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COATING DEPOSITION ON CUTTING TOOLS AND STAMPING EQUIPMENT USED IN THE MANUFACTURE OF POWER MACHINES PARTS AT THE "KREMEN-2" PVD COATING MACHINE *)

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The paper presents wear-resistant coating deposition technology process developing using cathodic arc (ARC PVD). Development of deposition process can be divided into four stages: development of chemical compositions and coating architecture; development of technology for manufacturing targets of a given composition; development of equipment for coating deposition technological process and development of coating deposition modes.

During the research, it was revealed that the most promising coatings have a nano-sized structure: nanolaminated coatings, in which there is a periodic (with a period of the order of 10–20 nm) alternation of layers of different chemical compositions and nanocomposite coatings, in which particles of the solid phase are located in an amorphous matrix, which prevents the growth of crystallites of solid particles. The principle of increasing hardness and wear resistance in such coatings is described by the Hall-Petch equation:

$$HV \approx \sigma_0 + Kd^{-1/2}, \qquad (1)$$

where HV – hardness, σ_0 – stress at the onset of dislocation slip in the crystal, K – coefficient depending on the material. In nanocomposite coatings, as the grain size decreases, the movement of dislocations becomes energetically hampered, which is why hardness increases [1].

For the deposition of nanostructured coatings, during the work, the “Kremen-2” PVD coating machine was developed, in which the process based on deposition from a vacuum arc (ARC PVD).

«Kremen-2» has an oil-free vacuum pumping system, which allows obtaining a working vacuum at the level of 5·10–4 Pa. The installation is equipped with the following electrophysical devices:

- 12 arc evaporators with a discharge current of up to 140 A, equipped with a magnetic arc control system. The arc control system makes it possible to reduce the volume of the droplet phase in the deposited coating [2];
- gas ion source with voltage up to 3.5 kV;
- MEVVA type metal ion source with an accelerating voltage of up to 50 kV.

References

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