**Brief information about the project**

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| Name of the project | AP09259081 "Study of the properties of plasma and the interaction of the plasma cord with intra-chamber materials in thermonuclear power reactors" |
| Relevance | According to experts, in 20-25 years, global electricity consumption will double, which forces humanity to look for alternative and efficient energy sources with minimal impact on the planet's ecosystem. One of such methods of obtaining energy is the implementation of controlled thermonuclear fusion. In implementing this idea, the global international projects ITER (with magnetic confinement) and NIF (with inertial confinement) are the most effective today. This project is aimed at a fundamental study of the problems existing in thermonuclear power plants based on proven experimental diagnostic methods and theoretical models. The scientific novelty of the project lies in the implementation of simulation experimental work on a plasma accelerator to study the thermal interaction of the plasma cord with intra-chamber materials under conditions close to thermonuclear ones, which will serve as the basis for developing recommendations for stabilizing the plasma cord and selecting candidate materials for the first wall of thermonuclear power reactors with magnetic confinement plasma. It is also proposed to measure the intensity of soft and hard X-rays and the effect of radiation exposure on candidate materials. Obtaining new thermodynamic characteristics of dense degenerate plasma of a deuterium-tritium mixture based on original interparticle interaction potentials, which consider both correlation effects at large distances and quantum mechanical effects of diffraction and symmetry at short distances. Computer simulations will be carried out over a wide range of plasma densities and temperatures. |
| Purpose | Development and optimization of a system of electrodes (squirrel cage) of a complex geometric configuration of a pulsed plasma accelerator to reduce electrode erosion and increase the reproducibility and work function of a pulsed plasma accelerator (density, energy of a quasi-stationary plasma column, X-ray radiation) and for experimental modeling of processes in near-wall thermonuclear plasma. Research and diagnostics of a plasma filament in a pulsed plasma accelerator in an external magnetic field. Determination of local parameters of the plasma and the external circuit of the plasma accelerator. Energy, structural properties and dynamics of plasma in a pulsed plasma accelerator in an external magnetic field: energy density, magnetic field distribution, flow velocity, oscillograms of the plasma cord current and the external circuit of the plasma accelerator. Presumably, 1 (one) |

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| | article will be published in a peer-reviewed foreign and (or) domestic publication recommended by KOKSON. |
| Objectives | The energy, structural properties, and dynamics of plasma in a pulsed plasma accelerator in an external magnetic field will be studied: energy density, magnetic field distribution, flow velocity, oscillograms of the plasma cord current and the external circuit of the plasma accelerator. One (1) article will be published in a peer-reviewed foreign and (or) domestic publication recommended by KOKSON.<br>A new system of electrodes of complex geometric configuration (squirrel cage) will be manufactured and modernized to reduce electrode erosion and increase the reproducibility and work function of the pulsed plasma accelerator (density, energy of the quasi-stationary plasma column, X-ray radiation). |
| Expected and achieved results | Results of an analysis of the applicability of interaction potentials for modeling the structural characteristics of dense plasma in thermonuclear power reactors with inertial confinement. Interaction potentials that take into account non-ideal effects at different stages of compression, structural characteristics (radial distribution function, structure factor) of dense plasma in thermonuclear power reactors with inertial confinement. Characteristics of scientific and technical products according to qualification criteria and economic indicators; diagnostics of a plasma cord in a pulsed plasma accelerator under the influence of an external magnetic field. Concentration and temperature of electrons depending on the discharge power and working gas pressure in the vacuum chamber of the plasma accelerator. Presumably, 2 (two) articles will be published in peer-reviewed foreign and (or) domestic publications recommended by KOKSON and 1 (one) article and (or) review in a peer-reviewed scientific publication in the scientific direction of the project included in 1 (first), 2 (second ) and (or) 3 (third) quartiles in the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 50 (fifty). |
| Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles | Scientific director of the project - **T.S. Ramazanov**, Doctor of Physical and Mathematical Sciences, Professor, H-index – 29, citation index – 3227. Author ID Scopus – 6701328029, Researcher ID Web of Science – N-4833-2014 (Google Scholar) https://www.webofscience.com/wos/author/record/896743 , Scopus: https://www.scopus.com/authid/detail.uri?authorId=6701328029<br>**Muratov Mukhit Mukhametnurovich**, Doctor PhD, Associate Professor, Hirsch Index – 4, Author IDScopus – 16488595800, Researcher IDWebofScience – O-2126-2014, ORCID 0000-0001-7270-9834 |

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| List of publications with links to them | 1. M.K. Dosbolayev, A.B. Tazhen. Measuring the self-generated magnetic field and the velocity of plasma flow in a pulsed plasma accelerator // Recent Contributions to Physics, №2 (77), 2021.<br>2. М.К. Досболаев, А.Б. Тажен, Т.С. Рамазанов. Исследование магнитного поля плазменного потока в импульсном плазменном ускорителе // VII Международная конференция «Лазерные, плазменные исследования и технологии», Москва, Россия, 2021.<br>3. M.K. Dosbolayev, A.B. Tazhen, T.S. Ramazanov. Pulsed plasma flow diagnostics // Recent Contributions to Physics, №2 (81), 2022.<br>4. M.K. Dosbolayev, A.B. Tazhen, T.S. Ramazanov, Ye.A. Ussenov. Investigation of dust formation during changes in the structural and surface properties of plasma-irradiated materials // Nuclear Materials and Energy, Vol. 33, 2022.<br>5. M.K. Dosbolayev, A.B. Tazhen, T.S. Ramazanov. Experimental modeling and study of a wall dust plasma in a tokamak // 9th International conference on the physics of dusty plasmas, Moscow, Russia, 2022.<br>6. M.K. Dosbolayev, A.B. Tazhen, T.S. Ramazanov, Ye.A. Ussenov. Investigation of dust formation during changes in the structural and surface properties of plasma-irradiated materials // Nuclear Materials and Energy, Vol. 33, 2023.<br>7. M.K. Dosbolayev, A.B. Tazhen, Zh.B. Igibaev, A.U. Utegenov, T.S. Ramazanov. Investigation of the plasma column evolution and dynamics in the PW-7 plasma accelerator // Physical sciences and technology, Vol. 10, № 1, 2023. |
| Patents | - |