Topic number

STUDY OF PROCESSES OF DUST FORMATION IN TNER ON MODEL SET OF PULSED PLASMA ACCELERATOR

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In this work the results of the experimental investigation of dust formation after interaction of pulsed plasma flow with candidate material of thermonuclear reactor in PPA-30 are presented. Via Raman spectrometer it was revealed, that after interaction of plasma, the surface structure of graphite target becomes amorphous. Also in this experimental work, the materials with fractal surface as in tokamaks, which was appeared by the erosion, were obtained.

1. Introduction

Since the eighties of the last century, an interest in the creation of controlled thermonuclear fusion reactors with magnetic confinement has been actively developing for domestic and industrial using. Due to this, tokamak is the most perspective device for its implementation. It is known, that the main problem of realization of controlled thermonuclear fusion is the dust formation, which appears after interaction pulsed plasma flow with the components of reactor, placed inside the vacuum chamber. It has been established that the dust microparticles form layers in the form of films, which can be carried out of the chamber and, thus, be distributed in other systems of the reactor. Thereby, the accumulation of dust and precipitation of film in the volume of reactor play a negative role. First of all, it leads to instability of combustion of high temperature plasma and nucleation of breakdowns, secondly, to the capture and accumulation of tritium, which is a problem for safe of reactor operation and its economy [1]. Composition of particles includes materials of the first wall and other internal elements of structure, which are typically graphite, titanium, tungsten, beryllium and steel.

2. Results

The experiments were performed on a plasma accelerator PPA-30. Device consists of two coaxial electrodes, separated by an insulator. To investigate the dust formation after irradiation of the material with pulsed plasma flow, graphite plate was used. After the collision with the target of plasma flow, formed dust particles collected by separate container for further analysis (Figure 1). Analysis showed that the structure of obtained particles has a rough surface and the particle size varies in the range ~ 10-45 micron.

According to the Raman spectrum [2] it was revealed that the graphite surface is an inhomogeneous. The Raman spectrum of the defective area of the sample, which is characterized by an increase in the peak intensity of D, the total broadening of the peaks and the peak offset G in the high frequency region with a value of 1595 cm^{-1} suggests a certain degree of amorphous structure.

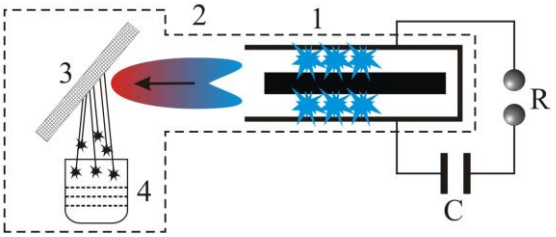

Figure 1. Principle schematic of the model experimental set-up. 1-system of electrodes, 2-plasma flow, 3-graphite plate, 4-container of separate.

3. Conclusion

Experimental results of study of processes of the dust formation on model set in IETP KazNU are shown. According to the results of synergetic analysis of erosion products, it was found that after interacting with pulsed plasma flow, the target surface becomes amorphous, which indicated the increasing of D peak in the Raman spectrum of the irradiated target.

4. References

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