

"... faculty trains specialists capable to develop new metallic and nonmetallic materials, high-end technologies for it production and determining of properties, automation of technological processes using modern computer and information technologies..."



INFORMATION

PACKAGE

**FACULTY OF PHYSICAL  
ENGINEERING**

Kyiv, 2016

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## CONTENT

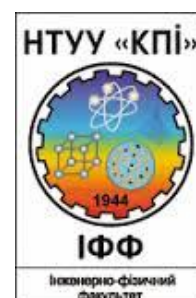
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\*\*\* The information is current as for 2016/2017 academic year. In the next academic year, there may be minor changes in the list of training directions, specialties, and specializations.



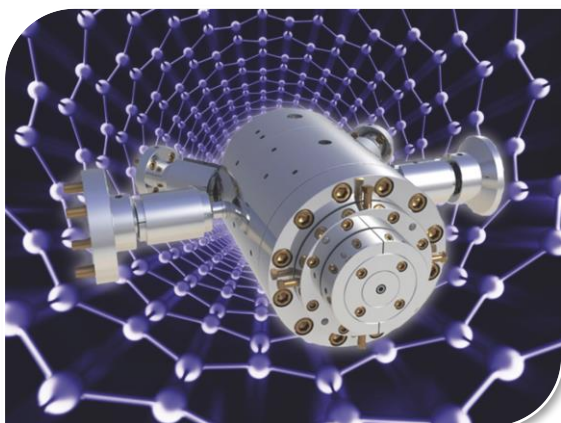
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## 1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY

Training of metallurgical specialists at the Igor Sikorsky KPI was started since its



formation. **Faculty of Physical Engineering (FPE)** was allocated as a separate subdivision on the 7 October 1944 with the purpose of training a highly-skilled engineers-specialists – metallurgists and metallographists for reconstruction and development of metallurgical and mechanical engineering industries.

The faculty trains highly qualified professionals for the development of new materials (metals, alloys, composite and ceramic materials), high-end technologies for their production, research and management of properties, process automation with the use of modern computer and information technology

Nowadays more than 1,000 students study at the Faculty. High-quality training in 2 specialties and 8 specializations is provided by the department's modern material and technical base, selfless work of academic staff and support personnel.

With years of experience of fruitful cooperation, Faculty and NASU formed educational and scientific association in areas of Material Engineering, Material Engineering and Special Metallurgy, Material Engineering and Metallurgy, which includes the world-famous centers of NASU: E.O. Paton Electric Welding Institute, Z.M. Frantsevich Institute of Materials Science., G.V. Kurdyumov Institute for Metal Physics, Physical and Technological Institute of Metals and Alloys, V.M. Bakul Institute for Superhard Materials. This allowed involving the scientific potential of these institutes into educational process for training of high-level specialists and masters.

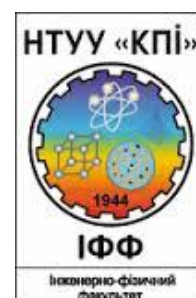
### Structure

The faculty consists of 5 departments.



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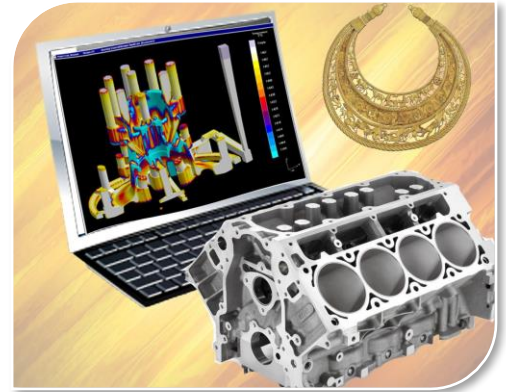
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**1. Department of Foundry of Ferrous and Nonferrous Metals** provides training specialists with a degree in "Metallurgy" (specializations "Artistic and Jeweler Casting", "Foundry Engineering and Computerization of Foundry Processes").

Department trains specialists in development of new materials, high-end technologies for its production and formation, determining the properties of materials and assess the quality of the finished product, process automation with the use of modern computer technology and information technology, CAD/CAM systems, including AutoCAD, CATIA, Pro CAST, LVMFlow, MagmaSoft..

The best students have the opportunity to complete their studies in Germany and receive a double degree. The acquired knowledge and skills will help them to establish his own business.



**2. Department of Metal Engineering and Heat Treatment** trains specialists with a degree in "Material Engineering" (specialization "Metal Engineering and Thermal Processing").

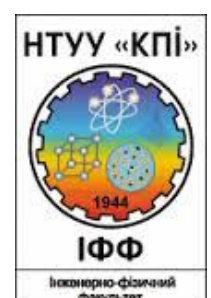
Graduates work in enterprises and organizations of the automobile production and instrument making, aerospace and electronic engineering, microelectronics, in the leading research institutes of the National Academy of Sciences of Ukraine, as a high academic staff, public sector worker, innovation sector and international institutions.

Active cooperation with well-known centers of NASU allows to use advanced laboratories of these institutions in teaching, as well as to involve both the known scientists into educational process and students into performing the investigations of the most urgent problems of modern material engineering.



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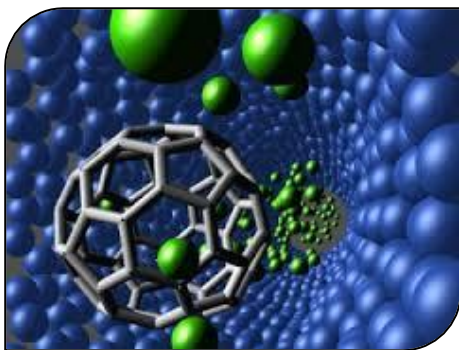


**3. Department of High-Temperature Materials and Powder Metallurgy** trains specialists with a degree in "Material Engineering (specializations "Material Engineering of Powder Composite and Coatings", "Nanotechnology and Computer Design of Materials", "Powder Metallurgy") and in "Metallurgy" (specialization "Powder Metallurgy").



Department trains specialists in the development of new materials and resource-saving technologies for almost all branches of science and engineering from medicine and microelectronics to aerospace engineering.

Today, the department is a leading institution in Ukraine that trains specialists in the development and use of composite and powder materials, special materials for coating, highly emissive materials, structural ceramics, etc.



**4. Department of Metal Physics** trains specialists with a degree in "Material Engineering" (specialization "Physical Material Engineering").

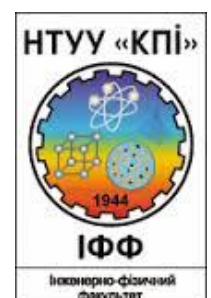
Department graduates are generalists in the field of modern technologies at the intersection of material engineering, management, computer science, medicine, and biology.

The purpose of the specialty is computer design and experimental study of nanomaterials, development of nanotechnology for biomedical engineering, energy-saving environmental systems, micro- and nano-electronics, aerospace and military equipment, robotics, criminalistics.



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**5. Department of Physical and Chemical Basics of Metal Technology** trains specialists with a degree in "Metallurgy" (specialization "Special Metallurgy").

Department is only in Ukraine, provides training in Special Metallurgy at all educational levels. Students get basic training in the theory and practice of metallurgy, casting and others, as well as acquire in-depth knowledge in the field of production of high quality metals and alloys using the modern special methods: electroslag, vacuum, plasma and electron beam technology, electromagnetic treatment of alloys in the liquid state, and in crystallization.

Upon completion of training, graduates obtain a Europe-recognized Government-issued degree, which provides employment opportunities in the specialty in any domestic or foreign companies



## 2. EDUCATIONAL PROGRAMS



**Levels of higher education.** Training of students at the FPE is carried out at several levels of higher education. The first (Bachelor's, I – IV academic years) – the students acquire fundamental knowledge in physics, mathematics, mechanics, computer engineering, and special disciplines. During the IV year, they defend bachelor course work and receive qualification degree Bachelor. At the

second level (Magistracy, V – VI academic years) training is carried out according to the Master program. Students are trained and acquire relevant skills including laboratory practice. Additionally, students have the opportunity to continue their education in a graduate course, and then in a doctoral candidacy of the University.

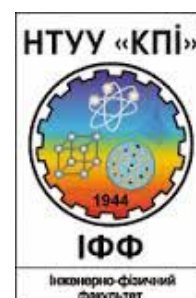
**Terms of specialists training:** Bachelor (b) – 4 years; Master (m) – 2 years (standard terms of training at Bachelor course and Magistracy), Graduate course / Doctoral candidacy – 3 years (4 years by the correspondence study).

Training of specialists is carried out on the full-time and correspondence forms of education.

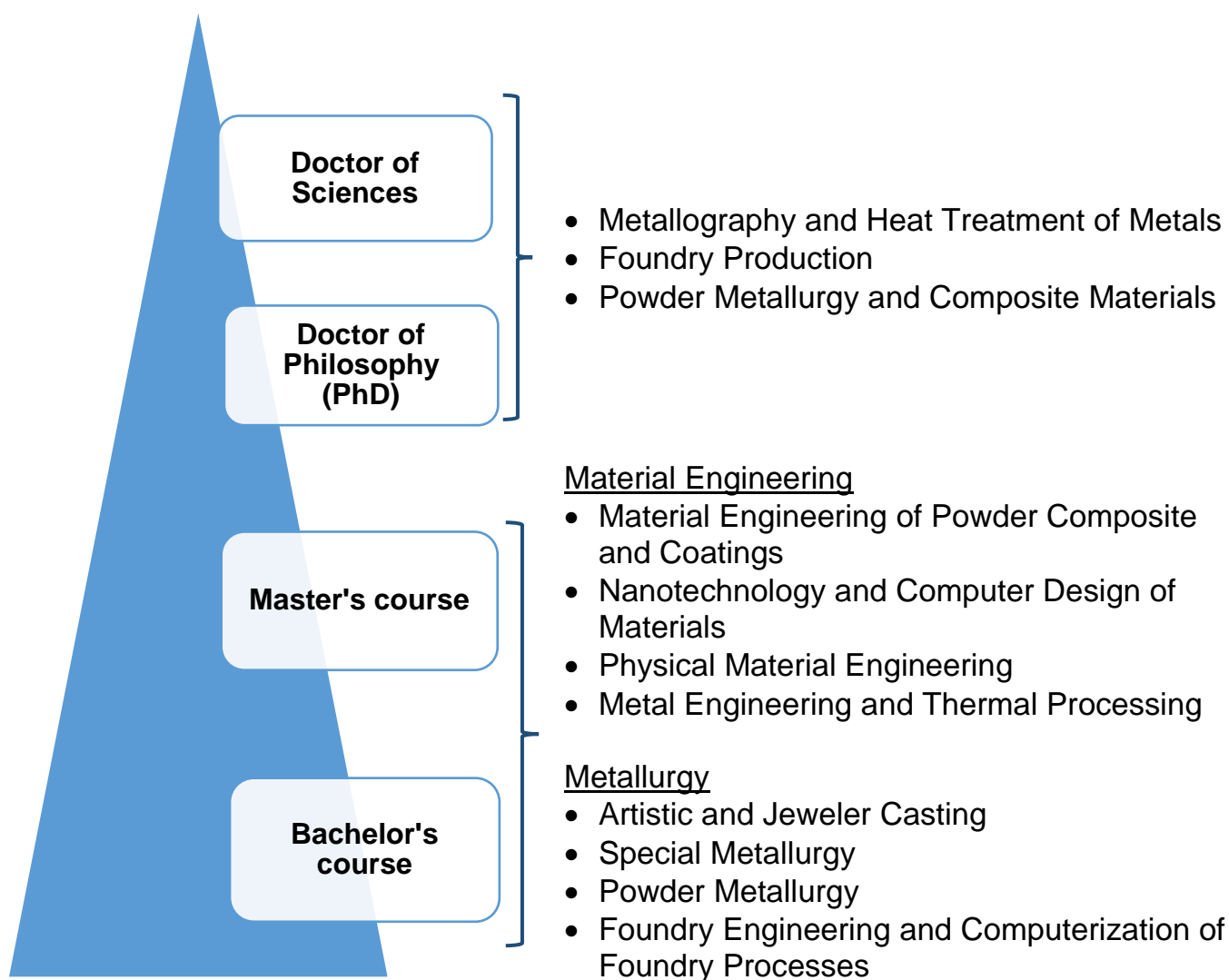


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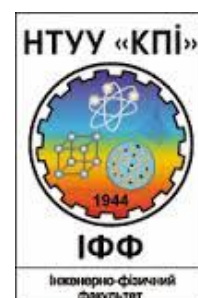


## Areas and specialties of students training at the FPE:



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### 3. TRAINING AND LABORATORY BASE

The faculty has modern technical training base: research and training centers, laboratories, equipped with modern equipment and special training and demonstration systems.

#### Centers:

##### ***Center for X-ray Structure Analysis Rigaku.***

Center is intended to performing fundamental and applied experimental research, solving technical and scientific tasks in the field of materials engineering using modern techniques for record and processing of X-ray diffraction data with the use of diffractometer Ultima IV – direct, accurate, reliable and versatile information on the phase composition and structure of materials as the base of it physicochemical and mechanical properties control.



***Center for Electron Microscopy*** for fundamental and applied research on the structure and chemical composition of materials, solution of technical and research tasks in the field of materials engineering.

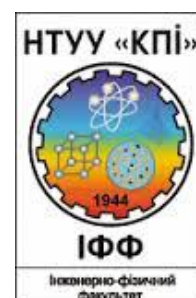
#### Laboratories:

- Laboratory of Computer 3d Modeling and Analysis (Educational program TEMPUS "MMATENG");
- Laboratory of Micromechanical Testing;
- Laboratory of Optical Microscopy;
- Laboratory of Single Crystals Growing;
- Laboratory of Electron Beam Technology;
- Laboratory of Mass Spectrometry;
- Laboratory of Nanotechnologies and Nanomaterials;
- Laboratory of Dispersed Ceramic Materials;
- Laboratory of Preparation of Microsections (sample preparation);
- Laboratory of Foundry of Ferrous and Nonferrous Metals.



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## 4. RESEARCH ACTIVITY

### The main scientific directions of the faculty:

Research work at the **Department of Foundry of Ferrous and Nonferrous Metals** is performed on the following topics:

- technological features for predicting the properties of melts and the metal structure of castings for use in extreme conditions
- development of the methodology of forecasting the structure and properties of the metal in the casting of iron-based alloys with high chromium content.
- theoretical and technological principles of the development of new alloys with specific properties for the production of casting units
- theoretical and technological principles of special properties control of superalloys cast components for particularly critical applications.
- theoretical and technological principles of structure control of the modified micro-alloyed castings.
- theoretical and technological fundamentals of properties differentiation of the composite molding methods.



### **Faculty elaborations, recommended for manufacturing application:**

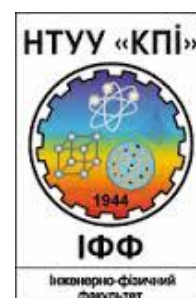
- production processes of high-quality castings of ductile iron by the intermolding modification.
- heat-resistant chrome-aluminum steels and technology of manufacturing of its castings for use in corrosive environments at temperatures up to 1300 °C.
- new nickel-free abrasion-resistant iron and technology of production its castings, which work under intensive abrasive and hydroabrasive wear.
- technological processes of modifiers production containing dispersed refractory particles for producing of aluminum alloys.
- liquid ester class hardeners for rare-glass chemical technological systems
- molding and core mixtures of different composition and destination.
- parting highly thermostable coatings for molds and cores
- methods for determining the properties of the molding sand, forms and nonstick coatings.

2. The activities of the **Department of Metal Engineering and Heat Treatment** is integrated into the framework of the scientific school of "Control and management of



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metals and alloys quality by surface, thermal, chemical-thermal treatment, the impact of liquid and crystallization processes":

- protective coatings on steel and hard alloys
  - development of operational methods for monitoring and quality control of liquid metals and alloys
3. **Department of Metal Physics** provides investigations on the following topics:
- formation of nanoscale magnetic solid FePt films, doped with Ag, Au, Cu, to increase the density of magnetic recording and storage of information
  - the impact of processes on the outer surface of thin metal layers on the phase formation in volume (according to the agreement with the State Agency for Science, Innovation, and Informatization of Ukraine)
  - creating functional and biocompatible composite coatings on titanium alloys and iron, reinforced with carbon nanotubes and the elements of the implementation, in conditions of extreme energy impacts
  - thin-film solar cells based on nanocrystalline silicon doped with rare earth elements (International Project SRDF UKP2-7040-KV-11 under the program CRDF – CGP 2010/2011 Applied Energy Research Competition of the Department of Metal Physics and Department of Microelectronics of the Igor Sikorsky KPI with the Department of Physics at Boston College (Chestnut Hill, Massachusetts, USA)
  - initiative work Computer Methods of materials designing
  - thermal stability and operational reliability of nanoscale metal films of dielectrics and semiconductors

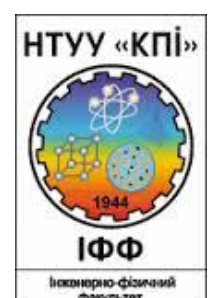
4. The research works at the **Department of Physical and Chemical Basics of Metal Technology** are carried out on the following topics:

- gases in the ferrous, nonferrous metals and its alloys (the study of diffusion processes, mass transfer, and the solubility of gases in metals, development of techniques and equipment to determine the gas content in the solid state and rapid methods for determining the concentration of gases in melts directly into the melting furnaces and ladles);



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- melts refining, modification, and microalloying (development of new progressive ways to improve the physical, mechanical and performance properties of ferrous and non-ferrous alloys);
- special metallurgical technologies (research of processes and parameters of electroslag, vacuum, plasma, electron beam technology and electromagnetic treatment of metals and alloys in the liquid state and crystallization);
- special means of casting (the study of the processes and parameters of electro, chill, centrifugal casting, shell mold casting, etc.);
- automation of processes of special metallurgy;
- obtaining of cast composite materials;
- development of technology for production and research of alloys with shape memory effect;
- development of high-quality technology for smelting wastes of ferrous and non-ferrous metal refining melts from harmful substances and so on.



5. The research work at **the Department of Physical and Chemical Basics of Metal Technology** is conducted on the following topics:

- refining, modifying and microalloying of melts (development of new progressive ways to improve the physical, mechanical and performance properties of ferrous and non-ferrous alloys);
- special metallurgical technology (research processes and parameters of electroslag, vacuum, plasma and electron beam technologies and electromagnetic processing of metals and alloys in a liquid state and under crystallization);
- Special casting agents (study of the processes and parameters of electro-chill and centrifugal casting, shell casting, etc.);
- Special metallurgy process automation;
- Obtaining the cast composite materials;
- Process development for production and research of the shape memory effect;
- Development of high-quality technologies for remelting of ferrous and non-ferrous metals wastes, refining of melts from harmful substances, and so on.



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## 5. INTERNATIONAL PROJECTS AND COLLABORATION

### 1. [Joint Ukrainian-German Faculty of Engineering Igor Sikorsky KPI and the Otto von Guericke Magdeburg University \(Germany\).](#)

The purpose of the joint faculty is the improving the specialists training to meet the needs of enterprises of Ukraine and the joint Ukrainian-European, including Ukrainian-German enterprises. Graduates of the Joint Faculty are skilled in modern technics, knowledge-intensive technologies, European standards, the German language, the ability to create scientific and technical documentation in German language and work with it. After training completing, graduates obtain a German Master of Science degree and a Ukrainian Master's degree, which makes it possible to find a highly qualified job in any company or firm of both in Ukraine and in the European Community.



### 2. [The project of cooperation with the European Union "TEMPUS MMATENG"](#)

The purpose of the Tempus project at the Department Physical Engineering is a modernization of curricula of the two-level training program (Bachelor/Master) in Material Engineering on the competency-based approach and the best practices of implementation of the Bologna process.

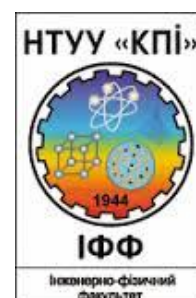
#### Project objectives:

- Develop and implement the modernized curricula in Material Engineering with an integrated infrastructure support;
- Improve the skills of teachers, to create a service-officers for Engineering Materials (Material Engineering Service Office, MESO);
- To create educational and scientific laboratories of information technology in Material Engineering.



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**4. Department of High-Temperature Materials and Powder Metallurgy**

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