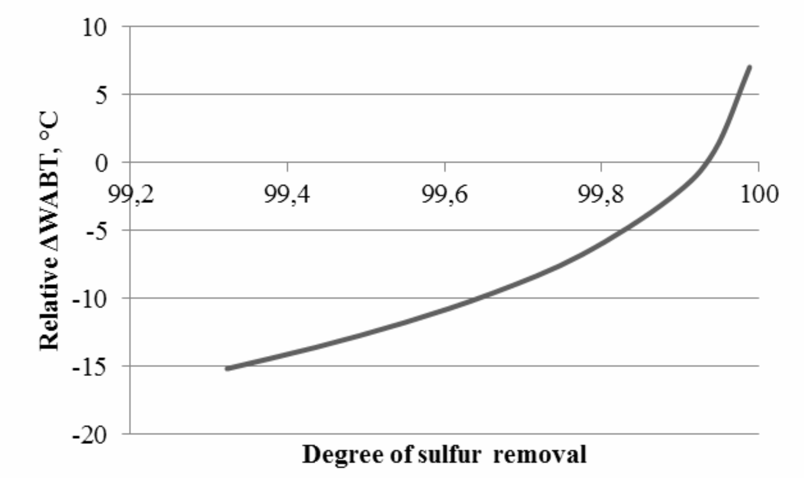

Fig. 5. Variation of weighted average bed temperature versus degree of desulfurization.

Due to the obtained graphs listed above, there is the possibility to predict required increasing or decreasing of the temperature in reaction zone. These changes can be caused, for example, by variations in productivity of the unit or by changes in desired degree of sulfur removing.

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TECHNOLOGICAL CHARACTERISTICS OF THE SURFACE OF THE CUTTING TOOLS AFTER THERMOCHEMICAL TREATMENT

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In modern machine industry more and more attention is paid to reliability and durability of the cutting tools. As a consequence, a large number of experiments and research for the purpose to increase life duration of cutting tools and their operating reliability is carried out. One of the methods to improve these characteristics is a thermochemical treatment.

Thermochemical treatment (TCT) is a universal method of surface alloying which provides formation of diffusion coatings on steel, cast iron, hard alloys.

Roughness of surface is one of the most important characteristics defining the operating characteristics of the cutting tool. Its value influences on the resistance of the cutting tool and on temperature and wear rate both of the front surface and the back surface.

Influence of the application of the diffusion layers on the surface roughness of the cutting tool is shown in Table 1. The surface roughness of the samples before and after saturation is evaluated on profilograph (model 201 according to State Standard 2789-73). Class of roughness was determined by the magnitude of the arithmetic average of profile R_a, which determined at five sites of test surface. Roughness of surface after application of the diffusion layers exceeds the initial surface roughness by 1-2 classes. The exception is the process of diffusion chromizing, after which roughness is stagnant or even decreases.

Table 1 – Roughness of surface of solid alloys after thermochemical treatment

№ п/п	Type saturation	ВК6		ТТ10К8Б	
		R_a, micrometer	Class of roughness of surface	R_a, micrometer	Class of roughness of surface
1	Basic	0,22 – 0,26	9а – 9б	0,23 – 0,26	9а – 9б
2	Cr	0,19 – 0,23	9б – 9в	0,26 – 0,29	9а
3	Nb	0,66 – 0,77	7в	0,40 – 0,45	8б
4	Cr-Ti	0,61 – 0,62	8а	0,52 – 0,60	8а
5	Ti-Nb	0,61 – 0,72	7в – 8а	0,40 – 0,52	8а – 8б
6	Cr-Nb	0,70 – 0,80	7в	0,90 – 0,91	7б

ВК6, ТТ10К8Б [2].

The surface hardness of the samples after the thermochemical treatment is measured on a Vickers hardness tester of 100 N and a Rockwell hardness tester under load 600 N. The result is determined as the arithmetic average of 10 – 15 measurements.

Application of the carbide layers increases the hardness of samples when measured on Vickers device and slightly reduces the hardness on scale A of Rockwell device (Table 2).

Table 2 – Effect of the application of the diffusion carbide layers on the hardness of hard alloys

№ п/п	Type saturation	ВК6		ТТ10К8Б	
		HV	HRA	HV	HRA
1	Basic	1420	88,0	1530	89,0
2	Cr	1850	85,3	1850	86,0
3	Nb	1680	84,1	1850	83,2
4	Cr-Ti	2290	87,6	3200	88,4
5	Ti-Nb	2830	86,9	1850	87,8
6	Cr-Nb	2320	87,8	2190	88,5

In the process of metal cutting most of the mechanical work, which expended in the cutting process, is converted into heat. The temperature in the cutting zone has a significant influence on the cutting process and tool wear.

Carbide layers give high wear resistance at high temperatures to carbide tools, reducing the tendency to seizure and improving chemical stability, criterion which is to enhance the oxidation resistance.

Heat resistance of the samples with and without diffusion layers is determined by the gravimetric method according to State Standart 6130-71. Test temperature is selected to 800°C in an air atmosphere. Selecting the test temperature of 800°C because, when the surface of the metal cutting, inserts is heated to the same a temperature. To simulate the conditions of the real cutting process, the heat resistance inflicted diffusion coatings was determined by cyclic heating samples by measuring the weight gain after 20 minutes of heating at a total exposure time temperature for 2 hours. Each result was obtained as the average of 4 - 5 measurements. The quantity of heat resistance was evaluated by the increase in weight of the sample divided by the surface area of the sample according to the formula:

$$K = \frac{q_1 - q_0}{S_0}, mg / sq.cm \ , \qquad (1)$$

where q_1 and q_0 – the mass of samples before and after heating; S_0 – the surface area of the sample before test.

Samples measuring 12,5 x 12,5 x 4,75 mm. The thickness of the diffusion layers was 1-15 micrometer. The test results on the heat resistance of the alloy samples ВК6 and ТТ10К8Б, at two-component saturation (t =

1000°C, 4 hour) showed significant improvements in oxidation resistance (the best score in carbide inserts subjected chromium-titanium).

When oxidized carbide alloy, then cross-section of the oxidized sample in the plane, parallel to the original surface has the shape of a Maltese cross. Appearance of such a sample with outgoing angles at the edges is a typical sign of easily oxidation on the surface of the section metal-oxide [1]. Porosity of scale explained volatility resulting oxide $W0_3$. Tungsten carbide is susceptible to oxidation to a greater extent than titanium carbide.

When happen combined saturation with forming in diffusion layer a titanium and niobium carbides, heat resistance curve has a smooth appearance, that can indirectly serve as proof of the formation of mixture carbides in layer.

Differents in heat resistance of carbides can be explained as follows. When oxidized carbides side by side oxidation of metals, then form gaseous oxides of carbon and nitrogen, that loosen the oxide film. Protective ability of oxides can be roughly estimated by relation Pilling-Berdvards:

$$\alpha = \frac{M \cdot d}{m \cdot D}, \qquad (2)$$

where M – molecular weight of the oxide, resulting in the oxidation of 1 mol of a compound; m – molecular weight of the oxidized compound; D, d – density of the oxide and compound.

This relation shows how the specific volume formed by the interaction with the external environment of the oxide is more or less than the specific volume of the oxidized compounds. If the value is $\alpha < 1$ oxide film formed is not solid, that causes a continuous oxidation; if the value $\alpha > 1$ forms a protective oxide layer, hindering the access of oxygen to the compound. For large values of the oxide layer, it receives large internal stresses, has brittleness and loses its protective properties. The greatest protective properties have oxide layers, which somewhat greater than 1. Pilling-Berdvards values for some carbides are given in table 3.

Table 3 – Values of the Pilling-Berdvards' criterion

	T_iC	Z_rC	N_bC	T_aC	Cr_3C_2	Mo_2C	WC	VC
Relation of Pilling-Berdvards	1,53	1,42	2,22	1,91	1,17	3,56	2,72	3,45
t° of active oxidation, °C	1100 – 1200	1100 – 1200	900 – 1000	900 – 1000	1100 – 1200	500 – 800	500 – 800	800 – 900

1. It is revealed that roughness of surface of carbide cutter insert after thermochemical processes increases, excluding the diffusion of chromium plating, after which roughness is stagnant or even falling.
2. After thermochemical treatment of solid sintered alloys, increased their heat resistance and microhardness of the surface layer. Better heat resistance have hard alloys with application of chromium carbide layers, which is consistent with the data obtained by Pilling-Berdvards' criterion.

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CROSSROADS

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Traffic on roads may consist of pedestrians, ridden or herded animals, vehicles, streetcars and other conveyances, either singly or together, while using the public way for purposes of travel.

A road junction is a location where vehicular traffic can change between different routes or directions of travel.