Kazakh Physical Society


KAZAKH KBTU BRITISH
TECHNICAL
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# Second Annual Meeting of Kazakh Physical Society

June 6-8, 2019, Almaty

# SECOND ANNUAL MEETING OF KAZAKH PHYSICAL SOCIETY

**June 6-8, 2019, Kazakh-British Technical University**

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| | Al Farabi National University, Almaty, Kazakhstan<br>**Investigation of carbon nanowalls synthesis by pecvd method** |
| **11:20 – 11:35** | **Daniele Malafarina**<br>Nazarbayev University, Nur-Sultan, Kazakhstan<br>**Observable properties of a black hole mimicker** |
| **11:35 – 11:50** | **Essen Suleimenov**<br>Kazakh-British Technical University, Almaty, Kazakhstan<br>**Effect of Non-Stationary Electric Current on The Oxide Meline System - Gas Phase** |
| **11:50 – 12:05** | **Chingiz Akniyazov**<br>Fesenkov Astrophysical Institute, Almaty, Kazakhstan<br>**Space debris cloud evolution; De-orbiting small space debris** |
| **12:05 – 12:20** | **Almasbek Utegenov**<br>Institute for Experimental and Theoretical Physics, Al-Farabi Kazakh National University, Almaty, Kazakhstan<br>**Properties of the Complex Plasma in the Radiofrequency Discharge With Imposed DC Field** |
| **12:20 – 12:35** | **Aigerim Tazhen**<br>Institute for Experimental and Theoretical Physics, Al-Farabi Kazakh National University, Almaty, Kazakhstan<br>**Experimental investigation of the properties of plasma-dust formations on pulsed plasma accelerator** |
| **12:35 – 14:00** | **LUNCH BREAK** |
| **14:00 – 14:15** | **Sagi Orazbayev**<br>Institute for Experimental and Theoretical Physics, Al-Farabi Kazakh National University, Almaty, Kazakhstan<br>**Synthesis of carbon nanoparticles in plasma medium and their application** |
| **14:15 – 14:30** | **Farid Umarov**<br>Kazakh-British Technical University, Almaty, Kazakhstan<br>**Particle-solid surface interactions** |
| **14:30 – 14:45** | **Gulzipa Sataeva**<br>L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan<br>**Nanostructured Potassium Sulfate Crystals** |
| **14:45 – 15:00** | **Saken Toktarbay**<br>Department of Theoretical and Nuclear Physics, Al-Farabi Kazakh National University, Almaty, Kazakhstan<br>**Investigation of the stability of orbits by using the adiabatic theory of motion in General Relativity.** |
| **15:00 – 15:15** | **Nurlan Bakranov**<br>Kazakh National Research Technical University after K.I. Satpayev, Almaty, Kazakhstan<br>**Photoelectrochemical Application of Heterostructured Semiconductors** |
| **15:15 – 15:30** | **Timur Kulsartov**<br>IETP, Al-Farabi Kazakh National University, Almaty, Kazakhstan<br>Kazakh-British Technical University, Almaty, Kazakhstan |

# Experimental investigation of the properties of plasma-dust formations on pulsed plasma accelerator

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**Abstract:** In this work, the process of interaction of a pulsed plasma with the surface of graphite plates is studied. Trajectories of the scattered dust particles at plasma erosion of plate surface are obtained. The high-speed «Phantom VEO710S» camera with the capture rate of 78,000 frames/sec were used to capture the interaction of a pulsed plasma flow with the surface of the graphite plates and the evolution of the particles The size of deposited carbon nanoparticles varies within the range of 20-180 nm. In addition, nanoparticles of the electrode material were obtained.

## Introduction

Currently, one of the main challenges in successful devise and operation of the ITER is erosion of the internal walls of the reactor's vacuum chamber. The product of this erosion process is the particles of micron to submicron size found in the reactor chamber. The presence of dust in the plasma pinch negatively affects the thermonuclear processes in ITER. Plasma-thermal (radiation) effects on the walls of the chamber is one of the key challenges in constructing safe and durable chambers, it is the adverse effects of pulsed plasma flow to the walls of the reactor chambers is the key issue in understanding and tackling the plasma dust formation issue in ITER [1, 2].

The experiments were carried out on the installation of a pulsed plasma accelerator IPU-30 [3]. The schematic diagram of the experiment is shown in Figure 1 (top view). There are two graphite plates (Figure 1), placed in the plasma flow path at a 45-degree angle to the axis of chamber, at a distance 60 mm from the end of the electrodes. The length of the plates extends to the diameter of the outer electrode, so the plasma flow appeared in interelectrode space pass through the any sector of the graphite plates. These plates are the source of carbon dust particles. The particles are emitted when the plasma flow is interacting with the surface of the plate and moves along the plasma flow direction in sufficient value of the discharge voltage. The copper substrates are placed at a distance of 30 mm from the graphite plate. These substrates are used to collect the dust particles that are formed during the erosion of the plates.

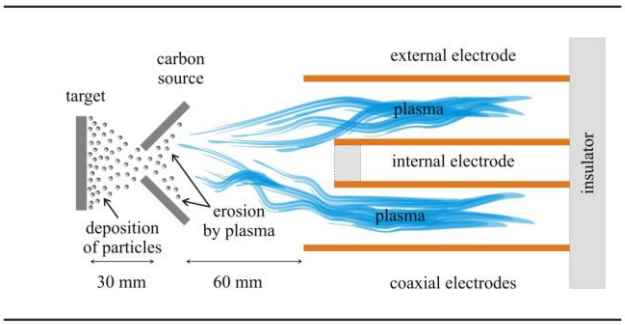


Fig. 1. Schematic diagram of the experimental setup and plasma processes in it. Top view.

The interaction of a pulsed plasma flow with the surface of the graphite plates and the evolution of the particles were captured by the high-speed "Phantom VEO710S" camera. The capture rate of 78,000 frames/sec. Thus, the distance between neighboring frames is 12.82 μsec. The size of collected carbon dust particles varies within the range of 20-180 nm [4, 5].

## References

J.C. Flanagan et al., "Characterising dust in JET with the new ITER-like wall" Plasma Phys. Control. Fusion **57**, 014037 (2015).
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