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Contact diagnostics of pulsed plasma

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In the present work the concentration and energy of charged particles in pulsed plasma were measured by the Faradey cup. Also, the experiments in the pulsed plasma accelerator (PPA) were carried out, where the graphite samples with formed fractal surfaces were obtained due to their interaction with pulsed plasma.

At the present time the experiments with pulsed plasma are directed at studying of the processes of intensive interaction of accelerated powerfull pulsed plasma flows with the first wall of fusion reactors. They cause erosion of materials and worsen operating resources. It is assumed that the protective coatings of the diverter are most intensevely influenced by the plasma during disruptive instability, when the thermal load can be up to 10 MJ/m^2 during the time interval of 1-2 ms [1]. Another important factor affecting the properties of the plasma column (breakdown of the plasma column, a sharp decrease in temperature of the plasma) is the dusty component (production of erosion),. In this regard, much attention was paid to the determination of energy characteristics of different types of particles produced during plasma ignition at pulsed gas puffing. The obtained data were used to identify the nature of interaction of plasma with protective materials. In our case, the experiments were performed on a model setup of pulsed plasma accelerator. To determine the concentration and energy of charged particles of the pulsed plasma, the diagnostic device Faraday cup (FC) was used. To register the signal in the FC the oscilloscope LeCroy 354A (500 MHz) was used.

The results (currents of plasma particles) are shown in Figure 1.

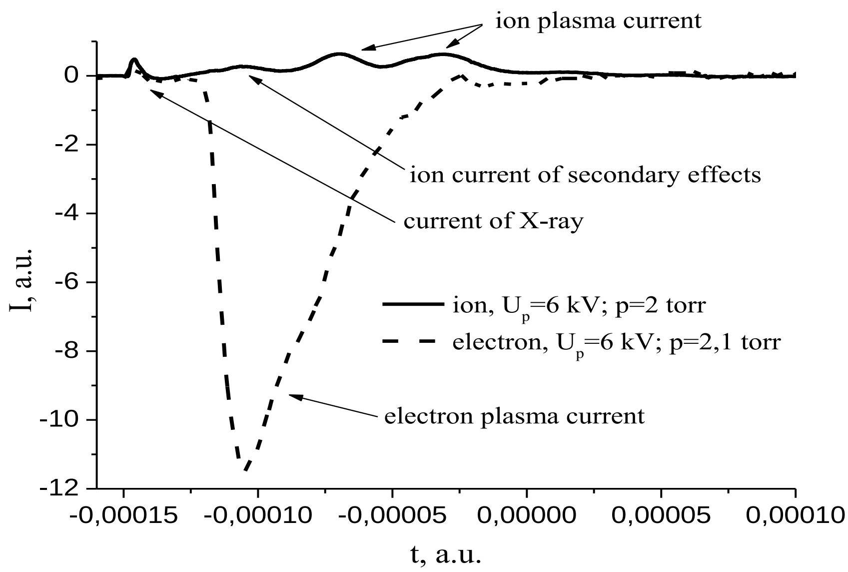

Fig. 1: Oscillograms of ion and electron plasma currents.

Analyzing the results in Figure 1, it was found that the first positive impulse (a peak) corresponds to the X-ray radiation current. The electrons, accelerated in the electric field during plasma ignition in the PPA, are decelerated moving to the negative electrode of the plasma accelerator, thereby emitting X-ray radiation. X-rays, ahead of ion and electron beams, are attracted to the inner electrode of FC at different bias voltages, interact with the electrode, and on the oscilloscope screen we see the first signal. This signal can be accepted as the time of occurrence of a gas discharge, i.e. the origin of counting. The intense negative pulse corresponds to the electronic current. The second positive pulse appears as a result of secondary effects, such as knocking out by energetic particles of a certain number of electrons from the collector electrode. The third and fourth positive pulses correspond to plasma ion currents, therefore, these signals are used in determining characteristics of pulsed plasma.

Then, using these signals electronic and ionic currents were determined, and the I-V characteristics of the FC were plotted. The results are shown in Figure 2.

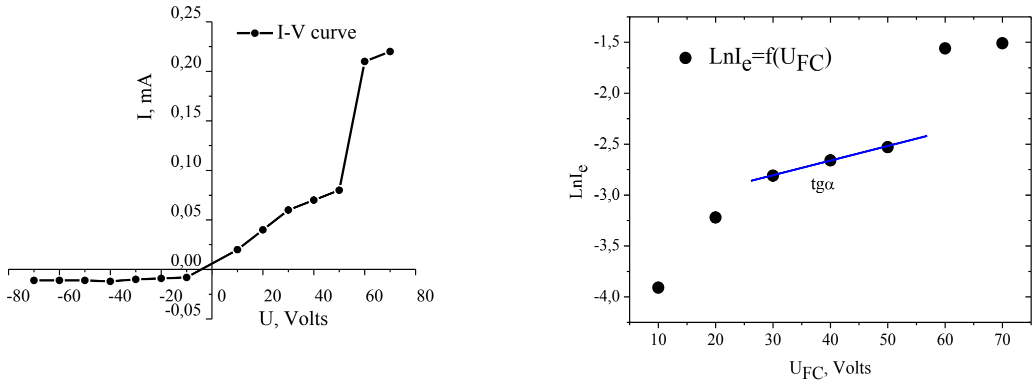

Fig. 2: I-V characteristics of the FC and its electronic part in the logarithmic scale.

Thus, based on the obtained data and using simple calculations the ion energy and concentration were determined. The ion concentration was determined by the following formula:

$$n_i = \frac{U_R}{RqAv_i}, \qquad (1)$$

where v_i – is the velocity of ions, U_R – is the voltage across the resistor of the differentiating chain, A is the area of the hole on the outer electrode (screen).

The energy of ions was determined by the following formula:

$$E_i = \frac{1}{2} M_i v_i^2 \qquad (2)$$

where M_i – is the atomic mass of hydrogen ion.

The process of interaction of the plasma beam with graphite material was studied. The samples confirmed formation of films with strongly developed fractal surfaces, which is exactly the same as in fusion devices. It is revealed that formation of fractal systems consisting of branched structures such as "cauliflower" are related to the process of diffusion of adatoms.

References

[1] Progress in the ITER Physics Basis. *Nuclear Fusion*. **47** (2007) 217.

[2] N. S. Klimov, V. L. Podkovyrov, A. M. Zhitlukhin, et al., *J. of Nuclear Materials*. **390-391** (2009) 721.