

**DEVELOPMENT AND STUDY OF A PROTOTYPE LOW-FREQUENCY
POWER SOURCE FOR A HIGH-CURRENT PULSED MAGNETRON
DISCHARGE**

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This paper addresses the problem of the development of a discharge power source compatible with plasma magnetron-type process devices with an unbalanced magnetic system. The aim of the work was to develop a circuit for magnetron discharge voltage modulation based on inexpensive electron components. Consideration is given to possibilities of implementing a package surface treatment technology using a pulsed flow of an energetic gas-metal plasma generated by an anomalous glow discharge with closed electron drift.

The applicability of two discharge voltage modulation circuits based on an inductive/capacitive energy storage system was studied. A resonance modulation circuit with charging voltage doubling was chosen. The circuit makes it possible to generate discharge pulses of width up to 10 ms and power up to 20–30 kW at a pulse repetition rate up to 100 Hz. The discharge voltage was switched using type 161-160-16 thyristors. The parameters of the modulation circuits under study were tried out together with a prototype integrated magnetron plasma device with a planar and a cylindrical magnetron sputtering system of the unbalanced and the balanced type, respectively.

The operating parameter range of a high-current pulsed magnetron discharge voltage source was determined. Plasma parameters in the surface treatment area were studied. The metal ion content of the generated plasma was determined. Coatings with characteristics exceeding those obtained using a steady magnetron discharge were deposited. The plasma process device studied in this work allows one to execute all process steps of ion-plasma treatment in a single vacuum cycle.

It is concluded that the pulsed discharge source circuit developed meets the requirements for the deposition of functional nanostructured metal coatings and is suitable for high-intensity low-energy nitrogen ion implantation.

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

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