MEASUREMENTS OF THE ENERGY AND MASS-CHARGE COMPOSITION OF THE ION FLUX OF A VACUUM SPARK ON A TUNGSTEN CATHODE COATED WITH FUZZ NANOSTRUCTURES. *

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The report is devoted to measurement of ion flow parameters of vacuum spark discharge with tungsten cathode, coated with FUZZ nanostructures.

A pulse of 20 kV, 50 ns was used. Distance cathode-anode 30-20 microns. Measurements were taken in 10 series of 100 pulses. For each position of the cathode, three series of 100 pulses were performed.

All components of the experimental setup are arranged coaxially, which makes it easier to find the optimal relative position of the spectrometer source and detector to obtain a spectrogram. The Thomson spectrometer has a circuit modified with respect to those previously used [1].

This design of the spectrometer differs from the previously used one by the presence of a plasma disruption system with additional acceleration of the ion component by 200 eV.

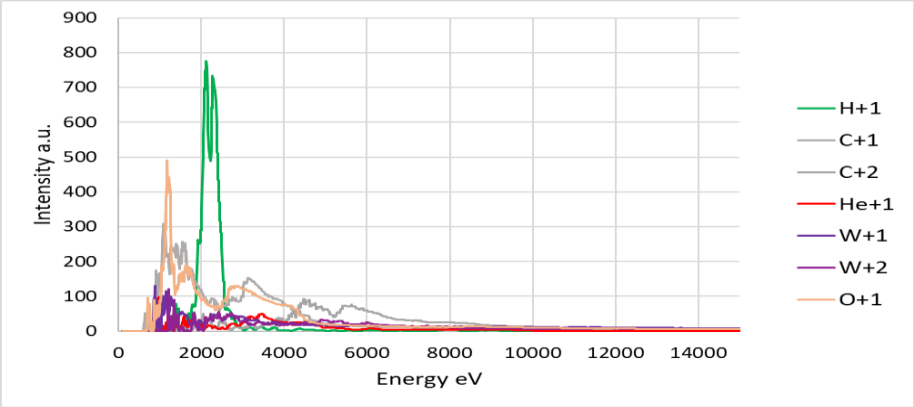

Fig.1. Energy spectra of the ion flux from the surface of tungsten coated with FUZZ for the first hundred pulses.

As a result of the measurements performed, it can be unambiguously indicated that during the first few tens of discharges on the FUZZ surface, the flow contains mainly hydrogen ions and impurities. Subsequently, the proportion of tungsten ions increases, while the proportion of hydrogen ions decreases to a few percent. The helium ion signal is present in almost all frames with a good ion signal. The energy spectra of the ions contain several local maxima in the range of 1000-6000 eV, which is several times less than the pulse amplitude at the anode, and, consequently, the energy of explosive electrons. When the cathode surface is cleaned from the coating, the proportion of fast hydrogen ions decreases, therefore, the velocity of the plasma boundary should drop by an order of magnitude from 10^8 cm/s to 10^7 cm/c.

REFERENCES

[1] Muzukin I.L . A Nanosecond Discharge Over a Dielectric Surface as a Method for Generation of Multicharged Plasma Plasma Science, IEEE Transactions 2005, vol. 33, № 5 Page(s): 1654 – 1657.

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