strength, but also made the final annealing temperature 30-35 ^{O}C lower and increased the resistance to abrasive wear of the cobalt binder.

References:

1. DS Terentev, IS Laptev, D.A. Petrina. Vliyanie nanorazmernix chastits monokarbida wolframa na struktur i svoystva wolframokobaltovix tverdix splavov // XIV Mejdunarodnaya nauchno-teknicheskaya Uralskaya shkola-seminar metallovedov — molodix uchenikh, Yekaterinburg, November 11-15, 2013. Pages 242-244.
2. ST Parmonov., Sh.M. Shakirov, K.A. Sharipov, S. Sadaddinova. Percussion abrasive wear of abrasives on working details made from solid alloys // UNIVERSUM: TECHNIChESKIE NAUKI. May 2022 issue #5, pages 51-55.
3. ST Parmonov, FY Hakimov. HARD ALLOY APPLICATIONS (literature review) // UNIVERSUM: TECHNIChESKIE NAUKI. August 2023.
4. AN Stepanchuk, II Bilqk, PA Boyko // Technology powder metallurgy // Kiev. 2011. 215-270 st.