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ION-PLASMA METHOD FOR FORMING MULTILAYER CERAMIC HARD COATINGS*

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A method for vacuum-arc plasma-assisted deposition of ceramic hard coatings based on high-entropy alloy (HEA) nitrides has been developed. The scheme of the experiment on the deposition of HEA coatings is shown in fig. 1.

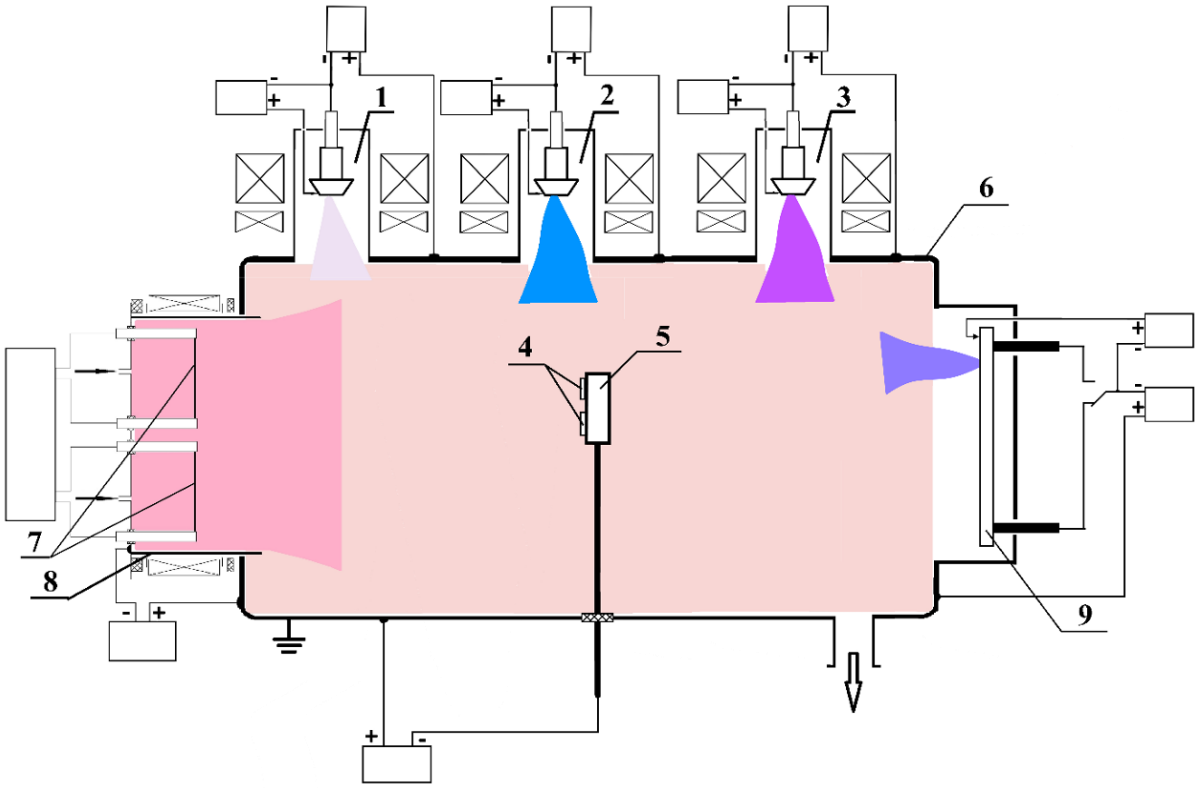

Fig. 1. Scheme of the experiment on obtaining HEA-hard coatings: 1 – DI100 arc evaporator with Mo cathode, 2 – DI80 arc evaporator with Nb cathode, 3 – DI100 arc evaporator with Ti-Al cathode, 4 – samples, 5 – substrate holder, 6 – vacuum chamber, 7 – heated cathodes, 8 – PINK-P gas plasma generator, 9 – DP400 arc evaporator with Cr cathode.

After fixing the samples on the substrate holder, the vacuum chamber was evacuated by a turbomolecular pump to a limiting pressure of $5 \cdot 10^{-3}$ Pa. Then, argon was injected to a pressure of 0.3 Pa, an extended gas plasma generator "PINK-P" with an output aperture of 40 × 400 mm was turned on, and ion-plasma cleaning of the surface of the samples took place. After cleaning, a mixture of gases (argon + nitrogen, pressure 0.3 Pa) was injected in different proportions and all metal plasma generators were turned on simultaneously, which ensured the generation of a sufficiently homogeneous in volume (± no worse than 20% of the average density value) multicomponent gas-metal plasma and HEA coverage growth. After the deposition was completed, the samples were cooled in a vacuum chamber to a temperature below 100°C and removed for examination. Optimal modes of application of ceramic coatings of HEA are revealed; the radial distribution of the ion current density from the plasma, the deposition rate, and the elemental composition of the coatings are determined. The elemental and phase composition, the defective substructure of ceramic coatings have been studied, the microhardness, wear resistance and friction coefficient have been determined.

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