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STUDY OF THE INFLUENCE OF PLASTIC DEFORMATION OF THE HSS M2 SURFACE ON ION-PLASMA NITRIDING IN THE GLOW DISCHARGE*

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This paper examines the influence of plastic deformation of the HSS M2 surface on the characteristics of the hardened layer after ion-plasma nitriding in the glow discharge.

It is known that diffusion of atoms in metals is greatly influenced by various structural defects - deviations of the lattice structure from the ideal one [1]. As the structural defects increase, the diffusion rate in the metal increases. However, along with structural defects, diffusion is also affected by the size of the metal grain: the finer the grain, the higher the diffusion rate [2, 3]. Therefore, to increase the diffusion rate in metals, methods of plastic deformation have recently become increasingly widespread. One of these methods is the method of intense plastic deformation by torsion, which consists in deformation of metal by two simultaneously acting forces: compression and torsion (Fig. 1a).

In the study it was found that the plastic deformation of the steel surface increases the rate of nitrogen diffusion deep into the material, due to an increase in dislocation density and the formation of microdefects, due to a highly refined grain-like ultrafine grain structure. It was also found that the plastic deformation of the steel surface before ion-plasma nitriding leads to a 2-fold increase in the thickness of the hardened layer HSS M2, due to an increase in surface free energy, which contributes to increased adsorption of the saturation element and the formation of nitrides in the near-surface layer of nitrided material.

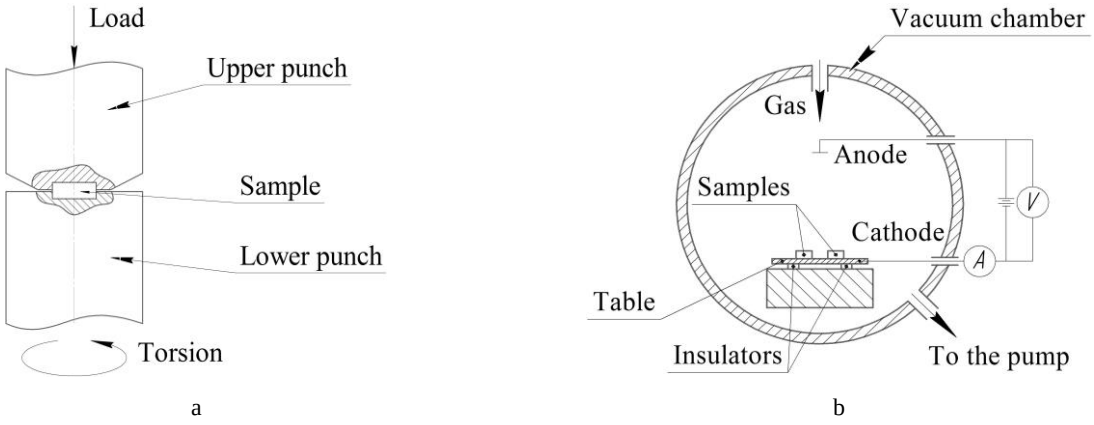

Fig.1. Process schemes: a - severe plastic deformation by torsion, b - ion-plasma nitriding in a glow discharge.

REFERENCES

[1] Bokshtejn B. S., Diffusion in metals, Moscow: Metallurgy, 1978.

[2] Valiev R. Z., Zhilyaev A. P. and Langdon T. G., Bulk nanostructured materials. Fundamental and Applications, Hoboken: Wiley/TMS, 2014.

[3] Valiev R. Z. and Aleksandrov I. V., Nanostrukturnye materialy, poluchennye intensivnoj plasticheskoj deformaciej, España: Universidad Complutense de Madrid, 2000.

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