

# Materials for Nuclear and Renewable Energy

National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)

Degree or qualification is awarded: **Master Degree**

Language of study: **Russian**

Mode of study: **full-time**

Duration: **2 years**

Availability of free education: **no**

Price: **207 610 rubles per semester**

Programme curator: **B.A. Kalin**

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**Program objectives:** The program is intended to prepare masters with a good physical and mathematical knowledge and includes disciplines that enable to study the physicochemical and mechanical properties of structural and fuel materials, research methods of the structural-phase state of materials, and design principles of advanced structural and functional materials. This academic program will make it possible to obtain knowledge of the processes occurring in solids under the action of external factors, research methods of the behavior of solids under the influence of various types of radiation, the development of radiation-resistant materials used in nuclear power plants and fusion reactors, as well as the skills to work with the modern equipment. The program will enable masters to successfully participate in international projects for the further development of fundamental knowledge of materials and solve the most complex applied problems of the world nuclear science and engineering.

**Training period at full-time study:** 2 years.

**Graduating department:** Department of Materials Science (Dept. No. 9)

**StrAU:** Institute of Nuclear Physics and Technologies

**Field of the professional activity:** Theoretical and experimental investigations for solving research and technological problems in the field of reactor materials science and renewable energy, including: physical principles of the production and treatment of materials; study of the structure and properties of functional and structural materials using the modern equipment; study of the processes of changing the structure of metals, alloys and ceramics under extreme conditions of operation; search for technological solutions to create new generations of materials with improved functional properties for their use in today's energy-intensive engineering; a highly skilled exploitation of the modern technological equipment.

**Objects of the professional activity:** Modern and advanced materials of power facilities; modern technologies of materials production; physical and physicochemical phenomena in the processes of obtaining, treatment and use of materials under extreme conditions (high temperatures, high stresses, radiation, corrosion action and others).

**Features of the curriculum:** The optimal combination of fundamental and applied education in the additional physical and mathematical training, getting of practical skills in the study of experimental methods of materials research, mastering of computer technologies and professional practical training. Practical studies and researches are carried out with the use of modern analytical and high-tech equipment.

The educational program is extremely flexible, allowing students to select a set of disciplines in accordance with the proposed learning trajectories: "Advanced Technologies in Materials Science" (a part of the disciplines is taught at the JSC "VNIINM" and FSUE "NII NPO "Luch") and "Materials under Extreme Conditions" (a part of the disciplines is taught at the NRC "Kurchatov Institute"). The disciplines of the professional module are taught by qualified associate professors and professors (including foreign ones in English).

**Basic professional disciplines (common for the two learning trajectories):**

Special Chapters of Theoretical Physics; Special Chapters of Higher Mathematics; Radiation Solid State Physics; Nuclear-Physical Methods of Research of the Structure and Properties of Materials; Modern Ideas of the Structure of

Materials; Modern Research Methods of the State of Materials; Metrology, Standardization and Certification; Specialized Software Packages for Numerical Modeling and Analysis; Experimental Methods of Materials Science; Nuclear Fuel Materials; Functional and Structural Materials for Nuclear Power Facilities; Computer and Information Technologies in Science and Industry; Modern Problems of the Sciences of Materials and Processes (Selected Sections of the Modern Materials Science); Functional Materials for Power Engineering.

Basic professional disciplines (for the trajectory "Advanced Technologies in Materials Science"):

Modeling of Technological Processes; Structural Materials For Nuclear Reactors; Composite Materials; Liquid Metals; Non-Destructive Testing Methods; Special Issues of Material Science; High-Temperature Nuclear Fuel; Superconductor Technologies; Technologies of High-Temperature Materials; Materials Science Problems of Ecology.

Basic professional disciplines (for the trajectory "Materials under Extreme Conditions"):

Research Methods of Reactor Materials; Materials for Fusion Reactors; Modification of Materials; Materials Science of Nuclear Power Facilities; Semiconductor Technologies; Special Issues of Radiation Materials Science.

**List of enterprises for the practical training and employment of graduates:** SC "Rosatom", JSC "VNIINM" NRC "Kurchatov Institute", IMET RAS, FSUE "NII NPO "Luch", JSC "NIKIET", JSC "VNIHT", OKB "GIDROPRESS", RSC "ENERGIA", JSC "SNIIP" and other scientific and technical centers.

**Head of the program:** B.A. Kalin (phone: +7 495 788-56-99, ext. 9427, email: [BAKalin@mephi.ru](mailto:BAKalin@mephi.ru), Doctor of Physical and Mathematical Sciences, Professor, Head of the Department of Materials Science, Honored Worker of Science and Technology of the Russian Federation, Honored Worker of Higher Education of the Russian Federation, Laureate of the Russian Government Prize, Member of the International Academy of Sciences of Higher School.

## **Specializations within this programme**