

## Review of proposal for opening a new project entitled “Nanocomposite and functional track etched membranes”

It is well-known that the Dubna heavy-ion accelerator facilities at FLNR JINR offer unique opportunities for interdisciplinary research, especially for material science and nanotechnology. Swift heavy ions are capable of generating in dielectrics high aspect ratio damage trails known as ion tracks. Due to their nanoscopic dimensions, the ion-track technology utilizes the special ion track properties to produce nano- and microporous materials. Track-etched membranes (TMs) are an example of an industrial application of the ion-track technology. The size, shape, and density of track-etched pores can be varied in a controllable manner, which paves the way for the manufacturing a wide variety of membranes with different morphologies and architectures. Using various physico-chemical methods, the properties of TMs can be additionally modified to gain specific properties and functions. These membranes find versatile applications in science and industry. The present project employs unique possibilities of the above approaches in order to develop membranes with new functionalities and novel membrane separation properties.

Apart from the modern heavy-ion accelerators, the project team is provided with a number of modern analytical methods, including scanning electron microscopy, high-resolution transmission electron microscopy, atomic force microscopy, X-ray photoelectron spectroscopy, Raman spectroscopy, energy dispersive and crystal diffraction X-ray spectroscopy and many other complementary techniques. The ion-track technology will be employed in combination with new thin film, multilayer, nanofiber and other technologies to produce composite membrane materials combining two and more functions (for example, separation and sensoric functions). One of the most important directions of the project is the further development of nanopore membranes for new separation processes. This includes the fabrication of “track-extracted” (also known as “soft-etched” or “UV-track”) membranes possessing selectivity for singly charged ions over the doubly-charged ions in electrolyte solutions. Another interesting solution is the use of small-pore membranes for electrobaromembrane separation of different monovalent cations.

The focus on biomedical applications of TMs deserves a special mentioning. On one hand, the use of TMs for medical and biological purposes is one of the most conventional applications of this type of membranes. On the other hand, nowadays new ideas emerge on how TMs can be used for cancer diagnostics, exosome separation, adherent cell growth, regenerative

medicine, and others. Therefore, the research and development work in the field of biomedical applications is of high current interest.

The list of the different innovative approaches to be used in the project for the development of new functional membrane is quite long and versatile. Even in case only a few approaches will be a success, the project is worth of implementing. The project team has a solid background in the field, which allows to expect that the main goals of the project will be achieved.

As a good estimate of growing interest of JINR participating countries in the topics of this project, is continuously increasing number and quality of joint publications in peer reviewed journals. The team actively co-operates with many research groups in Russia and other member countries, and pursue fruitful collaboration with the leading scientific centers.

Investigations planned in the framework of the project are novel and of current importance; they also satisfy contemporary demands and have a significant scientific value. There is no doubt that the novel track-etched membranes, in particular those with targetely functionalized fixed groups, will find new important applications, which will valorize the project. The team has all required equipment and manpower resources to implement the planned work.

I strongly support the proposal for the opening this new project.

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