

Review

of the project «Construction of a complex of combined neutron moderators at the IBR-2 reactor» in 2020-2022

In 2020-2022, in the framework of theme 1105, the implementation of the project of construction of a cold neutron source at the IBR-2 reactor will continue. The cold neutron source includes three moderators located behind the stationary reflectors surrounding the IBR-2 reactor core. The head part of the moderator is an assembly of flat and grooved water chambers and a cryogenic chamber producing cold neutrons. The geometrical arrangement of these chambers in each particular moderator is different and depends on the instruments that are oriented towards the moderator's surface. This makes it possible to obtain an optimal neutron spectrum at the sample position. The working substance in the cryogenic chamber is a mixture of mesitylene and m-xylene shaped as beads with a diameter of 3.4-3.9 mm.

At present, the first stage of the cold neutron source—combined moderator CM-202 designated for beamlines 7, 8, 10, 11—has been installed and put into trial operation. From July 2012 to April 2018, it operated for 3033 h for physics experiments. The successful operation and extended neutron spectrum from the moderator's surface made it possible to significantly improve the qualitative and quantitative characteristics of spectrometers and diffractometers. An increase in the cold neutron flux by a factor of up to 16 made it possible to reduce the duration of experiments. In view of the successful experience of CM-202 operation, in 2017-2019, in the framework of theme 1105, a combined moderator CM-201 was developed, constructed and underwent a preliminary on-site fit check. This moderator was specially designed for experimental instruments on beamlines 1, 4, 5, 6, 9. The calculations of neutron-physical characteristics of the head part of the moderator show that the cold neutron flux in the wavelength region of 7 Å will be increased by a factor of up to 9. The commissioning of this moderator into trial operation is scheduled for the autumn of 2019.

It should be noted that, at present, the source of cold neutrons, developed and operated by FLNP JINR at the IBR-2 reactor, is the only cold neutron source in the Russian Federation. A distinctive feature of the source is the shape of the working substance and the way it is loaded into the moderator chamber using the pneumatic conveying of pellets at cryogenic temperatures. This principle of operation is unique and has no analogues in the world. In the process of implementation of the project, new technical units and devices, techniques and software have been developed. The inventions that are valuable not only for this project, but also for the national economy, have been protected by a number of patents, which enhances the significance of the project.

In the framework of the project, in 2020-2022, it is planned to conduct a series of experiments to refine the neutron-physical parameters of the CM-201 moderator, and evaluate the improvements achieved through the use of the cold moderator for the IBR-2 instruments. The automation of a number of engineering systems will be carried out as well, which implies a reduction in the workload for the maintenance personnel and partial operational independence of units and equipment. The modernization of the cryogenic system of the source will continue, in the framework of which a new refrigerator with a cooling power of 1800 W at 10 K will be purchased, installed and put into service. Considering that the contribution of the temperature component to the

increase in the cold neutron flux can reach a factor of 6, it is important to have a reliable cryogenic system of sufficient power.

The positive results of the CM-202 operation for physics experiments, development and construction of CM-201, modernization of the cryogenic system, development of the infrastructure of the complex, results reported in scientific journals, obtained patents, high professional qualification of the personnel performing the work are to ensure the successful implementation of the project within the designated time frame.

I consider it necessary to support the project "Construction of a complex of combined neutron moderators at the IBR-2 reactor", which will make it possible to conduct world-class experiments and maintain the competitiveness of the IBR-2 facility among high-flux neutron sources in the world.

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