

MAGNETRON FORMATION AND USE OF INTENSIVE GAS-METAL PLASMA FLOWS

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This paper states that the surface strengthening of a machine part structural material by the physical action of concentrated energy flows on the surface under treatment is the most universal and effective method for maximizing the function and performance indices. The paper considers surface treatment technologies based on the use of a high-energy gas-metal plasma flow generated by an abnormal glow discharge with closed electron drift. Gas-metal plasma is used in modifying a surface working metal layer and in depositing a nanostructured functional coating. In this work, gas-metal plasma was generated using an unbalanced magnetron sputtering system operating in the magnetron discharge current frequency modulation mode.

The aim of this work was to develop a plasma process device with a high-current pulsed magnetron discharge (HCPMD) for generating a high-energy gas-metal plasma flow. The device is designed for an integrated treatment of friction pair working surfaces. The strengthening is achieved by a surface modification of the structural material via high-intensity low-energy ion nitriding followed by the deposition of a nanostructured functional coating. It was shown by experiment that an HCPMD is suitable for generating a high-energy gas-metal plasma flow thus assuring a high-quality strengthening of the structural material surface. The device is designed for performing all stages of ion-plasma treatment in a single vacuum cycle.

The spatial characteristics of a gas-metal plasma flow were studied, and it was shown that the device developed is more efficient for a local treatment of tube-type friction pair working surfaces. The local parameters of an HCPMD plasma in the vicinity of the surface under treatment were studied. Samples treated by combined strengthening that includes preliminary plasma beam nitriding and the final deposition of a nanostructured functional coating were prepared. It was shown that surface treatment in the HCPMD mode results in performance characteristics superior to those obtained when the magnetron device operates in the stationary discharge mode.

Keywords: *physical vapor deposition (PVD), high-intensity low-energy ion implantation, high-current pulsed magnetron discharge (HCPMD), planar magnetron sputtering system, cylindrical magnetron sputtering system, pulsed discharge power source.*

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