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The efficiency of the pulsed power input in the limited plasma diode

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The work deals with obtaining the high pulsed power in the high-current plasma diode. Under certain conditions in the diode, the space charge electric double layer is formed in the current-carrying plasma. Almost all active discharge voltage focuses on it. The powerful electron and ion beams accelerated in the layer can be used both for the solid surface treatment, and for the plasma heating. In the last case the fast and local energy input into the plasma occurs.

The investigations were carried out using the high-current plasma diode with a limited working surface of high-voltage electrode. Such scheme provides the stable double layer localization near the work surface. The working surface limitation was carried out by means of ceramic insulator which closed the high-voltage electrode side surface. The current density on the electrode could reach up to 2 MA/cm^2. Under conditions of the double layer formation at relatively small stored energy in capacitor bank (up to 200 J) it is possible to get over 100 MW pulsed power inputted into the discharge. This allows using such diode for generating the powerful directional EUV radiation. The observed radiation power at a wavelength of 13.5 nm reached up to 3 MW.

For correct calculation of the active power dynamics inputted into the discharge it has been developed the calculation method based on the discharge current dynamics. The key points that influence on the results accuracy have been determined.

Since the double layer is a powerful dynamic system, the works on separation of the double layer current capacitive component from the discharge current have been carried out. The obtained in quasi-MHD approximation the expression for the strong double layer capacity shows that in our case at the layer voltage V_{DL} ~ 100 V, the layer capacity reached C_{DL} ~ 0,5 μF!

Authors: Prof. AZARENKOV, Mykola (V. N. Karazin Kharkiv National University); Mr HRECHKO, Yaroslav (V. N. Karazin Kharkiv National University, Ukraine); Mr KASHIRIN, Anton (V. N. Karazin Kharkiv National University); Dr SEREDA, Ihor (V. N. Karazin Kharkiv National University); Dr TSELUYKO, Aleksandr (V. N. Karazin Kharkiv National University)

Presenter: Mr HRECHKO, Yaroslav (V. N. Karazin Kharkiv National University, Ukraine)

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