C2-P-025702

VARIATION OF THE ION CHARGE STATE IN THE PLASMA FLOW DURING THE REPEATING MICROSECOND VACUUM ARC DISCHARGE WITH THE W-FUZZ CATHODE*

YU. A. ZEMSKOV, YU.I. MAMONTOV, I.V. UIMANOV

Institute of Electrophysics UB RAS, Yekaterinburg, Russia

The "W fuzz" nanostructure, which is a harmful effect in the operation of thermonuclear installations, has been widely studied over the past decade. One of the aspects of the study is the electrophysical properties of this nanostructure, in particular, the fundamental properties of its behavior in vacuum discharges. Thus, it was shown [1] that the average charge of tungsten ions in the plasma of a vacuum arc on a “fuzz”-nanostructured cathode surface differs significantly from the average charge of tungsten ions in the absence of nanostructured formations. The average charge in the case of the presence of "fuzz" layer was noticeably lower than without it. In addition, it was shown that the average charge of tungsten ions increases as the sample surface is eroded by repeated discharges. In this work, an attempt was made to confirm and clarify the data of [1]. For this aim, a short arc discharges up to 10 μs were chosen with purpose to provide greater detail in measurements of the evolution of the charge composition of the arc plasma as the nanostructured layer was destroyed. The Thomson spectrometer with automatic signal recording and digital data analysis was used as an analytical instrument. The arc on the "W-fuzz" sample was initiated more than 350 times. The results demonstrate an increase in the average charge of tungsten ions with the erosion of the sample surface. However, in this experiment, contrary to the results of [1] it was not possible to achieve the ion flow parameters equal to parameters for tungsten samples without fuzz-nanostructure. In addition, the detailing of erosion using short arcs made it possible to record a very noticeable spread in plasma parameters from discharge to discharge (± 0.5 units for the value of the average charge of tungsten ions). These features can be explained by the incomplete destruction of the nanostructured layer in the region accessible to arc plasma. This effect is apparently possible in case of the short arcing on the large sample.

REFERENCES

[1] S.A. Barengolts et al, “Dynamics of the changes in the parameters of the arc plasma during the destruction of a heliuminduced tungsten fuzz by arc pulses”, 2020, Nucl. Fusion **60** 044001.

* The work was supported by the Russian Science Foundation (grant No. 20-19-00323).