Experimental investigation of the interaction of plasma flow with the wall of fusion reactor

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One of the problems of controlled fusion physics related to the control of the plasma flow is minimization of erosion of intrachamber components, in particular, the first wall of the reactor, which leads to formation of dust (micron-sized particles) and nanostructured products.

Accumulation of dust in the reactor volume mainly plays a negative role. Firstly, it leads to instability of the high-temperature plasma burning and the emergence of disruptions, secondly, it leads to the capture and accumulation of tritium, which worsens safety of the reactor and its efficiency, etc. [1-5].

Nowadays, carbon or its composites are adopted as materials contacted with plasma used as a facing in the separatrix area of the diverter. Candidate materials are the materials that could characterize the processes occurring with materials from which the reactor is made and to find the best composite, which could replace the material of the reactor.

This work is devoted to the study of the formation of dust at interaction of accelerated pulsed plasma flow with graphite plates. To imitate and investigate this process a plasma accelerator of the coaxial type has been used. The accelerators of such type are universal setup for generation of plasma flow and to investigate it's interaction with candidate materials of first wall of the reactors (TOKAMAK). In the experiments, as the plasma-forming gas, hydrogen and argon were used, the charging voltage of the capacitor battery of the accelerator varied from 3 to 14 kV. To determine the energy characteristics of the plasma the Faraday cup and cone calorimeter were used. Pre-treated graphite plates in the interaction with the plasma confirmed formation of a film and particles with highly developed surfaces like "cauliflower" and fractal structures similar to the results of fusion devices (Figure 1). By the results of preliminary investigations it is assumed that the growth of such structures is probably associated with the processes of deposition and diffusion of adatoms.

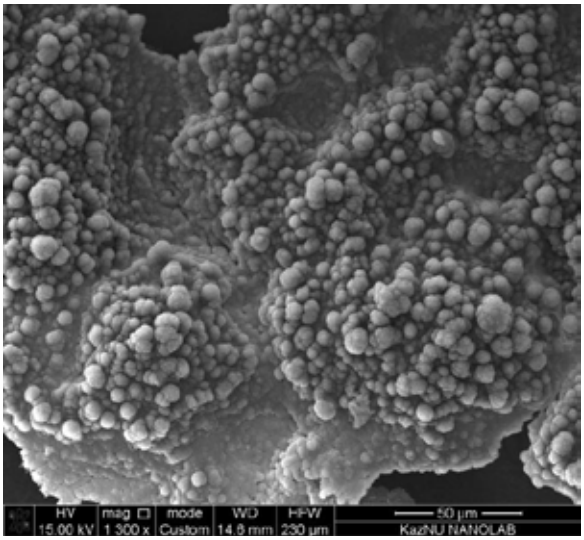

Figure 1. Fractal structure of graphite surface.

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