

Ministry of Science and Higher Education of the Russian Federation
Peter the Great St. Petersburg Polytechnic University

Institute of Mechanical Engineering, Materials and Transport

APPROVED BY

Director of IMMiT



A.A. Popovich

December 5, 2024

PROGRAM

of the entrance test for applicants to the master's program in the field of study

22.04.01 « Materials Science and Materials Technology »

22.04.01 08 «New Materials and Additive Technologies (International Educational Program)»

Code and name of the field of study / educational program

Saint Petersburg, 2024

ANNOTATION

The program contains a list of topics (questions) on the disciplines of the basic part of the professional cycle of the curriculum for training bachelors in the direction **22.03.01 Materials Science and Materials Technology**, included in the content of tickets (test tasks) of the entrance examination to the master's degree.

The entrance examination is assessed on a 100-point scale and is conducted in the form of an interdisciplinary exam in the amount of requirements imposed by state educational standards of higher education for the level of training of a bachelor in the direction corresponding to the direction of the master's degree, conducted in person in written or oral form and remotely.

The minimum number of points) confirming successful completion of the interdisciplinary exam is 50 points (50%).

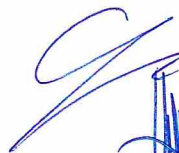
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The program was reviewed and recommended for publication by the Academic Council of the IMMiT (protocol No. 6 of December 4, 2024).

1. DISCIPLINES INCLUDED IN THE PROGRAM OF ENTRANCE EXAMINATIONS TO THE MASTER'S PROGRAM

1.1. Powder and composite materials

1.2. Materials Science

2. CONTENT OF ACADEMIC DISCIPLINES

2.1. Powder and composite materials

1. Basic properties of metal powders.
2. Methods for obtaining metal powders.
3. Compaction of powder materials. Methods for forming powders.
4. Sintering of powder materials.
5. Quality control of products made from powders.
6. Gas-thermal coating methods.
7. Metal composite materials.
8. Basic methods for producing composite materials.
9. Strength of composite materials.
10. Nanopowders: preparation and properties.
11. Bulk nanostructured materials.

Basic literature for studying the course:

1. Composite Materials Engineering, Volume 1. / Xiao-Su Yi, Shanyi Du, Litong Zhang. - Springer Singapore, 09 February 2019
2. Composite materials - Handbooks, manuals, etc / Schwartz, Mel M. - New York: McGraw-Hill. 1984. PP 651.
3. Powder Technology Handbook, Fourth Edition / Ko Higashitani, Hisao Makino, Shuji Matsusaka /

2.2. Materials Science

1. Crystal structure of metals and alloys.

2. Diffusion processes in metal.
3. Plastic deformation of materials.
4. Mechanical properties of metals and alloys.
5. The influence of deformation and heating on the structure and properties of the metal.
6. Construction materials.
7. Theory and technology of heat treatment of steel.
8. Chemical-thermal treatment.
9. Classification of tribomaterials (anti-friction, friction and wear-resistant).
10. Nanostructure and its application.

Basic literature for studying the course:

1. Nanomaterials. An Introduction to Properties, Synthesis and Applications / Emmanuel Craig. - Larsen and Keller Education (7 Jun.2019) .
2. Fundamentals of Statistical and Thermal Physics / F.Reif. -Waveland Pr Inc; 56946th edition (December 30, 2009), PP. 651.
3. Foundations of Materials Science and Engineering 6th Edition / William Smith, Javad Hashemi. - McGraw-Hill Education, March 15, 2018.

EXAMPLE OF A TEST TASK

**«Санкт-Петербургский политехнический университет Петра Великого»
Институт машиностроения, материалов и транспорта**

APPROVED BY

Program Manager

 L.V. Razumova

December 4, 2024

ENTRANCE TEST

for the educational program

22.04.01 « Materials Science and Materials Technology »

22.04.01 08 «New Materials and Additive Technologies (International Educational Program)»

Code and name of the field of study / educational program

1. Examples of test questions (each question has a score of 4):

1.1. Fine-grained or powdered non-metallic materials that have very high hardness are called ...

- a) glass.
- b) plastic.
- c) abrasive.
- d) ceramics.

1.2. The mechanical properties of metals and alloys include:

- a) weldability.
- b) plasticity.
- c) melting point.
- d) density.

2. Examples of a descriptive question in the test (maximum score - 20):

- 2.1. Advantages, disadvantages and main features of additive technologies.
- 2.2. Methods for analyzing the structure, phase composition and mechanical properties of compact materials.