

Report of the Reviewer on the proposal for the opening of the theme “Investigations of Functional Materials and Nanosystems Using Neutron Scattering”

Since 2021, at FLNP the scientific theme 04-4-1142-2021/2025 “Investigations of Functional Materials and Nanosystems Using Neutron Scattering” was successfully implemented. In the last few years, many interesting scientific results related to structural, magnetic and dynamical properties of various functional materials and nanosystems were obtained. These results were published in more than 300 articles, with considerable part of them – in leading scientific journals belonging to Q1 quartile, and presented in 210 conference presentations. The high research quality is supported by 5 JINR prizes attributed to selected research cases. The progress in upgrade of the IBR-2 spectrometer complex, including development of new instruments should be also noted.

According to the new JINR Regulation on organization and planning of scientific research, the theme structure will be re-formalized. Starting from 2024, in the framework of the theme it is planned to open a new project “A Study of Structure and Dynamics of Functional Materials and Nanosystems at the IBR-2 Spectrometer Complex” and prolongate a project “Development of an inelastic neutron scattering spectrometer in inverse geometry at the IBR-2 reactor”, both for a term of 5 years.

In the framework of the new project “A Study of Structure and Dynamics of Functional Materials and Nanosystems at the IBR-2 Spectrometer Complex” within the theme, the research plans will be focused on actual problems of the condensed matter physics, materials science, chemistry, biophysical and geophysical sciences, as well as applied topics including texture analysis, residual stress determination, neutron radiography and tomography studies of different materials, products and object. The expected results of scientific research, based on studies of crystal and magnetic structure, dynamics and properties of promising functional materials and nanosystems, biological systems, polymers, constructional materials, rocks and minerals will be important for clarification of driving mechanisms responsible for occurrence of interesting physical phenomena and formation of functional properties at microscopic level. The IBR-2 high flux pulsed reactor spectrometer complex will be used as the main experimental base, complemented by available laboratory equipment. The scientific research will be performed in cooperation with numerous organizations from JINR Member States as well as other countries, and other JINR Laboratories.

To ensure the realization of the scientific programme at the internationally competitive level, a special attention will be provided to further upgrade of the IBR-2 spectrometer complex. The development of the new small angle neutron scattering and imaging spectrometer, as well as modernization of other available neutron scattering instruments and extension of associated laboratory equipment are planned.

The second project within the theme “Development of an inelastic neutron scattering spectrometer in inverse geometry at the IBR-2 reactor” will be dedicated to a construction of an advanced inelastic neutron scattering spectrometer in inverse geometry with a wide range of scientific applications based on studies of atomic and molecular dynamics of functional materials. The first part of the project was realized during 2021-2023. The numerical modeling and technical design of the main spectrometer elements was performed and a model element of the focusing analyzer is being developed. A purchase of materials for the project realization, including highly oriented pyrolytic graphite single crystals and their testing, was also done. During the forthcoming five years, it is planned to develop the main elements of this spectrometer and start its assembly on the 2nd experimental channel of the IBR-2 reactor.

The proposed theme with projects will be realized mostly in the Department of Neutron Scattering Investigations of Condensed Matter of FLNP. The Department staff is well recognized in research community and has a many years experience in the given research field, as supported by large number of publications in distinguished scientific journals and conference presentations,

attributed awards and prizes. Large number of young scientists and specialists from JINR Member States ensures positive expectations in future Department development.

Concluding, I endorse the opening of the theme “Investigations of Functional Materials and Nanosystems Using Neutron Scattering” with projects “A Study of Structure and Dynamics of Functional Materials and Nanosystems at the IBR-2 Spectrometer Complex” and “Development of an inelastic neutron scattering spectrometer in inverse geometry at the IBR-2 reactor” and recommend realization of the theme at JINR for the period of the Seven Year Plan of JINR Development for 2024-2030 with a first priority.

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