Review of the project
"Research of deep subcritical electronuclear systems and possibilities of their application for energy production, transmutation of the waste and research in the field of radiation material science
Part III.
Quasi-infinite target"
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At present, the development of nuclear power, which uses fission energy from uranium-235 or plutonium-239 for energy generation, is being hindered. First of all, it is caused by the problems associated with the constant accumulation of long-lived radioactive waste, and, secondly, because of the lack of natural uranium resources with an acceptable cost of extraction, which is necessary for the development of large-scale nuclear power.

To solve these problems and provide conditions for unlimited development of nuclear energy through the use of uranium-238 and thorium-232, whose resources far exceed the resources of organic fuel, a concept for the development of nuclear energy with a closed fuel cycle is being created. In order to maintain the neutron potential of such a nuclear power system, it is necessary to put into operation innovative nuclear installations with an external neutron source, which are considered subcritical systems with a high-current accelerator of charged particles (protons or light ions).

Requirements for the accuracy of calculations of the main parameters (neutron output from the target, neutron spectrum both inside the target and on its surface, radiation resistance of structural materials surrounding the target, parameters of local energy release in the target, "window" and blanket, etc.) of innovative nuclear installations with an external neutron source (ADS) were developed at the beginning of this century, but to date they have not been achieved. The reason is that all high-energy transport programs used for calculating such systems were created in various laboratories for scientific tasks related mainly to the field of high-energy physics. Therefore, when using them to calculate nuclear power plants, they must be verified in a wide range of energies and masses of charged particles that bombard both models of neutron-forming targets made of various materials, and the "target+ subcritical blanket" model.

For this purpose, an experimental installation with a Nuclotron beam was created at VBLHEP from 2010 to 2013, which included a part of the "Quint" target of 500 kg of natural uranium and a control system for the input beam. A new method for measuring neutrons generated in targets was developed and implemented, both in "in situ" and in passive mode.

The performed studies related to the determination of the main ADS parameters with various targets bombarded by protons and light ions showed new and interesting experimental results, which obtained the dependences of the energy yield in the uranium Assembly on the energy of incident deuterons, the spatial distribution of the U238(n,γ)Pu239 reaction, the rigidity of the neutron spectrum of secondary radiation, and the neutron leakage spectra measured on the installation surface.

In the proposed part II of the project-research of the quasi-infinite target "Buran", an experimental installation will be created based on the Assembly of a target from 20 tons of natural uranium and a set of measuring devices that will allow:

- to determine the number of particles that bombard the target in each drop;
- to determine the shape of their spatial distribution for each dump;
- to determine the power of the beam of particles bombarding the target;
- to conduct studies with inserts that model targets of various types;
- to study the distribution of neutron fluxes with threshold detectors and fission chambers in a quasi-infinite Buran target with inserts from various targets;
- to perform measurements of reaction rates for the formation of residual product nuclei in experimental samples from natU;
- to determine the multiplication factor of the input beam energy.

The uniqueness of the proposed installation is determined by its size, which exceeds the neutron diffusion length by 5-6 times, which, according to estimates, will ensure their leakage at the level of 5-10%. The possibility of replacing the neutron-forming Central insert from natU with a diameter of 200 mm with inserts from 232Th, natPb, natPb+Bi, natW, natTa,..., 27Al of the same diameter will allow, for the first time, to measure the change in spectral indices in a quasi-infinite target from natU with a diameter of 1200 mm.

Such a facility will be put into operation for the first time, both in the Russian Federation and in Europe, and will undoubtedly have a large international potential, as it can be used to develop a range of nuclear data necessary for verification of high-energy transport programs that are widely used in world practice for calculating ADS.

I would like to mark an importance of research devoted to radiation material science/

I consider it appropriate implementation of the proposed project.

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