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Composite materials production technology for machining materials

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The interfaces in such compounds can be considered as independent elemental structures in which the dissolution processes, the formation of new phases, and the redistribution of impurities occur. The transition layer plays an important role. The technology for the production of composite materials for machining materials is based on the ability, under certain specified conditions, to combine chemically inactive materials into monolithic compounds for the possibility of their practical implementation.

In the transition layer, a bond is formed between the main elements of the hard coating and the matrix. The level of properties of the created composite material depends on the perfection of this connection. An important role is played by intermediate layers, which promote the activation of the diffusion capacity of the hard alloy elements into the matrix of the base material. These elements include, first of all, elements of the groups' copper, nickel, titanium, and intermetallic compounds. In the deposition of local thin films, the technique of magnetron vacuum deposition was mainly used to create intermediate diffusion layers. In these systems, the material is sputtered by bombarding the surface of the target (sample) with ions of the working gas (argon), which are formed in the optimal glow discharge plasma. This method is well proven when thin films are implanted on the surface of a metal cutting tool at low sample surface temperatures. However, the use of an inert gas as a carrier of ions will create a "thermal" effect during spraying and will not allow the required amount of material to be applied to the covered cavities and onto a sufficiently rough surface.

The magnetron method also limited the technology in the materials used, since only non-magnetic metals can be sprayed. The use of an arc discharge in vapors of the working substance allows the ion deposition process to be carried out in a sufficiently high vacuum and without the use of an inert gas as an ion carrier. To ignite an arc discharge in a vacuum, this installation uses an electromechanical system as it has the greatest reliability and simplicity (table 1).

Table 1 - Main technical characteristics of the electric arc evaporator

Alternating current voltage 50 Hz	– 220 V.
Power consumption no more	– 2 KW.
Rated working arc current	– 75-100 A.
Number of current control channels electromagnetic coils	– 2.
Current in the substrate circuit in the deposition mode coatings	– 25A.
The high voltage potential of the substrate	– 600…1000 V.
Evaporator water cooling	– 40 l \ h.
Minimum	– 5 mkm \ h.
Maximum	– 100 mkm \ h.

For films with a melting point above 1000 ... 15000C, the formation of non-oriented layers with small granule sizes not exceeding 15 nm is characteristic. For films with a melting point below 10,000 C, the layers consist of large single crystals oriented relative to the substrate.

Table 2 -Voltage values at the evaporator cathode at the minimum stable arc current

Evaporated material	Al	Ti	Cu
Cathode voltage B	20	21	20
Minimum arc current A	40	50	30

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