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TECHNOLOGY OF COATING ON GUN DRILLS

Barakaev Nusratilla Rajabovich
Doctor of technical sciences, professor
Urinov Nasillo Fayzilloevich
Candidate of technical sciences, associate professor
Shomuradova Indra Fozilovna
Undergraduate
Bukhara Engineering-Technological Institute

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Abstract:
The article covers technological process of applying coatings by PVD-method and analysis of variations of deposition

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INTRODUCTION

The use of wear-resistant coatings is very promising direction for improving the accuracy and surface quality of deep holes obtained with gun drills. The coatings are deposed to previously prepared working part of the gun drill (Fig. 1).

Fig. 1. Gun drills with coatings deposed

In relation to gun drills, firms *Botek, Stock, Guhring* (Germany) recommend the following types of coatings (Table 1.1).

Table 1
Wear-resistant coatings for gun drills

Coating	Microhardness,HV*	Oxidation start temperature, °C	Friction coefficient**
TiN	22…26	400…550	0.4…0.55
AlTiN	32…36	700…900	0.5…0.70
TiCN	35…40	400	0.2…0.3

* The optimum range of hardness is indicated;
** Friction on steel 45.

MAIN PART

Wear-resistant coatings are deposed on the working part of gun drills in two ways [1]:

1. Chemical deposition of coating from the atmosphere – Chemical Vapor Deposition (CVD)
2. Physical deposition of coatings in vacuum – Physical Vapor Deposition(PVD)

However, because the *CVD* method is more expensive, less productive and more sensitive to changes in technological parameters, the *PVD* method is most widely used.

Typical technological process for applying coatings by the *PVD* method consists of the following basic operations [1]:

1. Loading drills, heating and pumping out the vacuum chamber;
2. Cleaning of working surfaces of drills by ion etching in a gas discharge;
3. Cleaning of working surfaces of drills by bombardment with metal ions and heating to operating temperatures;
4. Coating;
5. Cooling and unloading of drills;
6. Quality control of the applied coating.

Functional characteristics of the coating and, above all, its adhesion to the base, strongly depends on the quality of preparation of the mating surfaces. Therefore, the surfaces of the working part of the gun drill are carefully prepared in advance. The operations of preparation of mating surfaces include [1]:

1. Sharpening
2. Ultrasonic cleaning;
3. Washing;
4. Vacuum drying (70-80°C)

After diamond sharpening of gun drills, their cutting edges have sharp saw-tooth edges (Fig. 2) [2]. When drilling, this leads to a reduction in tool life. Therefore, in [2], it is recommended after diamond sharpening to carry out “dry” polishing in the medium of aluminum oxide - corrax granules or mixture recommended by *Otec* firm, consisting of 70% silicon carbide with a grain size of 1.4 mm and 30% walnut granules with a grain size of 1.6 mm

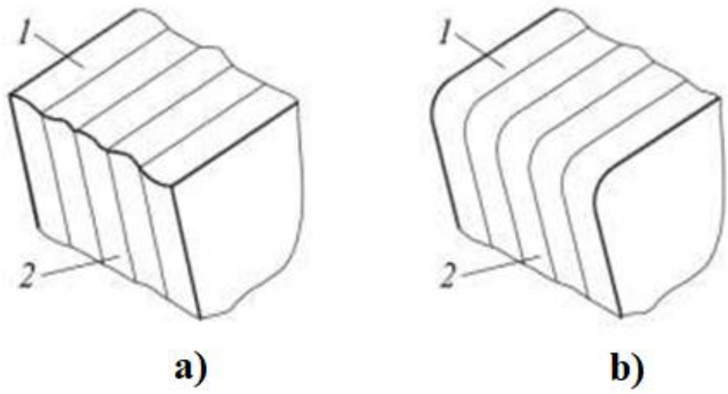

Fig. 2. View of cutting edge of the gun drill
a- after diamond grinding; b- after “dry” polishing (1- front surface; 2- rear surface)

The following coating variations are used for PVD-method (Fig. 3) [26]:

a) Method of vacuum-arc evaporation;
b) Method of magnetron sputtering;
c) Method of electron beam evaporation.

PVD methods, as a rule, are based on the evaporation (sputtering) of a substance in a vacuum chamber, followed by ionization of particles, acceleration in electric (magnetic) field towards the surface to be coated, and their condensation on this surface in the presence of a reaction gas.

Refractory metals (Ti, Cr, Mo, Zr, Al, etc.) are usually used as the evaporated (sprayed) substance, and nitrogen, methane, oxygen are used as reaction gases, and, accordingly, coatings are obtained in the form of nitrides, carbides, carbonitrides or oxycarbides of refractory metals.

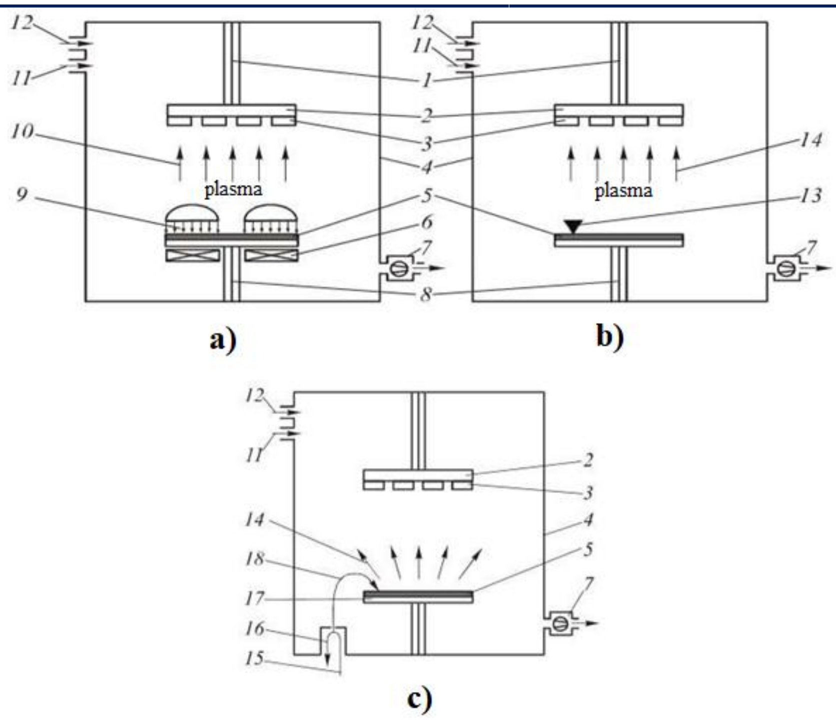

Fig. 3. Schematic diagrams of covering deposition on cutting tool by *PVD*-methods: 934774440
a- magnetron sputtering; b- vacuum-arc evaporation; c- electron-beam evaporation
1 – shift voltage supply; 2 – tool holder; 3 – tool; 4 – vacuum chamber; 5 – sediment material; 6 – magnet system for magnetron sputtering; 7 – vacuum pump; 8 – disruption voltage supply; 9 – ionic beam; 10 – sputtered material; 11 – reactive gas; 12 – inert gas; 13 – cathode spot; 14 – evaporated material; 15 – accelerating voltage supply; 16 – thermal cathode; 17 – crucible; 18 – electron beam

To implement *PVD*-method, the equipment of *Hauser* (Netherlands), *Oerlikon Balzers* (Switzerland), Platit (Switzerland), Multi Arc Vacuum System (USA) and other are used.

CONCLUSIONS

As an example, general view of installation for coatings deposition by the PVD method is given on Fig. 4, and the characteristics of coatings obtained by the PVD method are given in Table

Fig. 4. Platit (Switzerland) brand installation for deposition of wear-resistant coatings by PVD-method p-300

Main characteristics of coatings obtained by the PVD method

Coating	Color	Microhardness,HV*	Friction coefficient **	Temperature of oxidation beginning in air, ˚C
TiN	golden	23…25	0.55	550…600
TiCN	gray-blue	35…37	0.2	400
(Ti, Al)N	violet	31…35	0.6	800…850
(Ti, Al)CN	black	35…37	0.25	500
CrN	violet	12…14	0.3	650
ZrN	red	26…28	0.5	550
(Ti, Cr)N	silvery	18…20	0.5	700
(Ti, Al, Cr)N	metal	28…30	0.4	850…900

* Optimal range indicated;
** Friction on steel 45.

REFERENCES

1. Grigoriev S.N. Methods of increasing the durability of cutting tools. Moscow: Mechanical engineering. 2011, p. 368.
2. Kirsanov S.V., Grechishnikov V.A., Babaev S.A. Tooling backup for drilling deep and accurate holes of small diameters /