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POSSIBILITY OF APPLICATION OF RARE METALS IN THE INDUSTRY OF UZBEKISTAN

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Annotation: *The demand for rare metals in high-tech industrial productions determines their high cost on the world market. The article provides an example of the possibility of using rare earth metals for coating the plates of cutting tools in order to increase productivity.*

Keywords: *cutting tool, rare metal, tool, CNC machine, plate, PVD coatings, CVD coating.Mastering the production of fundamentally new types of products and technologies, ensuring on this basis the competitiveness of domestic goods on external and internal resources.*

Uzbekistan has a highly developed metallurgical industry, which is based on the richest natural resources. Suffice it to say that Uzbekistan ranks fourth in the world in terms of proven gold reserves and seventh in terms of its production, seventh in terms of uranium reserves and eleventh – twelfth in the world in terms of copper reserves. The republic also has significant reserves of other metals, including precious and rare earths, such as silver, molybdenum, bismuth, tungsten, lithium and others.Mechanization and automation of production and technological processes should be considered both from the point of view of improving equipment, technological equipment and process quality, and from the point of view of ensuring the technical and economic efficiency of the use of rare earth metals.The specificity of rare metals and at the same time their demand in high-tech industrial productions determine their high cost on the world market, disproportionately greater than the cost of the most familiar metals, their alloys or chemical compounds.It can only be summarized that at present rare metals should be considered not only as "vitamins of industry", but also as full-fledged factors of innovative industrial development of our

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country. Therefore, the strategically important state task of the birth of our entire production structure has arisen.Rare metals - the historically established name of a large group of elements, this term to a certain extent reflects a number of their features:

-relatively small scale of production and consumption, one of the most well-known rare metals, for example, rubidium, is produced in quantities about 130 times smaller than 2 aluminum;

-low prevalence in nature, their clarks do not exceed 10-9%; the most common rare metal rubidium is contained in the earth's crust in an amount of 0.015%;

-most rare metals do not form independent minerals in nature and are scattered in the crystal lattices of other minerals; many of them are natural satellites of heavy and light non-ferrous metals;

-very low content in ores and extremely complex composition of such raw materials; no rare metal is obtained by direct reduction from raw materials, initially the raw materials are enriched and the resulting rough concentrates and industrial products are processed into chemical compounds;

-in addition to ore raw materials, the source of rare non-ferrous metals is industrial waste from non-ferrous and ferrous metallurgy, chemical industries.The use of rare metals began at the end of the XIX century . The first of their number was recognized by tungsten, followed by molybdenum, niobium, tantalum, and then gradually the rest. There is a predominance of them in the bowels of Uzbekistan.

One of the conditions for the effective operation of automatic lines, CNC machines and automated complexes of these machines controlled by computers, as well as flexible automated systems is the use of quick-change non-commissioning designs of tools and tool blocks (cutting and auxiliary tools assembled). Rapid tool changeability is ensured by improving the methods of its fastening and basing, as well as the unification of the connecting surfaces of the cutting and auxiliary (clamping) tools in order to reduce its nomenclature. The cutting tool is an integral part of the integrated automated system of the CNC machine.The cutting tool for CNC machines must meet the following requirements: ensuring high and stable cutting characteristics;

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satisfactory chip formation and removal; ensuring specified conditions for processing accuracy; versatility of application for typical machined surfaces of various parts on different machine models; quick changeability when switching to another machined part or replacing a blunted tool. When cutting workpieces by turning, milling, drilling and similar operations, cutting tools are used. In order to guarantee effective chip removal from the workpiece and sufficient tool life, the cutting plate of the cutting tool must be hard and viscous. Hardness, however, may be related to brittleness. Composite materials with both hardness and viscosity containing solid ceramic particles in a metal matrix are a very popular choice for plates. A number of such metal-ceramic composites or cermets have been developed. The so-called hard metals or hard alloys, in particular WC-Co, consisting of tungsten carbide grains in a cobalt matrix, are the materials chosen to make cutting tool plates for many applications. The plates remove the chips and shape the workpiece, but they themselves wear out during processing. The wear of the cutting tool plates occurs on their contact surfaces with the workpiece and can be mainly caused by mechanical, chemical and thermal interaction with the workpiece. Idle machines during the plate change is very expensive. Many studies are aimed at improving the wear resistance of plates through the use of hard coatings. Hardness is a measure of resistance to plastic deformation and there is a relationship between hardness and wear resistance. Although coatings increase wear resistance, they are often subject to catastrophic types of destruction, such as peeling and the like. Coatings can be formed on plates through a number of technologies, which are mainly classified as PVD (physical vapor deposition) or CVD (chemical vapor deposition). The PVD process gives the coating very good properties. The coating is applied to a surface accessible to irradiation. PVD coatings are characterized by compressive residual stresses that occur during the application process.

Due to the risk of coating destruction as a result of peeling with increasing coating thickness, PVD is mainly limited to thin coatings.CVD coatings are not coatings applied to an exposed surface. Moreover, the deposition temperature is usually much higher than with PVD technologies, which facilitates the development of a diffusion

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layer between the coating and the substrate, which allows for good adhesion between them. Good adhesion is one of the most important requirements for plate coatings.In addition, there are a number of materials and material-base combinations that can only be applied using one or another coating technology.The use of a prefabricated tool with replaceable polyhedral plates (SMP) makes it possible to improve the operational qualities of the tool, provides significant savings in scarce cutting materials. At the same time, favorable conditions are being created for the widespread use of more wear- and heat-resistant cutting materials.

The assembled tool with SMP has found wide application, its output is constantly increasing, both in volume and in nomenclature. The specific weight of such the tool today accounts for 35 – 40% of the total output of cutting tools.

Fig.1.The milling cutter with the use of coated plates

The choice of cutting tool material is an important factor when planning a metalworking operation, and the use of coatings on cutting plates also increases productivity. Tool materials are a variety of alloys with specific properties, and can have various combinations of hardness, strength and wear resistance. As a rule, the tool material demonstrating good processing results should have the following characteristics:

- Hardness to ensure resistance to deformation and wear on the back surface;
- Strength to avoid breaking of the cutting edge;
- The ability not to react with the processed material;
- Chemical stability to counteract oxidation and diffusion;

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- Resistance to sudden temperature changes.

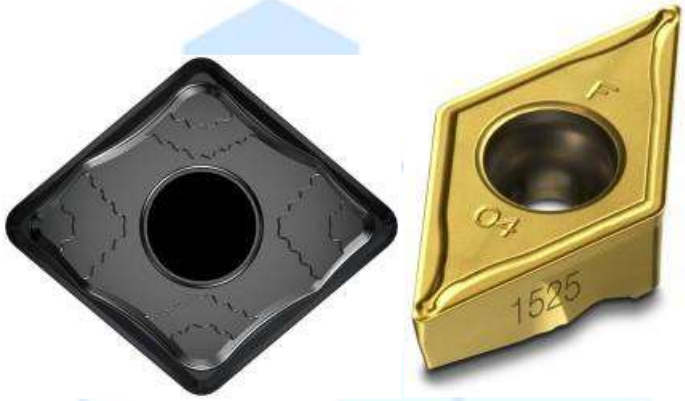

Fig.2 Cutting plates made of a) kermet, b) coated with a tungsten-rich cobalt binder.

Further, Kermet firmly occupies its position – it is a solid alloy containing particles of high hardness based on titanium. The name "kermet" consists of two words – ceramics and metal. Initially, the cermets consisted of titanium carbides (TiC) and a nickel binder. Modern cermets no longer contain nickel, but have a complex structure including particles of titanium carbonitride Ti (C, N), the second solid phase (Ti,Nb,W) (C,N) and. Ti (C, N) adds wear resistance to the alloy, the second solid phase increases resistance to plastic deformation, and the amount of cobalt will determine the strength. Compared with conventional hard alloys, kermet has a higher wear resistance and a low tendency to stick. On the other hand, it has a lower compressive strength and low thermal shock resistance. Cermets can also act in combination with a PVD coating to improve wear resistance. A replaceable plate made of hard alloy is a tool of a certain shape (geometry), it happens with and without holes, sometimes for even better resistance to high temperature and mechanical stress, the plates are coated with special compounds. The more edges the plate has, the longer it can be used, turning the sharp side over each time. If there are several cutting edges, it saves money! And the use of coatings applied to cutting surfaces with a size of several mm not only improves the cutting properties, but also leads to savings of rare metals. The introduction into the industry of Uzbekistan of the use of rare metals for its own needs leads to an increase in competitiveness and economic growth.

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